Comprehensive Program for Accepted Contributed Talks at ICIAM 2023 Tokyo

Compiled by Zhijian Lai (Visit Profile)

ICIAM 2023 Tokyo is surprisingly large. The official website only provides a web version of the program for online browsing, in which the details of each session need to be opened one by one to view.

For the convenience of globally searching program information in one go, I have created the PDF files containing all the information. This way, you can directly search for keywords within the PDF file.

Feel free to download the following files for your convenience (please note that updates may be forthcoming):

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[0, a], U)*control*, *where*U$ may be a separable Hilbert space or uniformly convex Banach space. Undoubtedly, exact controllability is much more beneficial than null controllability. But, null controllability plays its role in a system where exact controllability does not hold. Differential inclusion can properly define partial differential equations involving jump discontinuous functions.

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[00002] Propagation of Lamb wave in the plate of microstretch thermoelastic diffusion materials

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E812

Type : Contributed Talk
Abstract : The present study investigates the effect of three thermoelastic theories on the propagation of Lamb wave in a linearly isotropic microstretch diffusion plate subject to stress free thermally insulated/impermeable and isothermal/isoconcentrated boundary conditions. The secular equations of the Lamb wave are obtained for both symmetric and anti-symmetric modes of vibration. The phase velocities and attenuation coefficients are computed numerically for a particular model and these results are compared for the three theories: Coupled Thermoelasticity theory, Lord-Shulman theory and Green-Lindsay theory. The velocity curves and the attenuation coefficients are illustrated graphically. It is observed that there are three modes of velocity and attenuation for each symmetric and anti-symmetric vibration. We have noticed that the velocity of the corresponding Lamb wave increases from first to third mode of symmetric vibration in both thermally insulated/impermeable and isothermal/isoconcentrated plates. At short wavelength, the secular equation of symmetric mode of vibration reduces to that of Rayleigh surface wave for both the plates. Some special cases are also deduced from the present formulation.
Classification : 74J15, 74B15, 80A17, 80A10
Format : Online Talk on Zoom
Author(s) : Sarat Singh Sanasam (Mizoram University) Sanjay Debnath (Mizoram University)

[00003] Reflection of plane waves in a rotating transversely isotropic thermoelastic diffusion solid half-space from impedance boundary in a fractional-order thermo-elasticity

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D102

Type : Contributed Talk

Abstract : The governing equations of a rotating transversely isotropic thermoelastic medium with diffusion in a fractional-order derivative thermo-elasticity are formulated. The velocity equation is obtained, which indicates the existence of four quasi plane waves. Reflection of these plane waves from a stress-free thermally insulated surface with impedance boundary is studied. The effects of anisotropy, rotation and impedance parameters on reflection coefficients are shown graphically.

Classification : 74-Mechanics of deformable solids

Author(s) : Dr. Anand Kumar Yadav (Shishu Niketan Sr. Sec School Sector 22D Chandigarh, India)

[00008] Semi Analytic Solution for Coupled (n+1)-dimensional Viscous Burgers' Equation using Homotopy Perturbation Method

Session Time & Room : 4E (Aug.24, 17:40-19:20) @E506

Type : Contributed Talk

Abstract : Semi analytic solution for coupled (n+1)-dimensional non-linear viscous Burgers' equation has been obtained by Homotopy Perturbation Method. Potential of prescribed semi analytical technique is specifically examined for (3+1)-dimensional non-linear Burgers' equation with very small kinematic viscosity factor has not been considered yet. Numerical experiments with illustrated absolute error and 3D graphical presentation testify the reliability of the technique. All the computational procedure has been done using MATLAB.

Classification : 65H20, 65N12, 65N15, 35C10

Format : Online Talk on Zoom

Author(s) : Shelly Arora (Punjabi University, Patiala) Atul Pasrija (Punjabi University, Patiala) Sukhjit Singh Dhaliwal (SLIET, Longowal)

[00009] Numerical Solution of KuramotoSivashinsky Equation Using Orthogonal Collocation with Bessel Polynomials as Basis

Session Time & Room : 2E (Aug.22, 17:40-19:20) @G402

Type : Contributed Talk

Abstract : Bessel polynomials has been proposed as a base function in orthogonal collocation to discretize fourth order Kuramoto-Sivashinsky equation. Convergence of numerical results have been analysed through L2

and L norms to discuss the effectiveness of technique. Number of test problems have been solved and comparison of results in space as well as in time direction at different number of collocation points has been presented. The numerical values are presented graphically to confirm applicability of technique.

Classification : 35E15, 35G20, 65M70, 33C10

Format : Online Talk on Zoom

Author(s) : Shelly Arora (Punjabi University, Patiala) Indu Bala (Punjabi University, Patiala)

[00010] Convergence Analysis of Fourth Order Extended Fisher Kolmogorov Equation Using Quintic Hermite Splines

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G502

Type : Contributed Talk

Abstract : An improvised collocation technique has been proposed to discretize multi-parameter fourth order non-linear extended Fisher Kolmogorov equation. The spatial direction has been discretized with quintic Hermite splines whereas temporal direction has been discretized with weighted finite difference scheme. The fourth order equation in space direction has been decomposed into second order using space splitting by introducing a new variable. The space splitting has been proposed to improvise the convergence of approximate solution. The proposed equation has been analyzed on uniform grid in both space and time directions. Error bounds for general order Hermite splines are established. ϵ- uniform rate of convergence for the proposed scheme has also been discussed elaborately. The technique is illustrated by various numerical examples and error growth has been discussed by computing L_2 and L_∞ norms.

Classification : 35K41, 35K55, 65M70, 65N35

Format : Online Talk on Zoom

Author(s) : Shelly Arora (Punjabi University, Patiala) Priyanka Bhardwaj (Punjabi University, Patiala) Saroj Kumar Sahani (South Asian University, New Delhi)

[00013] Singularly perturbed problems on a graph

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E606

Type : Contributed Talk

Abstract : In this talk, a singularly perturbed convection diffusion problems on a graph domain will be discussed. Initially, the problem is designed on a simple graph i.e k-star graph. On the common vertex, the continuity and the Kirchhoff's conditions will be discussed along with their complexity. The problem may be extended to a general graph with many vertices and edges. Some tests problems will be discussed based on upwind finite difference methods using piece-wise Shishkin meshes. Error estimates and the order of convergence are to be discussed.

Classification : 65Lxx, 65Mxx

Format : Online Talk on Zoom

Author(s) : Vivek Kumar Aggarwal (Delhi Technological University)

[00014] Pathway Fractional Integral Operator with Composition of Generalized function G_(,,r) [a, z]

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G305

Type : Contributed Talk

Abstract : The purpose of this paper is to consider the properties of generalized function G_$(,,r)$ $[a, z]$. For this purpose we obtain certain image formulas using Pathway fractional integral operators with these properties. We also mentioned some important special cases of the main results.

Classification : 26A33, 33E12

Format : Talk at Waseda University

Author(s) : Harish Nagar (Chandigarh University) Seema Kabra (Sangam University)

[00016] Existence and Attractivity Results for Volterra Type Nonlinear Perturbed Random Integral Equations

Session Time & Room : 1D (Aug.21, 15:30-17:10) @A208

Type : Contributed Talk

Abstract : In this talk, we prove an existence and locally attractivity result for Volterra type nonlinear perturbed random integral equations in separable Banach space under mixed generalised compactness, contraction and caratheodory conditions and also we will prove the existence of maximal and minimal solution Volterra type nonlinear random integral equations with some applications.

These types of Volterra type nonlinear perturbed random integral equations are used in various natural phenomena in which randomness occurs.

Classification : Existence of Solutions and their properties, Random Integral Equations, Applications in Abstract Spaces
Format : Online Talk on Zoom
Author(s) : SIDDHARTH GANESH SHETE (Swami Ramanand Teerth Marathwada University Nanded Maharashtra)

[00017] Modified Operational Laws for Neutrosophic Numbers in Decision-Making Problems

Session Time & Room : 2C (Aug.22, 13:20-15:00) @G301

Type : Contributed Talk
Abstract : This presented work results from the study of the existing basic operational laws of neutrosophic numbers which had some shortcomings clearly stating that these are the special type of neutrosophic numbers and not applicable in every practical situation. To overcome this limitation the general basic operational laws of neutrosophic numbers are proposed in this paper and a numerical example from a real-life situation has been solved optimally to show the validity of the proposed neutrosophic numbers laws.
Classification : 03B52, 03B52, 15B15, 28E10
Format : Talk at Waseda University
Author(s) : Akanksha Singh (Chandigarh University)

[00018] Structures and evolution of bifurcation diagrams for a one-dimensional diffusive generalized logistic problem with constant yield harvesting

Session Time & Room : 5B (Aug.25, 10:40-12:20) @G401

Type : Contributed Talk
Abstract : We study the diffusive generalized logistic problem with constant yield harvesting:

\begin{equation*}
\left{
\begin{array}{ll}
u^{\prime \prime }(x)+\lambda g(u)-\mu =0, & -10$. We prove that, for any

fixed $\mu >0,$ on the $(\lambda ,\left \Vert u\right \Vert _{\infty })$-plane, the bifurcation diagram consists of a $\subset $-shaped curve and then we study the structures and evolution of bifurcation diagrams for varying $\mu >0.$

Classification : 34B18, 74G35
Format : Talk at Waseda University
Author(s) : Shin-Hwa Wang (National Tsing Hua University, TAIWAN) Kuo-Chih Hung (National Chin-Yi University of Technology, Taiwan) Yiu-Nam Suen (National Tsing Hua University, TAIWAN)

[00020] Image Functions Approximated by CNN

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E711

Type : Contributed Talk
Abstract : Convolutional Neural Networks (CNN) have been widely used to image understanding. However it remains an open problem to prove the approximation of image functions via CNN. In this work, it is proved that an image function can be approximated by CNN on the basis of the axiom of choice in set theory and an uncountable number of training data from the viewpoint of image decomposition.
Classification : Artificial neural networks and deep learning
Format : Talk at Waseda University
Author(s) : Jian-Zhou Zhang (Sichuan University)

[00021] Study of sonic-supersonic patch arising in axisymmetric relativistic transonic flow

Session Time & Room : 3D (Aug.23, 15:30-17:10) @G601

Type : Contributed Talk
Abstract : In this work, we study a sonic-supersonic patch arising in 3-D axisymmetric relativistic transonic flows. The main difficulty here is the coupling of nonhomogeneous terms due to axisymmetry and the sonic degeneracy for the relativistic flow. However, using the characteristic decompositions of angle variables, we prove the existence and regularity of solutions in partial hodograph plane first and then by using an inverse transformation, we construct a smooth solution in the physical plane.
Classification : 35L65, 35M10, 35M33, 35Q75, 35A01
Author(s) : RAHUL BARTHWAL (Indian Institute of Technology Kharagpur) RAHUL BARTHWAL (Indian Institute of Technology Kharagpur) T Raja Sekhar (Indian Institute of Technology Kharagpur)

[00025] Riemann problem and limiting behaviour of a macroscopic production model

Session Time & Room : 3D (Aug.23, 15:30-17:10) @G601

Type : Contributed Talk

Abstract : We are concerned with a macroscopic production model which is a hyperbolic system of conservation laws with the equation of state for a Van der Waals gas. Solution to the Riemann problem for the system for all types of initial data is constructed, which contains a vacuum state for certain initial data. Delta shock wave solution and vacuum state is observed in limiting cases.

Classification : 35L65, 35L67

Format : Talk at Waseda University

Author(s) : Balakrishna Chhatria (Indian Institute of Technology Kharagpur)

[00026] STRESS ANALYSIS OF AN EDGE CRACK UNDER TIME-HARMONIC WAVE DISTURBANCE

Session Time & Room : 5C (Aug.25, 13:20-15:00) @E812

Type : Contributed Talk

Abstract : This article determines a stress intensity factor (SIF) at the tip of an edge crack in two considered models.

Problem-1 is an orthotropic strip of a finite thickness bonded by an orthotropic half-plane, and problem-2 is an orthotropic vertical semi-infinite strip. Edge cracks have been invaded perpendicularly by time-harmonic elastic waves. The system has been solved by using Fourier transform and Schmidt method to find the approximate analytical expression for the SIF. The variations of in plane normalized SIF for the different crack lengths and thickness were depicted graphically (2D) for different particular cases.

Classification : 74R99, 42A38, 74J15

Format : Online Talk on Zoom

Author(s) : Neha Trivedi (Indian Institute of Technology (BHU) Varanasi, India) Neha Trivedi (Indian Institute of Technology (BHU) Varanasi, India)

[00028] Riemann problem for the Chaplygin gas equations for several classes of non-constant initial data

Session Time & Room : 4E (Aug.24, 17:40-19:20) @E506

Type : Contributed Talk

Abstract : Using the differential constraint method, a class of exact solutions is obtained for
the homogeneous quasilinear hyperbolic system of partial differential equations
describing Chaplygin gas equation; these solutions exhibit linearly degenerate that leads
to the formation of contact discontinuities. In fact, in this paper, we solved the gen-
eralized Riemann problem through a characteristic shock(s). For several classes of
non-constant and smooth initial data, the solution to the generalized Riemann problem
is presented.

Classification : 35L67

Format : Talk at Waseda University

Author(s) : Akshay Kumar (University of Hyderabad) Radha R (University of Hyderabad)

[00031] Stoneley wave in the transversely isotropic thermoelastic diffusion materials

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E803

Type : Contributed Talk

Abstract : This paper investigate the secular equations of Stoneley wave propagating through bonded and unbonded interfaces between two dissimilar transversely isotropic thermoelastic diffusion half-spaces. These equations are solved numerically by modelling two distinct crustal rocks and the resultant phase velocities and attenuations are plotted graphically. This analysis explicates the position and permeability of fractures and also helps in the assessment of valuable materials under earths crust. Some particular cases are also deduced from the present formulation.

Classification : Continuum Mechanics

Format : Talk at Waseda University

Author(s) : Sanjay Debnath (Mizoram University)

[00032] A geometrically preservative semi-adaptive method for the numerical solution of Kawarada equations

Session Time & Room : 1E (Aug.21, 17:40-19:20) @E702

Type : Contributed Talk

Abstract : This presentation concerns the numerical stability and geometric preservations of the numerical
solution of Kawarada equation problems. The nonlinear partial differential equations
exhibit strong quenching types of singularities that represent a number of key characteristics
from industrial and multi-physical applications. A second order semi-adaptive implicit finite difference
method will be constructed and investigated. We shall begin with a detailed mathematical analysis of the
stability without freezing singular source terms of Kawarada equations in this talk.
Preservation features of the solution vector sequences will then be
studied. Realistic orders of the convergence will be given via generalized Milne's devices. Finally,
computer simulations will be carried out to demonstrate the effectiveness of the
theoretical analysis and conclusions.

Classification : 65M06, 65M12, 65M50, 68U01, 65D18

Format : Talk at Waseda University

Author(s) : Qin Sheng (Baylor University)

[00034] Relative heat flux in nonlocal reaction-diffusion equations and thermoelectric efficiency

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G401

Type : Contributed Talk

Abstract : Thermoelectric generators directly convert a temperature difference into electrical energy. To study their efficiency, we consider second-order integro-differential equations describing the steady-state temperature distribution inside thermoelectric generators when the Seebeck coefficient of the thermoelectric material is temperature-independent but the electrical resistivity and thermal conductivity are temperature-dependent. In this talk, we show that the temperature solution is unique and the relative boundary

Fourier heat flux can be explicitly written. Therefore, the efficiency has an explicit formula.

Classification : 34B15, 35A02, 35J25, 34B10, 35K59

Format : Talk at Waseda University

Author(s) : Jaywan Chung (Korea Electrotechnology Research Institute) Byungki Ryu (Korea Electrotechnology Research Institute) Hyowon Seo (Kunsan National University)

[00035] Effects of toxicity and zooplankton selectivity under seasonal pattern of viruses on plankton dynamics

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A601

Type : Contributed Talk

Abstract : A mathematical model for the interacting dynamics of phytoplankton-zooplankton is proposed. The phytoplankton have ability to take refuge and release toxins to avoid over predation by zooplankton. The zooplankton are provided some additional food to persist in the system. The phytoplankton are assumed to be affected directly by an external toxic substance whereas zooplankton are affected indirectly by feeding on the affected phytoplankton. We incorporate seasonal variations in the model, assuming the level of nutrients, refuge and the rate of toxins released by phytoplankton as functions of time. Our results show that when high toxicity and refuge cause extinction of zooplankton, providing additional food supports the survival of zooplankton population and controls the phytoplankton population. Prey refuge and additional food have stabilizing effects on the system; higher values of the former results in extinction of zooplankton whereas phytoplankton disappear for larger values of the latter. Seasonality in nutrients level and toxins released by phytoplankton generates higher periodic solutions while time-dependent refuge of phytoplankton causes the occurrence of a period-three solution. The possibility of finding additional food for zooplankton may push back the ecosystem to a simple stable state from a complex dynamics.

Classification : 92B05, 92D25, 92D30, 37A50, 34D05

Format : Online Talk on Zoom

Author(s) : Samares Pal (University of Kalyani)

[00043] Matter-chameleon coupling in reconstructed Brans-Dicke cosmology

Session Time & Room : 3E (Aug.23, 17:40-19:20) @D407

Type : Contributed Talk

Abstract : In the present work, we studied the generalized Brans-Dicke (BD) model with a scalar field non-minimally coupled with the matter sector. We considered extended holographic Ricci dark energy $\rho_{\Lambda}=3\phi (\alpha\dot{H}+\beta H^2)$ in this BD cosmology framework, derived restrictions for BD parameter ω, and observed a stronger matter-chameleon coupling. The EoS parameter behaved like quintom. We observed an increasing potential function as matter-chameleon coupling gets stronger. Also, deceleration parameter transited from decelerated to the accelerated universe phase.

Classification : 83F05, 83C56

Format : Online Talk on Zoom

Author(s) : Surajit Chattopadhyay (Amity University, Kolkata)

[00045] Nonzero-sum stochastic impulse games with an application in energy markets

Session Time & Room : 1C (Aug.21, 13:20-15:00) @

Type : Industrial Contributed Talk

Abstract : We study a nonzero-sum stochastic differential game with both players adopting impulse controls, on a finite time horizon.
The objective of each player is to maximize her total expected discounted profits. The resolution methodology relies
on the connection between Nash equilibrium and the corresponding system of quasi-variational inequalities (QVIs in short).
We prove, by means of the weak dynamic programming principle for the
stochastic differential game, that the value function of each player is a constrained viscosity solution to the
associated QVIs system in the class of linear growth functions.
We also introduce a family of value functions
converging to our value function of each player, and which is characterized as the unique constrained
viscosity solutions of an approximation of our QVIs system. This
convergence result is useful for numerical purpose. We apply a probabilistic numerical scheme which approximates
the solution of the QVIs system to the case of the competition between two

electricity retailers. We show how our model reproduces the qualitative behaviour of electricity retail competition.

Classification : 91B70, 93E20, 49L25, 49N70

Author(s) : Mohamed Mnif (ENIT, Tunisia) Ren Aid (University of Paris Dauphine) Lamia Ben Ajmia (ENIT, Tunisia) Mhamed Gaigi (ENIT, Tunisia)

[00050] Generalized Game Theoretical Model with Multiple Types of Homogeneous Players

Session Time & Room : 3D (Aug.23, 15:30-17:10) @D514

Type : Industrial Contributed Talk

Abstract : We introduce a decision game model with finite number of types and each type has finite number of homogeneous players. We assume that each type of player has similar characteristics and will choose only between two alternative choices or decisions). The preference for each type of players is described by a discrete utility function which gathers the influence of players in the same group and the influence of players from the other groups. We will characterize all pure "united or separated" and mixed strategies that form Nash equilibria. The united strategies ensure that all players with same type will make same decision, while separated strategy includes at least one type of players who do not make same decision. We will determine the strategic thresholds for each type that identify the Nash regions in space. As a special case, we consider three types of homogeneous players and use geometry to construct three dimensional regions for Nash equilibria, where the horizontal axis reflects the preference for players of type one, the vertical axis reflects the preference for the players of type two, and the depth axis reflects the preferences for the players of type three, and we characterize all Nash equilibria regions. Finally, we apply our model in economics "tourist sector" by introducing a resort model for three types of tourists distributed among two resorts and determine the competitive Nash Equilibrium prices for given preference for the three types of tourists.

Classification : 91A06, 91A10, 91A35, 91A43, 91A11

Format : Talk at Waseda University

Author(s) : Abdelrahim Said Mousa (Birzeit University)

[00053] How predators choose their prey to maximize their utility functions by using switching prey

Session Time & Room : 3D (Aug.23, 15:30-17:10) @D514

Type : Contributed Talk

Abstract : In this work, we model the relationship between prey and predators by studying the interactive behavior of this prey-predator model and using the change of prey. The objective is to maximize the profit function of each predator by seeking the strategy provided by each predator to maximize its profit. To do so, we maximize this utility function being constrained by balance equations between biomass and trophic, and we show that this last problem is completely equivalent to finding the Generalized Nash Equilibrium Point. To calculate it, we use the conditions of KKT and we show that it is indeed a Problem of Linear Complementarity.

Classification : 91A06, 91B06, 92B05, 15A03, 15A30

Format : Online Talk on Zoom

Author(s) : Asmaa IDMBAREK (LAMS, Hassan II University of Casablanca, Casablanca, Morocco) Yamna ACHIK (LAMS, Hassan II University of Casablanca, Casablanca, Morocco) Hajar NAFIA (LAMS, Hassan II University of Casablanca, Casablanca, Morocco) Imane AGMOUR (LAMS, Hassan II University of Casablanca, Casablanca, Morocco) Youssef EL FOUTAYENi (LAMS, Hassan II University of Casablanca, Casablanca, Morocco)

[00058] Thermocapillary dynamics of viscous droplet driven by internal thermal singularity

Session Time & Room : 2D (Aug.22, 15:30-17:10) @E503

Type : Contributed Talk

Abstract : In a non-isothermal Poiseuille flow, we investigate the impact of an internal thermal singularity on the migration of a viscous immiscible droplet. The migration velocity strongly depends upon the type of thermal singularity and where it is located inside the droplet. In $Re \to 0$ and $Pe \to 0$ limits, this mathematical model provides a control mechanism for droplet migration, which may be useful in a variety of microfluidics as well as industrial applications.

Classification : 76T06

Format : Online Talk on Zoom

Author(s) : Arindam Basak (Indian Institute of Technology Kharagpur)

Rajaram Lakkaraju (Indian Institute of Technology Kharagpur) Raja Sekhar G P (Indian Institute of Technology Kharagpur India)

[00070] SDDS-SABC based Algorithm for solving non-linear optimization problems

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D502

Type : Contributed Talk

Abstract : Optimizing complex non-linear constrained optimization problems is often a challenging task. This work proposes a new hybrid method called SDDS-SABC based on the Split-Detect-Discard-Shrink technique and Sophisticated ABC algorithm to optimize the said problems. The SDDS method is responsible for shrinking the full search region through a recursive breakdown and improves computational effort to focus on the subregion covering potential solutions for further decomposition. SABC plays a vital role in extracting the best solutions from the subregions whose values help detect the promising subregion. Both SDDS and SABC are sequentially repeated until the region reduces to a nominal width representing the optimization problem's global/ close to global solution(s). The Ranking and selection rules have been applied to assist optimistic decision-making with an attitude to discard the subregion covering non-promising solution (s). At the same time, the subregion with a promising solution is accepted as the current shrink region for a further split. We introduce a new initialization scheme for food sources in the SABC algorithm, which excels the existing initialization process. Develop Dual-strategy Employed bee's phase, allowing bees to split into two groups and use their respective group strategies to explore their neighbourhood while maintaining their collaborative contribution. We also introduce a new Dynamic penalty method that is free from extra parameters or factors like most existing penalty methods do to improve the optimization efficiency. To check the validity of SDDS-SABC, we have applied it to benchmark functions and engineering problems. To measure our proposed method's statistical significance against other existing heuristic optimization methods, we carried out the non-parametric Friedman and Wilcoxon rank tests.

Classification : 90-xx, 90-08, 90-10, optimization algorithms

Format : Online Talk on Zoom

Author(s) : Dhirendra Sharma (Birla Institute of Technology Mesra, Ranchi) Darakhshan Jabeen Syeda (Birla Institute of Technology Mesra, Ranchi)

[00073] Scattering behavior for one dimensional wave maps into Riemannian manifolds

Session Time & Room : 2E (Aug.22, 17:40-19:20) @F310

Type : Contributed Talk

Abstract : In this talk, we explore the scattering behavior for wave maps from Minkowski space $\mathbb{R}^{1+1}$ into general Riemannian manifolds, provided the initial data are small. In particular, we show that the nonlinear scattering operator can be linearized as the corresponding linear scattering operator. The underlying physical intuition of this conclusion is that one-dimensional wave maps behave exactly in the same manner as their scattering fields detected by the far-away observers.

Classification : 35L05, 35A01, 35B40, 35P25, 35R30

Format : Online Talk on Zoom

Author(s) : Mengni Li (Southeast University)

[00074] Chaos in multidimensional disordered nonlinear lattices

Session Time & Room : 5B (Aug.25, 10:40-12:20) @E802

Type : Contributed Talk

Abstract : We study the mechanisms of energy transport in multidimensional heterogeneous lattice models, studying in particular the case of the Klein-Gordon model of coupled anharmonic oscillators in one and two spatial dimensions. We perform an extensive numerical investigation of the dynamics of the considered model revealing (i) the effects of the type of the impurity (heterogeneity) parameter on the systems' transport properties and classify the transport mechanisms of the nonlinear versions of the models into various dynamical regimes. (ii) that for it's nonlineaar version, chaotic transport persists and (iii) chaotic hotspots meander in the region of energy concentration supporting the spreading mechanism of energy.

Classification : 70K55, 70H07

Format : Talk at Waseda University

Author(s) : Bob Senyange (Muni University)

[00078] A higher order numerical scheme to a nonlinear McKendrick-Von Foerster equation with singular mortality

Session Time & Room : 2D (Aug.22, 15:30-17:10) @A201

Type : Contributed Talk

Abstract : In this paper, higher-order numerical schemes to the McKendrick-Von Foerster equation are presented when the death rate has singularity at the maximum age. The third, fourth-order schemes that are proposed are based on the characteristics, which are non-intersecting lines in this case, and are multi-step methods with appropriate corrections at each step. In fact, the convergence analysis of the schemes is discussed in detail. Moreover, numerical experiments are provided to validate the orders of convergence of the proposed third-order and fourth-order schemes.

Classification : 92D25, 65M25, 65M12

Format : Talk at Waseda University

Author(s) : Joydev Halder (School of Mathematics and Statistics, University of Hyderabad) Suman Kumar Tumuluri (School of Mathematics and Statistics, University of Hyderabad)

[00079] Multi-dimensional Optimal Systems for Chaplygin Gas Cargo-LeRoux model

Session Time & Room : 2E (Aug.22, 17:40-19:20) @F310

Type : Contributed Talk

Abstract : The famous Cargo-LeRoux model for the isentropic Chaplygin gas is studied using classical Lie symmetry
method. Optimal systems up to six-dimensions are constructed using the adjoint transformation and the
invariants of the admitted Lie algebras. We obtain exact solutions to the Cargo-LeRoux model by using the
one-dimensional optimal system and discussed the physical behavior of the solutions graphically. Finally, We
discussed the evolutionary behavior of a discontinuity wave.

Classification : 35L40, 70G65, 76N15

Format : Talk at Waseda University

Author(s) : Manoj Kumar Pandey (BITS Pilani K K Birla Goa Campus) Pabitra Kumar Pradhan (BITS Pilani K K Birla Goa Campus)

[00091] An infeasible interior-point arc-search algorithm for nonlinear constrained optimization

Session Time & Room : 5D (Aug.25, 15:30-17:10) @F312

Type : Contributed Talk

Abstract : Most algorithms based on interior-point methods are categorized as line search since they compute a search direction on a straight line. In this talk, we propose an interior-point method for nonlinear programming problems that computes the search direction along with an ellipsoidal arc. We discuss the convergence of the proposed method, and numerical experiments indicate it can solve the CUTEst benchmark problems in fewer iterations. A modified method can further reduce the computation time.

Classification : 49M37, 65K05, 90C30, 90C51

Format : Talk at Waseda University

Author(s) : Einosuke Iida (Tokyo Institute of Technology) Makoto Yamashita (Tokyo Institute of Technology) Yaguang Yang (US NRC)

[00092] The explicit formulae for the distributions of words

Session Time & Room : 2C (Aug.22, 13:20-15:00) @G301

Type : Contributed Talk

Abstract : The distributions of the number of words play key roles in information theory, statistics, and DNA analysis. Bassino et al. 2010, Regnier et al. 1998, and Robin et al. 1999 showed generating functions of the distributions in rational forms. However, we can not expand rational functions except for simple cases and do not have explicit formulae for the distributions from them. We show the explicit formulae for the distributions of words for the Bernoulli models.

Classification : 05A05, 05A15, 60C05, 62E15

Format : Talk at Waseda University

Author(s) : Hayato Takahashi (Random Data Lab. Inc.)

[00095] Low Reynolds number hydrodynamics of a slip-stick sphere

Session Time & Room : 2C (Aug.22, 13:20-15:00) @G304

Type : Contributed Talk

Abstract : Low Reynolds number hydrodynamics of spherical particles with non-uniform surface roughness show potential applications in microfluidic situations like swimming micro-organisms and emulsions. In this work, we study the hydrodynamics of spherical slip-stick particle models; namely, i) axisymmetric cap/strip model and ii) non-axisymmetric patch model, suspended in an unbounded arbitrary Stokes flow whose surface is partitioned into two different slip regions. We evaluate the optimum configurations for migrational and rotational motion of the slip-stick spherical particle.

Classification : 76D07, 35A25

Format : Talk at Waseda University

Author(s) : Shiba Biswas (Indian Institute of Technology Kharagpur, India-721302) Poornachandra Sekhar Burada (Indian Institute of Technology Kharagpur, India-721302) Raja Sekhar G P (Indian Institute of Technology Kharagpur, India-721302)

[00096] Multi-scale analysis of concentration distribution inside porous medium channel configuration

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D101

Type : Contributed Talk

Abstract : A multiple-scale perturbation analysis is presented for the two-dimensional concentration distribution of passive contaminant released in an incompressible viscous fluid channel filled with a porous medium. The flow is driven by the combined effect of the upper plate oscillation and the periodic pressure gradient. Homogenization technique is used to find the concentration distribution up to third order. For a fixed amplitude of oscillation and pulsation, frequency of pressure pulsation has stronger effect on the dispersion.

Classification : 76M50, 76R99, 76S99

Format : Online Talk on Zoom

Author(s) : Timir Karmakar (Department of Mathematics, National Institute of Technology Meghalaya, Shillong, Meghalaya 793003) Swarup Barik (2Department of Mathematics, SRM Institute of Science and Technology, Kattankulathur, Chennai 603203) Raja Sekhar G P (Indian Institute of Technology Kharagpur India)

[00098] Robust bring your own encryption algorithm using generalized heat equation associated with generalized Vigen$\grave{e}$re-type table over symmetric group

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E504

Type : Contributed Talk

Abstract : We develop a secure bring your own encryption algorithm that encrypts personal data. The proposed algorithm is based on a generalized heat equation associated with a generalized Vigen$\grave{e}$re-type table over symmetric group S_{n} so that existing attacks will be infeasible. Encryption keys are obtained from random key sequences tested by NIST statistical test suite. The robustness of the proposed algorithm has been found by comparing it with other competing existing algorithms.

Classification : 68P25, 68P30, Image encryption.

Format : Talk at Waseda University

Author(s) : Manish Kumar (BITS Pilani, Hyderabad Campus, Telangana, India)

[00100] Pointwise Controllability of Degenerate/Singular PDEs

Session Time & Room : 5B (Aug.25, 10:40-12:20) @A207

Type : Contributed Talk

Abstract : This work deals with some controllability results of a one-dimensional degenerate and singular parabolic equation. We provide approximate and null controllability conditions based on the moment method by Fattorini and Russel.

Classification : 93B05, 35K65, 35K67

Format : Talk at Waseda University

Author(s) : AMINE SBAI (Hassan 1st University and Granada University)

[00103] Two-dimensional Riemann problem for a new hyperbolic model for thin film flow of a perfectly soluble anti-surfactant solution

Session Time & Room : 3D (Aug.23, 15:30-17:10) @G601

Type : Contributed Talk

Abstract : This work is concerned with formulation of three-dimensional thin film model for an anti-surfactant solution and hence constructing unique global solution for a two-dimensional Riemann problem for the corresponding reduced hyperbolic form. We analyze the interactions of classical and non-classical waves in detail to construct the global solution of the corresponding 2-D Riemann problem. Further, we provide the expressions for strength, location and propagation speed of delta shock wave at each interaction point.

Classification : 35L65, 76L05, 35F55

Format : Talk at Waseda University

Author(s) : RAJA SEKHAR TUNGALA (Department of Mathematics, Indian Institute of Technology Kharagpur)

[00104] High order approximation of Caputo-Prabhakar derivative and its application in solving time fractional Advection-Diffusion equation

Session Time & Room : 1E (Aug.21, 17:40-19:20) @E702

Type : Contributed Talk

Abstract : This work aims to devise a high-order numerical scheme to approximate the CaputoPrabhakar derivative of order 0 < < 1, using an rth degree Lagrange interpolation polynomial, where $3\leq r\in\mathbb{Z^{+}}.$. This numerical scheme can be thought of as an extension of the presented schemes for the approximation of the Caputo-Prabhakar derivative in our previous work \cite{r1}. Further, we adopt the proposed scheme to solve a time-fractional Advection-Diffusion equation with the Dirichlet boundary condition. It is shown that the method is unconditionally stable, uniquely solvable, and convergent with convergence order, $ O(\tau^{r+1-\alpha}, h^{2}), $ where and h are the step sizes in the temporal and spatial directions, respectively. Without loss of generality, obtained results are supported by numerical examples for r = 4, 5.

\bibitem{r1} Deeksha Singh, Farheen Sultana, and Rajesh K Pandey,

Approximation of Caputo Prabhakar derivative with application in solving time fractional advection-diffusion equation, International Journal for Numerical Methods in Fluids. $94(7)(2022)$, pp. 896-919.

Classification : 65M06, 65M12, Numerical approximation of fractional derivative and its application

Format : Talk at Waseda University

Author(s) : DEEKSHA SINGH (Department of Mathematical Sciences, Indian Institute of Technology, BHU, Varanasi) Rajesh K. Pandey (Department of Mathematical Sciences, Indian Institute of Technology, BHU, Varanasi)

[00111] A convergent numerical method for time-fractional reaction-diffusion equation

Session Time & Room : 1E (Aug.21, 17:40-19:20) @E702

Type : Contributed Talk

Abstract : This paper design and analyze a robust finite difference scheme for solving a time-fractional reaction-diffusion equation with smooth and non-smooth solutions. The solution of this equation exhibits a weak singularity at the initial time $\mathrm{t}=0$. So we use graded temporal mesh in order to handle the singularity. We discretize the space variable using a cubic polynomial spline difference scheme. Further, the stability and convergence for both the smooth and non-smooth solutions are analyzed separately.

Classification : 65M06, 65M12

Format : Online Talk on Zoom

Author(s) : Anshima Singh (Indian Institute of Technology (BHU) Varanasi)

[00112] Vibration control on unplanned change in vehicle mass model

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E504

Type : Contributed Talk

Abstract : Prolonged vibration transfer to the human body during riding affects human health. In this work, we proposed a heuristic-based chaotic artificial bee colony (ABC) optimization technique to mitigate the vibration response of running vehicle with context to the safety and comfort of passengers during a ride. We have modeled the vehicle's six degrees of freedom dynamics as a half-car with passive suspension and passengers in a seated position. In the proposed work, two fundamental techniques are used in our analysis. Firstly, we estimate how changing the passenger mass in a vehicle affects the vibration behaviour of the entire system. This is done by simulating the dynamical model computationally and numerically over different bumpy roads. Thereby, distinguishing between the causal roles of mass, safety, and comfort, we formulate technologically constrained optimization problems and minimize the peak jerks of the vehicle and passengers. Further, implement techniques to optimize the vibration levels and design suspension parameters accordingly. The study also analyses the extreme range of vibration levels and comfort relationships for several road conditions to estimate the net effect of vehicle weight change during the ride.

Classification : 68-XX, 68Txx, 68T20, 37Nxx, 37N40

Format : Online Talk on Zoom

Author(s) : Darakhshan Jabeen Syeda (Birla Institute of Technology Mesra, Ranchi)

[00116] Multi-Scale Modelling of three phase lag (TPL) of lung cancer during cryosurgery

Session Time & Room : 4D (Aug.24, 15:30-17:10) @E504

Type : Contributed Talk

Abstract : On the basis of the study of cryosurgery with mathematical modelling we discuss about the study related to non-Fourier bio-heat transfer available numerically with various boundary conditions for frozen and non frozen region. By the CAD/ANSYS study a specific region is developed for the tumor detected area. Well elaborate three phase lag (TPL) bio-heat transfer model to analysis of the temperature distribution in living tissue. By this work of mathematical modelling of cryosurgery in lung cancer to elaborate the knowledge of TPL bio-heat model by using numerical methods.

Classification : 92-XX, 92Bxx, 92B05

Format : Online Talk on Zoom

Author(s) : Sarita Singh (Doon University Dehradun Uttarakhand IndiaDoon University Dehradun Uttarakhand)

[00122] Exact expansion of functions using partial derivatives: sensitivity analysis

Session Time & Room : 4E (Aug.24, 17:40-19:20) @F403

Type : Contributed Talk

Abstract : Expansions of functions such as Taylor series, ANOVA and anchored decompositions are widely used for approximating and analyzing complex mathematical models. We propose a novel and exact expansion of

functions using their cross-partial derivatives, the distribution functions and densities of the input variables. In uncertainty quantification and multivariate sensitivity analysis, such expansion allows for developing a dimension-free computation of sensitivity indices for dynamic models, and for proposing new lower and upper bounds of total indices.

Classification : 49Q12, 46G10, 46G99

Format : Online Talk on Zoom

Author(s) : Matieyendou LAMBONI (universit de Guyane)

[00129] Anomalous diffusion in standard maps with extensive chaotic phase spaces

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E505

Type : Contributed Talk

Abstract : In this work, we investigate the long-term diffusion transport and chaos properties of single and coupled standard maps (SMs). We analyze parameters that are known to produce anomalous diffusion in the phase spaces of maps, with the presence of so-called accelerator modes. We study how different ensembles affect the behavior, asymptotic diffusion rates, and time scales required for these maps. We also explore the global diffusion properties and chaotic dynamics of various coupled SM configurations.

Classification : 65Pxx

Format : Talk at Waseda University

Author(s) : Henok Tenaw Moges (University of Cape Town) Henok Tenaw Moges (University of Cape Town) Charalampos Skokos (University of Cape Town)

[00130] THE DYNAMICS OF THE MONKEYPOX VIRUS IN THE PRESENCE OF ENVIRONMENTAL TRANSMISSION

Session Time & Room : 5C (Aug.25, 13:20-15:00) @G401

Type : Contributed Talk

Abstract : A deterministic model for the environmental transmission dynamics of monkeypox with the presence of quarantine and vaccination is presented. The analysis of the model presented three important equilibrium states namely; monkeypox-free equilibrium (MPXV-FE), infected rodent-free endemic equilibrium (IRF-EE) and coexistence equilibrium (CO-EE). The local and global stability of the equilibrium states is established in terms of the basic reproduction number, $\mathcal{R}_0.$ For global stability, the

Comparison theory is used for MPXV-FE while the Voltera-Lyapunov matrix theory is used for both IRF-EE and CO-EE. Sensitivity analysis is performed using the Latin Hypercube sampling method with the results showing that environmental transmission parameters are the main driver of infection in the dynamics of monkeypox infection. This is further supported by numerical simulations to show the impact of environmental transmission on monkeypox infection and also the validity of the theoretical analysis presented. Based on the results, it is recommended that health practitioners and policy-makers should constitute control strategies that will focus on reducing environmental transmission and shedding of the virus in the environment while increasing the environmental decay rate of the monkeypox virus. This will complement the quarantine and vaccination strategies in place.

34C60, 92B05, 34D23, 34D20

Classification : 34CXX, 34DXX

Format : Online Talk on Zoom

Author(s) : Chinwendu Emilian MADUBUEZE (Federal university of Agriculture Makurdi Nigeria)

[00132] Incompatibility-governed deformations: a new approach to Elastoplasticity

Session Time & Room : 5B (Aug.25, 10:40-12:20) @G502

Type : Contributed Talk

Abstract : We present theoretical as well as numerical results concerning a novel approach to model elasto-plastic phenomena in deformable solids based on a decomposition of the total deformation tensor into a compatible (i.e., a symmetric gradient) and an incompatible part at each point of the domain. The incompatible part aims to model the part of the deformation due to dislocation movement that eventually is responsible for the creation of plastic regions. This is a joint work with Samuel Amstutz (Ecole Polytechnique de Palaiseau, France).

Classification : 35J48, 49S05, 74C05, 74G99, 80A17

Format : Talk at Waseda University

Author(s) : Nicolas Van Goethem (Universidade de Lisboa)

[00141] Multiscale Perturbed Gradient Descent: Chaotic Regularization and Heavy-Tailed Limits

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E711

Type : Contributed Talk

Abstract : Recent studies have shown that gradient descent (GD) can achieve improved generalization when its dynamics exhibits a chaotic behavior. However, to obtain the desired effect, the step-size should be chosen sufficiently large, a task which is problem dependent and can be difficult in practice. In this talk, we introduce multiscale perturbed GD (MPGD), a novel optimization framework where the GD recursion is augmented with chaotic perturbations that evolve via an independent dynamical system. We analyze MPGD from three different angles: (i) By building up on recent advances in rough paths theory, we show that, under appropriate assumptions, as the step-size decreases, the MPGD recursion converges weakly to a stochastic differential equation (SDE) driven by a heavy-tailed Lvy-stable process. (ii) By making connections to recently developed generalization bounds for heavy-tailed processes, we derive a generalization bound for the limiting SDE and relate the worst-case generalization error over the trajectories of the process to the parameters of MPGD. (iii) We analyze the implicit regularization effect brought by the dynamical regularization and show that, in the weak perturbation regime, MPGD introduces terms that penalize the Hessian of the loss function. Empirical results are provided to demonstrate the advantages of MPGD.

Classification : 68T07, Machine learning, optimization, stochastic differential equations

Format : Talk at Waseda University

Author(s) : Soon Hoe Lim (Nordita, KTH Royal Institute of Technology and Stockholm University)

[00144] The flux perturbed Riemann solution for isentropic Cargo-LeRoux model

Session Time & Room : 2E (Aug.22, 17:40-19:20) @G502

Type : Contributed Talk

Abstract : In this research, we study the pressureless Cargo-LeRoux model of conservation laws, which is modeled from the one-dimensional constant gravity Euler equations. Introducing flux perturbation of a van der Waals isentropic gas equation of state, the exact solution of Riemann problem is derived and establish the existence and uniqueness of the Riemann solution

globally. Finally, the influence of van der Waals excluded volume on the physical quantities is illustrated graphically using MATLAB software.

Classification : 35D30, 35L65, 76L05, 76N10, 76N15

Format : Talk at Waseda University

Author(s) : Sahadeb Kuila (DEPARTMENT OF MATHEMATICS, SRM Institute of Science and Technology, Kattankulathur, Tamil Nadu 603203) Sumita Jana (DEPARTMENT OF MATHEMATICS, SRM Institute of Science and Technology, Kattankulathur, Tamil Nadu 603203)

[00156] Convergence of adaptive algorithms for parametric PDEs with lognormal coefficients

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E504

Type : Contributed Talk

Abstract : Numerical methods for random parametric PDEs can greatly benefit from adaptive refinement schemes, in particular when functional approximations are computed as in stochastic Galerkin methods with residual based error estimation. In this talk we derive an adaptive refinement algorithm for an elliptic parametric PDE with unbounded lognormal diffusion coefficient steered by a reliable error estimator for both the spacial mesh and the stochastic space. Moreover, we will prove the convergence of the derived adaptive algorithm.

Classification : 65N12, 65N50, 65F10, 65F55, 65D40

Author(s) : Nando Hegemann (Physikalisch-Technische Bundesanstalt) Nando Farchmin (Physikalisch-Technische Bundesanstalt)

[00159] Wave interactions in drift- flux equations of two-phase flows

Session Time & Room : 2E (Aug.22, 17:40-19:20) @F310

Type : Contributed Talk

Abstract : In this talk, we consider the interactions of arbitrary shocks for a 3×3 system of conservation laws governing drift-flux equations of two-phase flows with isothermal and isentropic equation of states. Here, we use the properties of Riemann solution and interaction of weak shocks for this study. Consequently, we reduce the system of equations by taking the projection of shocks in the phase plane to investigate the interactions of arbitrary shocks.

Classification : 35L40, 35L45, 35L65, 35L67, Hyperbolic system of conservation laws

Format : Talk at Waseda University

Author(s) : Minhajul Minhajul (Department of Mathematics, Birla Institute of Technology and Science Pilani, K K Birla Goa Campus, India) Rakib Mondal (Department of Mathematics, Birla Institute of Technology and Science Pilani, K K Birla Goa Campus, India)

[00173] Symmetries and Explicit Solutions of Fractional Nonlinear DrinfeldSokolovSatsumaHirota System

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G305

Type : Contributed Talk

Abstract : In this work, a space-time fractional nonlinear DrinfeldSokolovSatsumaHirota system is considered. The symmetry approach and power series expansion technique are applied to derive the explicit solutions of the system. The coupled DSSH system was seen as a special form example of Lax pairs and a special case of the four-reduced KadomtsevPetviashvili hierarchy in literature. The main motivation for present work is the global behaviour and various applications of fractional DSSH in applied science. The results obtained in the paper can be useful in calculating in conservation laws of the system.

Classification : 26A33, 76M60, Fractional Derivatives, Symmetry Analysis

Format : Online Talk on Zoom

Author(s) : Komal Singla (Chandigarh University)

[00175] pFemView: An Open-Source Visualization Library for p-FEM

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E711

Type : Contributed Talk

Abstract : We present a new approach to visualize p-hierarchical basis finite element (p-FEM) solutions on the scientific visualization application ParaView. Since ParaView uses a linear/quadratic interpolation at specific geometric nodes, a refined visualization mesh needs to be constructed efficiently. This is accomplished via the key steps p-hierarchical to nodal projection and higher-order to lower-order projection, which have been implemented in an open-source C++ library pFemView. Furthermore, examples are presented to illustrate the effectiveness of this library.

Classification : 65N30, 65Y15, 68-04

Format : Talk at Waseda University

Author(s) : Janitha Gunatilake (University of Peradeniya)

[00177] Bifurcations of Limit Cycles and Multistability in Polynomial Dynamical Systems

Session Time & Room : 5C (Aug.25, 13:20-15:00) @G401

Type : Contributed Talk

Abstract : We study global limit cycle bifurcations and multistability in 2D polynomial dynamical systems, namely, in: the general Linard polynomial system, the Euler-Lagrange-Linard mechanical system, Leslie-Gower ecological or biomedical systems, and a reduced quartic Topp system which models the dynamics of diabetes. We study also 3D polynomial dynamical systems and, in particular, complete the strange attractor bifurcation scenarios in Lorenz type systems connecting globally the homoclinic, period-doubling, Andronov-Shilnikov, and period-halving bifurcations of limit cycles.

Classification : 34C05, 34C07, 34C23, 37G10, 37G15

Format : Talk at Waseda University

Author(s) : Valery A. Gaiko (United Institute of Informatics Problems, National Academy of Sciences of Belarus)

[00180] Relationship between musical notes and socio-political events

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E811

Type : Contributed Talk

Abstract : Historians and scientists long suspected that sounds and music impact different cultures. However, empirical data to support such claim is sparse. Previous research using Supervised Machine Learning algorithms, i.e. ANFIS (Adaptive Neuro-Fuzzy Inference System) has successfully categorised musical genre classification and predicted the outcome of the United Kingdom's election results using popular music released in that period by feeding sound wave features to the ANFIS algorithm. This study reports similar research for the Moroccan elections using two different supervised machine learning algorithms namely, k-NN and SVM.

Classification : 68T09, 91C99

Format : Talk at Waseda University

Author(s) : Choi-Hong Lai (University of Greenwich) Nakunam Kokulan (University of Greenwich) Yahya Chahine (University of Greenwich)

[00181] Control of the Stefan problem

Session Time & Room : 5B (Aug.25, 10:40-12:20) @A207

Type : Contributed Talk
Abstract : The Stefan problem is the quintessential macroscopic model of phase transitions in liquid-solid systems. We consider the one-phase Stefan problem with surface tension, set in two-dimensional strip-like geometry. We discuss the local null controllability of the system in any positive time, by means of control supported within an arbitrary open and non-empty subset.
Classification : 93B05, 35R35, 35Q35, 93C20, Stefan problem, free boundary problem, controllability
Author(s) : Debayan Maity (TIFR Centre for Applicable Mathematics)

[00188] Two-Phase Modelling of Plaque Growth in Early Atherosclerosis

Session Time & Room : 3D (Aug.23, 15:30-17:10) @D514

Type : Contributed Talk
Abstract : We discuss the early stage of atherosclerotic plaque formation within arteries. The production of foam cells characterizes such plaque. Foam cells generate from the differentiated form of monocytes (called macrophages) owing to oxidized low-density lipoprotein (ox-LDL) cholesterol intake. Initially, plaque radius grows exponentially and later on, it stabilizes with time. Such behaviour is due to the death of foam cells owing to the toxicity of excess ox-LDL intake, although ox-LDL enhances foam cell proliferation.
Classification : 92C35, 92-10, 76M20, 35B20, 92B05
Format : Talk at Waseda University
Author(s) : Abdush Salam Pramanik (Department of Mathematics, University of North Bengal) Bibaswan Dey (Department of Mathematics, University of North Bengal)

[00191] Two-Phase Modelling of Subcutaneous Injection of Drugs

Session Time & Room : 3D (Aug.23, 15:30-17:10) @A511

Type : Contributed Talk
Abstract : Various drugs and vaccines are administered through the subcutaneous pathway. The adipose cells within the subcutaneous layer impart structural anisotropy. We address the mechanical response of the

adipose tissue in terms of the computed stress fields to understand the pain a patient realizes. Tissue anisotropy instigates the interstitial fluid to generate one or more eddies. Eddies help a low viscous injected drug homogenize when the skin pinching height is high at the injection apply area.

Classification : 92C35, 92B05, 92C50, 35B20, 92-10, Mathematical Modeling of Problems on Biological Phenomena

Format : Online Talk on Zoom

Author(s) : Bibaswan Dey (Department of Mathematics, University of North Bengal) Abdush Salam Pramanik (Department of Mathematics, University of North Bengal) Timir Karmakar (Department of Mathematics, National Institute of Technology Meghalaya, India) Kalyan Saha (Department of Mathematics, University of North Bengal)

[00197] Mathematical analysis of a nonlinear SIS model with effect of migration

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G501

Type : Contributed Talk

Abstract : We consider a nonlinear SIS epidemic model with nonlocal disease transmission rate and diffusion in space which is a system of parabolic equations. The existence and uniqueness of steady state are studied using compact and nonsupporting operators, and strongly continuous semigroup theory, respectively. Due to the nonlinearity in the disease transmission rate, proof of the uniqueness of a steady state requires a completely different approach. The linearization around the nontrivial steady state of the model requires the study of a perturbed operator. Spectral analysis is used to study the local stability and the global stability of the steady state.

Classification : 35B35, 35Q92, 47H10, 92D25

Format : Talk at Waseda University

Author(s) : Soumak Nag (University of Hyderabad) Suman Kumar Tumuluri (University of Hyderabad)

[00200] Montgomery identity and Ostrowski type inequalities via Katugampola integral operator

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G305

Type : Contributed Talk

Abstract : In this talk, we will discuss the extended version of Montgomery identity using Katugampola integral operators. Also we will establish Ostrowski type integral inequalities and fractional integral inequality for product of two functions.

Classification : 26A33, 26D07, 26D10
Format : Online Talk on Zoom
Author(s) : Henok Desalegn Desta (Addis Ababa university) Deepak B. Pachpatte (Dr. Babasaheb Ambedkar Marathwada University, India) Tadesse Abdi (Addis Ababa University) Jebessa B. Mijena (Georgia College & State University)

[00204] Periodicity and Symmetry on a Class of Integral Equations with Weakly Singular Kernels

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G709

Type : Contributed Talk
Abstract : In this study, we introduce the periodic and symmetric properties of the states in a class of weakly singular integral equations. Motivation of this paper is based on the main results of previous paper: bounded forces produce bounded states in the infinite field. We furthermore observed that in finite times, steady states show. For each periodicity, two kinds of initial conditions apply: one is same as the original one, the other is the steady state from previous period. For symmetry, we apply same magnitudes of forces but opposite directions.
Classification : 37Mxx, 31Axx, 33Exx
Format : Talk at Waseda University
Author(s) : Shihchung Chiang (Chung Hua University)

[00205] `Period doubling' induced by optimal control in a behavioral SIR epidemic model.

Session Time & Room : 2E (Aug.22, 17:40-19:20) @A201

Type : Contributed Talk
Abstract : We consider a behavioral SIR epidemic model to describe the action of the public health system aimed at
enhancing the social distancing during an epidemic outbreak. An optimal control problem is proposed
where the control acts in a specific way on the contact rate. We show that the optimal control of social
distancing is able to generate a period doublinglike phenomenon. Namely, the period of the prevalence is
double the period of the control, and an alternation of small and large peaks of disease prevalence can be
observed.

Classification : 92D30, 34C60, 93C15
Format : Online Talk on Zoom
Author(s) : Sileshi Sintayehu Sharbayta (Addis Ababa University) Bruno Buonomo (University of Naples Federico II) Alberto d'Onofrio (University of Trieste) Tadesse Abdi (Addis Ababa University)

[00206] Tensor product-type methods for solving Sylvester tensor equations

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G304

Type : Contributed Talk
Abstract : The tensor biconjugate gradient $($TBiCG$)$ method has recently been proposed for solving Sylvester tensor equations. TBiCG is based on BiCG that may exhibit irregular convergence behavior. To overcome the limitations of BiCG, product-type methods have been proposed. In this study, we propose tensor product-type methods to solve Sylvester tensor equations. Furthermore, we consider the preconditioned versions using the NKP preconditioner. Numerical experiments illustrate that the proposed methods are competitive with some existing methods.
Classification : 15A69, 65F10
Format : Talk at Waseda University
Author(s) : Jing Niu (Nagoya University) Tomohiro Sogabe (Nagoya University) Lei Du (Dalian University of Technology) Tomoya Kemmochi (Nagoya University) Shao-Liang Zhang (Nagoya University)

[00208] Love wave along the interface with triangular irregularity

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E812

Type : Contributed Talk
Abstract : Propagation of the love wave is studied along the irregular interface between the porous layer and the elastic half-space. The porous layer is assumed to be saturated by two immiscible fluids. The irregularity at the interface is considered in the form of a triangular pit embedded in the half-space. The elastic half-space is considered to be initially stressed under the effect of gravity. A complex transcendental and implicit relation between the frequency and the phase speed of the Love wave is derived in the form of a dispersion relation. A numerical study is conducted to observe the effect of material parameters and irregularity on the behavior of the Love wave. A significant impact of the triangular pit, porosity, and frequency is observed on the phase speed of the propagating Love wave and depicted graphically.

Classification : 74J15
Format : Talk at Waseda University
Author(s) : Ashish Arora (I. K. Gujral Punjab Technical University)

[00212] Optimal control for a SIR epidemic model with limited quarantine

Session Time & Room : 5B (Aug.25, 10:40-12:20) @A201

Type : Contributed Talk
Abstract : Social distance and total lock-downs are interventions that have been used to mitigate the spread of the COVID-19 virus. However, these measures could be harmful to societies in terms of social and economic costs. Using optimal control tools and numerical
computations we investigate the optimal strategies that minimize the impact of an epidemic, by studying the conditions for an optimal control of a Susceptible-Infected-Recovered model.
Classification : 92D30, 34H05, 49N90
Format : Online Talk on Zoom
Author(s) : Rocio Celeste Balderrama (Departamento de Matematica-Universidad de Buenos Airesu) Javier Peressutti (Universidad de Mar del Plata) Juan Pablo Pinasco (Universidad de Buenos Aires-IMAS-CONICET) Constanza Sanchez de la Vega (Universidad de Buenos Aires_IMAS_CONICET) Federico Vazquez (Universidad de Buenos Aires-IC-CONICET)

[00213] Advances in Derivative-free Methods and the DFO VU-algorithm

Session Time & Room : 4D (Aug.24, 15:30-17:10) @D408

Type : Contributed Talk
Abstract : The VU-algorithm is a method of minimizing convex, nonsmooth functions by splitting the space into two subspaces: the V-space, on which the objective function's nonsmooth behavior is captured, and the orthogonal U-space, on which the function behaves smoothly. The algorithm's convergence is accelerated, as it takes a (slow) proximal point step in the V-space, then a (fast) quasi-Newton step in the U-space, since gradients and Hessians exist there. New convergence rates and subroutines are presented.
Classification : 90C25, 49J52
Format : Talk at Waseda University
Author(s) : Chayne Planiden (University of Wollongong)

[00218] Characterizations of diffusion matrices in homogenization of nondivergence-form elliptic equations

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G501

Type : Contributed Talk

Abstract : We provide characterizations of diffusion matrices A for which the sequence of solutions $(u^{\varepsilon})_{\varepsilon > 0}$ to $-A(x/\varepsilon):D^2 u^{\varepsilon} = f$ in Ω, $u^{\varepsilon} = g$ on $\partial\Omega$, converges to the solution of the homogenized problem with L^{∞}-rate $\mathcal{O}(\varepsilon^2)$ for all sufficiently regular f,g. Whereas such diffusion matrices can be characterized via the third-order homogenized tensor, we provide more explicit characterizations and prove an open conjecture posed by Guo and Tran.

Classification : 35B27, 35B40, 35J25

Format : Talk at Waseda University

Author(s) : Xiaoqin Guo (University of Cincinnati) Timo Sprekeler (National University of Singapore) Hung Vinh Tran (University of Wisconsin Madison)

[00219] Approximation methods for solving pursuit-evasion differential game

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G402

Type : Contributed Talk

Abstract : In this study we present an appropriate singular, zero-sum, linear-quadratic differential game. One of the main features of this game is that the weight matrix of the minimizers control cost in the cost functional is singular. Due to this singularity, the game cannot be solved either by applying the Isaacs MinMax principle, or the BellmanIsaacs equation approach. As an application, we introduced an pursuit-evasion differential game with an appropriate regularized cost functional and developed an appropriate dual representation. Developing the variational derivatives of this regularized cost functional, we apply several approximation methods and show how the numerical

results coincide with the dual representation.
Classification : 34H05, 49J15, 91A23, 90C90, 49N15
Format : Talk at Waseda University
Author(s) : Oleg Kelis (Technion) Oleg Kelis (The TechnionIsrael Institute of Technology)

[00224] Multi-objective multi-route STP with carbon emission and risk mitigation in Pharmaceutical Supply Chain under Pythagorean fuzzy Environment

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D505

Type : Industrial Contributed Talk
Abstract : This research proposes multi-objective multi-route fixed-charge solid transportation problem with carbon emission and risk mitigation in Pharmaceutical Supply Chain (PSC) under trapezoidal Pythagorean fuzzy environment. A novel ranking index is proposed to convert the suggested Pythagorean fuzzy model into its deterministic version. This study develops new computational procedure to minimize the chosen factors in PSC. Thereafter the model is solved by intuitionistic fuzzy and hybrid programming. Finally, an example is included to show the effectiveness of the model.
Classification : 90B06, 90B50, 90C29, 90C70
Format : Talk at Waseda University
Author(s) : Dr. Sankar Kumar Roy (Dept. of Applied Mathematics, Vidyasagar University, Midnapur-721102, West Bengal, India)

[00225] Multidimensional WENO-AO Reconstructions Using A Simplified Smoothness Indicator

Session Time & Room : 4C (Aug.24, 13:20-15:00) @E704

Type : Contributed Talk
Abstract : Finite volume, weighted essentially non-oscillatory (WENO) schemes using the simple smoothness indicator $\sigma= 1/(L-1) \sum_{j} (u_{j} - u_{m})^2$, are presented, where L is the number of mesh elements in the stencil, u_j is the local function average over jth element, and index m gives the target element. We develop a modification of WENO-Z weighting that gives a reliable and accurate reconstruction of adaptive order.

Convergence results are proved. Numerical experimental results are also provided.

Classification : 65D15, 65M08, 65M12, 76M12
Format : Online Talk on Zoom
Author(s) : Chiehsen Huang (National Sun Yat-sen University) Todd Arbogast (University of Texas; Austin) Chenyu Tian (University of Texas; Austin)

[00229] Mathematical modeling of spatial distribution of COVID-19 epidemic

Session Time & Room : 4C (Aug.24, 13:20-15:00) @E507

Type : Contributed Talk
Abstract : This study provides a mathematical study of the Susceptible, Exposed, Infected, Recovered, and Vaccinated population model of the COVID-19 pandemic by the bias of reaction-diffusion equations. We showed the spatial distribution of the model compartments when the basic reproduction rate R0 < 1 and R0 > 1. We demonstrate the model's effectiveness by performing numerical simulations and then investigated the impact of vaccination and the significance of spatial distribution parameters in the spread of COVID-19 epidemic.
Classification : 60J70, 62H12, 00A71
Format : Talk at Waseda University
Author(s) : Kayode Oshinubi (Northern Arizona University) Jacques Demongeot (University of Grenoble Alpes) Brice Kammegne (University of Dschang)

[00238] Numerical Schemes for Generalized Isoperimetric Constraint Fractional Variational Problem

Session Time & Room : 2E (Aug.22, 17:40-19:20) @F401

Type : Contributed Talk
Abstract : This paper discusses three numerical schemes for Generalized Isoperimetric Constraint Fractional Variational Problems (GICFVPs) defined using generalized fractional derivatives. Three Numerical schemes, i.e. linear, quadratic, and quadratic-linear schemes, are used to get numerical solutions of a GICFVP. The convergence rate of the linear and quadratic schemes for $\alpha\in(0,1)$ are $2-\alpha$ and $3-\alpha$. It is observed that the

presented schemes perform well, and when the step size h is decreased, the desired solution is attained.
Classification : 49R99, 65K10, 65L60, 65L70
Format : Online Talk on Zoom
Author(s) : DIVYANSH PANDEY (IIT (BHU) , Varanasi) Rajesh Kumar Pandey (IIT (BHU) , Varanasi)

[00240] Phantom cosmological model with observational constraints in symmetric teleparallel gravity

Session Time & Room : 3E (Aug.23, 17:40-19:20) @D407

Type : Contributed Talk
Abstract : The cosmological model of the Universe has been presented in symmetric teleparallel gravity and the parameters are constrained from the cosmological datasets. The nonmetricity function considered here contains higher power of the nonmetricity. With some algebraic manipulation the Hubble parameter has been obtained in redshift. The cosmological and geometrical parameters are obtained and constrained using the recent Hubble and Pantheon + SHOES datasets. The model shows early deceleration and late time acceleration.
Classification : 83C15, 83D05, 83C10, Modified Gravity, Cosmological Model.
Author(s) : Bivudutta Mishra (BITS-Pilani, Hyderabad Campus)

[00241] Adaptive sparse interpolation in high dimensions and applications to surrogate modeling in chemical engineering.

Session Time & Room : 4C (Aug.24, 13:20-15:00) @E507

Type : Contributed Talk
Abstract : We present theoretical and practical aspects on the development of accurate surrogate models from first-principles, multiscale, PDE models for industrial chemico-physical processes. We will present many applications in Phosphate industry done in collaboration with OCP-Group in Morocco.

The surrogate models are based on sparse multivariate polynomial interpolation. The goal is to reduce the computational time while preserving its physical properties such as monotonicity and positivity.
Classification : 65D40, 65D05

Format : Talk at Waseda University

Author(s) : Saad Benjelloun (Makhbar Mathematical Sciences Research institute) saad benjelloun (Makhbar institute) Abdellah Chkifa (UM6P)

[00250] Formation of delta shock waves and vacuum states in the vanishing pressure limit of the Riemann solution to the isentropic Euler system for logarithmic equation of state with the Coulomb-like friction term

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E505

Type : Contributed Talk

Abstract : We investigate the limiting behavior of the Riemann solution to the isentropic Euler equations for logarithmic
equation of state with the Coulomb-like friction term. The formation of vacuum state and delta shock waves are
identified and analyzed when the pressure vanishes. Unlike the homogeneous case, the Riemann solution is no
longer self-similar. We prove that the Riemann solution of the isentropic Euler equations for logarithmic equation of state with friction term converges to the Riemann solution of the zero-pressure gas dynamics system with a
body force when the pressure vanishes.

Classification : 35L65, 35L67, 35L45

Format : Talk at Waseda University

Author(s) : Anupam Sen (Post Doctoral Fellow at Centre for Applicable Mathematics, Tata Institute of Fundamental Research)

[00252] Stabilization and adaptive event-triggered tracking control for non-linear systems

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G402

Type : Contributed Talk

Abstract : An adaptive event-triggered-based output tracking problem for non-linear network control systems with malicious attacks is discussed in this work. An adaptive event-triggered mechanism is developed to reduce the number of triggering and communication burdens. Feedback control is constructed to force the output trajectories to track reference input with disturbance and malicious attacks. Tracking objective transformed into input-output finite time stabilization. Sufficient conditions are developed based on

LyapunovKrasovskii functional and advanced integral inequalities.
Classification : 34H05, 93D25, Systems and control theory
Format : Online Talk on Zoom
Author(s) : Vijayakumar Muthusamy (Anna University)

[00261] Translational motion of a slightly deformed viscous spherical droplet in Stokes flow

Session Time & Room : 4D (Aug.24, 15:30-17:10) @D401

Type : Contributed Talk
Abstract : The problem of steady translational motion of a slightly deformed spherical droplet immersed in an immiscible viscous fluid is studied analytically under the consideration of vanishing Reynolds number. The flow fields in both the regions i.e. in the interior of droplet and exterior of droplet are governed by steady Stokes equations that are solved asymptotically using a method of perturbed expansions undersuitable boundary conditions. The deformation from spherical shape is characterized by a small parameter called deformation parameter, therefore, we have solved the problem up to the second order of the deformation parameter by neglecting the higher orders. The effect of deformation parameter is observed by means of force expression. The explicit expressions for the hydrodynamic drag force exerted on the droplet surface are obtained for the special cases of prolate and oblate spheroids. Our results are in good agreement with the exisitng results in literature for deformed solid sphere up to first and second order.
Classification : 76D07, 76T06, Transport Phenomena, Motion of bubbles and drops
Format : Talk at Waseda University
Author(s) : Jai Prakash (Mahindra University, Hyderabad) Huan J. Keh (National Taiwan University, Taipei)

[00275] A fast data-driven method for designing compressible shock dominant flows

Session Time & Room : 2E (Aug.22, 17:40-19:20) @F310

Type : Contributed Talk
Abstract : We will present a new class of high-order numerical algorithms for computational fluid dynamics. Called "GP-MOOD," the new finite volume method is based on the Gaussian Processes modeling that generalizes the Gaussian probability distribution. Solutions at shocks and discontinuities are handled by the improved Multidimensional Optimal Order Detection (MOOD) strategy, which controls numerical stability and accuracy in an "a

posteriori" shock-capturing formalism. We also introduce a new data-driven "a priori" MOOD method.
Classification : 35L25, 76N15, 85-08, 65M08
Format : Online Talk on Zoom
Author(s) : Dongwook Lee (University of California Santa Cruz)

[00281] Simulation of the mechanical behaviour of steel-concrete-steel structures including concrete voids

Session Time & Room : 1E (Aug.21, 17:40-19:20) @F401

Type : Contributed Talk
Abstract : Numerical tools, including finite element simulations, are considered to investigate the effect of initial voids inside concrete on the mechanical behavior of steel-concrete composite structures in compression. A refined numerical strategy is first defined, including a particular care on the relations between each structural component. Due to high computational cost, progressive numerical simplifications are then discussed to conclude in the most acceptable simplified hypothesis. A parametric study is finally launched and perspectives are discussed.
Classification : 74-10, 74S05, 74R05, simulation, damage models, structural behaviour
Format : Talk at Waseda University
Author(s) : Ludovic JASON (Universit Paris-Saclay, CEA, Service d'tudes Mcaniques et Thermiques)

[00291] Graph Convergence and Iterative Algorithm for a System of Generalized Nonlinear Variational-like Inclusions

Session Time & Room : 3E (Aug.23, 17:40-19:20) @F311

Type : Contributed Talk
Abstract : We focus on the investigation of the problem of finding a common point lying in the solutions set of a system of generalized nonlinear variational-like inclusions and the fixed points set of a total asymptotically nonexpansive mapping. A new iterative algorithm is suggested by employing the concepts of P-η-proximal-point mapping and graph convergence. Convergence of a sequence of above is established. We Prove the strong convergence and stability of the sequence generated by our algorithm.

Classification : 47H20, Operator theory
Format : Talk at Waseda University
Author(s) : Suliman S Al-Homidan (King Fahd University of Petroleum and Minerals)

[00300] Coupling macro-micro simulations in complex fluids

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A601

Type : Contributed Talk
Abstract : Some of the most remarkable properties and functions served by some complex fluids originate from the interplay between external fields and microstructural dynamics. From a computational point of view this generates a set of challenges related to the need of coupling dynamics at different length and times scales, sometimes spanning several orders of magnitude. Micro-macro simulations have gained a lot of recognition within the field because these methods allow capturing full dynamics at the macroscale without losing resolution at the microscale. In this talk, we will review our efforts to couple existing macroscopic solvers for the Navier-Stokes equations with microstructural dynamics described by Langevin-type equations. In particular, we will discuss dumbbells models -under viscometric and capillary thinning flows fields- and parallel computing using GPUs.
Classification : 92B05, 76A05, 76A10, 76D05, 97M60
Format : Talk at Waseda University
Author(s) : Paula A Vasquez (University of South Carolina) Michael Cromer (RIT)

[00301] On some modifications in the conjugate gradient method and its application in unconstrained optimization problems

Session Time & Room : 3E (Aug.23, 17:40-19:20) @D502

Type : Contributed Talk
Abstract : Conjugate gradient (CG) methods are preferably used to solve large-scale unconstrained optimization
problems due to strong local and global convergence properties and low memory requirements. To enhanse its convergence, we introduce an improved hybrid form of the conjugate gradient method in this
work. We propose a new form of CG parameter (k), combining the Fletcher Reeves (FR) and three-term

search directions. Our proposed search directions formula satisfies the sufficient descent condition independent of any line search and are bounded. For the global convergence, some proper assumptions on the
objective function and its gradient have been taken into account, which fulfills the strong Wolfe-Powell
line search conditions. Finally, numerical experiments have been carried out on some standard benchmark test functions and compared with other CG methods from the literature to check the validity of
the proposed algorithm. Numerical results guarantee the efficiency and robustness of our proposed CG
method.

Classification : 90-XX, 90C26, 90C30, 90bxx, 90-08
Format : Online Talk on Zoom
Author(s) : Sweta Kumari (Birla Institute of Technology Mesra, Ranchi) Darakhshan Jabeen Syeda (Birla Institute of Technology Mesra, Ranchi)

[00302] Manifold-Free Riemannian Optimization

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E605

Type : Contributed Talk
Abstract : Optimization problems constrained to a smooth manifold can be solved via the framework of Riemannian optimization. To that end, a geometrical description of the constraining manifold, e.g., tangent spaces, retractions, and cost function gradients, is required. In this talk, we present a novel approach that allows performing approximate Riemannian optimization based on a manifold learning technique, in cases where only a noiseless sample set of the cost function and the manifolds intrinsic dimension are available.
Classification : 65K05, 53Z50, 65D15
Format : Talk at Waseda University
Author(s) : Boris Shustin (Tel-Aviv University) Haim Avron (Tel-Aviv University) Barak Sober (The Hebrew University of Jerusalem)

[00310] Human Activity Recognition from Inertial Motion Data

Session Time & Room : 2E (Aug.22, 17:40-19:20) @E803

Type : Contributed Talk

Abstract : Human activity recognition (HAR) using inertial motion streaming has gained a lot of momentum in
recent years. This has been driven by smart environments and the ubiquity of inertial-motion sensors in modern
commodity devices. HAR applications span all aspects of human life such as healthcare, sports,
manufacturing, etc. In this talk we give a brief description of the state-of-the-art work in HAR including
action recognition, biometrics analysis (gender, age,..), sensors location determination,
gait analysis, etc.

Classification : 68T01, 68T05, 92C47

Format : Talk at Waseda University

Author(s) : Walid Gomaa (Egypt Japan University of Science and Technology)

[00314] The Orthogonal Spline Collocation Method for Parabolic Problems with Interfaces

Session Time & Room : 1E (Aug.21, 17:40-19:20) @E702

Type : Contributed Talk

Abstract : The parabolic problems with interfaces are solved using a method in which orthogonal spline collocation (OSC) is employed for the spatial discretization and the CrankNicolson method for the time-stepping. The derivation of
the method is described in detail for the case in which cubic monomial basis functions are used in the development of the OSC discretization. The results of extensive numerical experiments involving examples from the literature are presented.

Classification : 65M06, 65M22, 65M55, 65M70, 35K05

Format : Talk at Waseda University

Author(s) : Danumjaya Palla (BITS-Pilani KK Birla Goa Campus) Santosh Kumar Bhal (Centurion University of Technology and Management) Graeme Fairweather (Mathematical Reviews, American Mathematical Society)

[00320] Sensing the electrical world: modelling to understand aerial electroreception

Session Time & Room : 4E (Aug.24, 17:40-19:20) @D514

Type : Contributed Talk

Abstract : Bees and spiders (and other arthropods) can sense naturally occurring electrical fields. This recent discovery expands our view of how such organisms explore their environments, revealing previously unknown sensory capabilities.

This talk consists of three topics: 1) the physical and biological feasibility of this sense, 2) how interactions between sensory hairs alter their sensitivity to different stimuli, and 3) the new sensory possibilities (e.g., object identification) and biological implications of this sense (e.g., decision-making).

Classification : 92C10, 92C05, 74F10, 92C42

Format : Talk at Waseda University

Author(s) : Ryan Palmer (University of Bristol) Daniel Robert (University of Bristol) Isaac Chenchiah (University of Bristol)

[00321] Modeling of hydromagnetic unsteady flow over a upright plate using Pseudospectral method

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D404

Type : Contributed Talk

Abstract : This study looks at the effects of a crosswise magnetic field along with thermal radiation proceeding the unsteady two-dimensional magneto hydrodynamic viscous flow, electrically insulating, and Newtonian fluid across an upright plate next to a Darcian rule. For governing equations, Pseudospectral Method is used. In this inquiry, the governing non-linear, coupled partial differential equations are decoded using Pseudospectral scheme that is reliable, effective, and has undergone substantial validation. The technique's precision and efficacy are proven.

Classification : 80Axx, 80Mxx, 80M22

Format : Online Talk on Zoom

Author(s) : Anju Saini (Graphic Era (Deemed to be University) Dehradun)

[00326] Estimating the lowest-order eigenvalue in Sturm-Liouville boundary value problem

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G401

Type : Contributed Talk
Abstract : We investigate a special case of the SturmLiouville boundary value problem $($BVP$)$ and examine the BVP in the
Schrdinger form. By considering a reciprocal quadratic form of the corresponding invariant function, we estimate the
lowest-order eigenvalue without solving the eigenvalue problem but by utilizing the localized landscape and effective
potential functions. Some combinations of parameter values yield poor spectrum estimates. Other combinations are
satisfactorily although the values tend to overestimate results from numerical computations.
Classification : 34B05, 34B24, 34L15
Format : Talk at Waseda University
Author(s) : Natanael Karjanto (Sungkyunkwan University)

[00327] COBIT As An Information Governance Framework

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D402

Type : Contributed Talk
Abstract : This contributed talk aimed to present the information governance frameworks , In order to answer to the problem of the study, first we will present the information governance definition and importance, the information governance frameworks, then we'll show the COBIT as one of the important frameworks, its benefits and its principles, finally the study concluded that COBIT is a framework that ensure an optimum information technology.
Classification : 93Dxx, 93Axx, 93-00
Format : Online Talk on Zoom
Author(s) : Amina Feddaoui (Chadli Bendjedid university el tarf)

[00328] Schrdinger map and Multifractality

Session Time & Room : 1E (Aug.21, 17:40-19:20) @E702

Type : Contributed Talk

Abstract : In this talk, we will explore the richness of the Schrdinger map equation by discussing some recent results on its evolution in both hyperbolic and Euclidean geometrical settings. In the latter case, the equivalent form of the equation describes the motion of a vortex filament, e.g., smoke rings, tornadoes, etc. With numerical, theoretical techniques, we will show that when the filament curve initially has corners, its evolution and the trajectory of its corners exhibit multifractality.

Classification : 65M06, 28A80, 11L05, 65M20, 35Q55, Mathematical physics, Numerical methods, Schrdinger-type equtaions, Hyperbolic space

Format : Talk at Waseda University

Author(s) : Sandeep Kumar (CUNEF University) Luis Vega (Basque Center for Applied Mathematics) Francisco de la Hoz (The University of the Basque Country)

[00329] A-posteriori error estimates for parabolic optimal control problems with controls acting on lower dimensional manifolds

Session Time & Room : 3C (Aug.23, 13:20-15:00) @F312

Type : Contributed Talk

Abstract : In this talk, we shall present a-posteriori error estimates for the fully discrete finite element approximation to the optimal control problem governed by parabolic partial differential equations where the control is acting on lower dimensional manifolds. We use piecewise linear and continuous finite elements for the approximations of state and adjoint variables whereas piecewise constant functions are employed to approximate the control variable. Moreover, the time derivative is approximated by using the backward Euler scheme. We derive a-posteriori error estimates for the various dimensions of the manifold. Numerical results reveal the effectiveness of the error estimators.

Classification : 49J20, 49K20, 65N15, 65N30

Format : Talk at Waseda University

Author(s) : Rajen Kumar Sinha (Indian Institute of Technology Guwahati) Ram Manohar (Indian Institute of Technology Kanpur)

[00331] Mathematical modelling of fluid-particle interaction

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E820

Type : Contributed Talk

Abstract : Fluid-particle interactions are fundamental to many problems in industry and biology, for example aircraft icing, where ice adheres to aircraft, and the movement of drugs/thrombi in blood. Mathematical modelling and asymptotic methods can be used to reduce such problems to simple ODEs and PDEs which can be solved to reveal an intriguing variety of particle motions. Current work includes an ice particle submerged in water, and a particle in lubrication flow with application to blood.

Classification : 76B10, 76D08, 76D09, 76M45

Author(s) : Ellen Mary Jolley (UCL)

[00334] A generalized study of the distribution of buffer over calcium on a fractional dimension

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G305

Type : Contributed Talk

Abstract : Here, we focus on cellular calcium fluctuations with different buffers, including calcium-binding buffers, using the Hilfer fractional advection-diffusion equation for cellular calcium. By combining with intracellular free calcium ions, buffers reduce the cytosolic calcium concentration. Models are developed for association, dissociation, diffusion, and buffer concentration. In comparison to the conventional calcium model, the modified Hilfer calcium model offers a richer physical explanation. Numerical simulations are also carried out in MATLAB.

Classification : 26A33, 35Q92, 44A10, 92C99

Format : Online Talk on Zoom

Author(s) : Sanjay Bhatter (Malaviya National Institute of Technology Jaipur) Kamlesh Jangid (Central University of Rajasthan, Ajmer) Shyamsunder - (Malaviya National Institute of Technology Jaipur) Sunil Dutt Purohit (Rajasthan Technical University, Kota) Dumitru Baleanu (Cankaya University, Ankara) Daya Lal Suthar (Wollo University)

[00335] Fractional Relaxation-Oscillation and Fractional Biological Population Equations: Applications of the Elzaki Decomposition Method

Session Time & Room : 3C (Aug.23, 13:20-15:00) @F311

Type : Contributed Talk

Abstract : In various suitable habitat scenarios, the Elzaki decomposition method is used to handle the fractional order relaxation and damped oscillation equation along with the time-fractional spatial diffusion biological population model. According to the graphs for the found solutions, fractional relaxation is a super-slow phenomenon due to its protracted descent, and fractional damped oscillation is an intermediate process that explains damped oscillation dynamic systems generated by some attenuated oscillations. The biological population model of time-fractional spatial diffusion portrays a rapid increase in population density in an ecosystem migrating from an unfavourable zone to a good habitat.

Classification : 26A33, 33E12, 35A22, 34C26, 60J70

Format : Online Talk on Zoom

Author(s) : Daya Lal Suthar (Wollo University)

[00337] Extending Matrix-less Methods for Eigenvalues and Eigenvectors

Session Time & Room : 4D (Aug.24, 15:30-17:10) @E508

Type : Contributed Talk

Abstract : Toeplitz and Toeplitz-like matrices arise in many fields; of special interest are the discretisations of differential equations. Matrix-less methods exploit the fact that we can view these Toeplitz(-like) matrices as part of a sequence of matrices and that the eigenvalues in the sequence behave as samplings of a function, called the symbol. We will discuss recent developments to handle the case of variable coefficient matrices, the approximation of eigenvectors, and Toeplitz(-like) matrices with non-monotone symbols.

Classification : 65F15, 15B05, 15A18

Format : Talk at Waseda University

Author(s) : David Meadon (Uppsala University)

[00339] Using Numerical Modeling two phase flow Method in evaporator design

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D403

Type : Industrial Contributed Talk

Abstract : Evaporator is a critical component in integration of simple cycle gas turbine into
combined cycle power plant. Evaporator should be designed in accurate way depend
on thermal parameters (gas & water). The method developed for design evaporator
of Baiji gas power plant in Iraq. The method based on modeling tow phase flow by
combination of three governing equations of energy conservation, Mass
conservation and momentum conservation equation with numerical simulation using finite difference method.

Classification : 80-xx, 80-10

Format : Talk at Waseda University

Author(s) : Maher Saab Salamah (Ministry of Electricity / Iraq)

[00344] Forced convection from an isothermal square cylinder in shear flow

Session Time & Room : 2C (Aug.22, 13:20-15:00) @D401

Type : Contributed Talk

Abstract : Forced convection from an uniformly heated square cylinder placed in linear shear flow of constant properties fluid is numerically investigated at Reynolds number, Re=100, shear rate, K=0.0-0.2 and Prandtl number, Pr=0.5. The two-dimensional mathematical equations of flow motion and energy are solved using a higher order compact (HOC) finite difference scheme on Cartesian grids. The effect of K is investigated on flow and thermal fields in terms of isotherm patterns, Nusselt number distributions etc. The resulting vortex shedding phenomena behind the cylinder is detected and thermal field is determined.

Classification : 76D05

Format : Online Talk on Zoom

Author(s) : Atendra Kumar (National Institute of Technology Srinagar, India)

[00348] Design of control for IT2 fuzzy stochastic systems with multi disturbances

Session Time & Room : 2E (Aug.22, 17:40-19:20) @D515

Type : Contributed Talk

Abstract : Anti disturbance control design problem is proposed for a class of interval type-2 fuzzy stochastic systems subject to uncertainty and multiple disturbances. A fuzzy exogenous system considers a new fuzzy disturbance observer to precisely evoke the properties of interval type 2 fuzzy stochastic models with multiple disturbances. In order to ensure the stochastic stability of the closed-loop fuzzy system, a new sufficient condition is constructed using the method of linear matrix inequalities by integrating the $\textit{Ito}$ operator and choosing the appropriate Lyapunov-Krasovskii functional candidate dissipativity performance index. Finally, the provided theory is demonstrated with the example.

Classification : 93Bxx, 93Exx, 93Dxx

Format : Online Talk on Zoom

Author(s) : Aarthi Subramanian (Research Scholar, Anna University Regional Campus Coimbatore) Marshal Anthoni S (Anna University Regional Campus Coimbatore)

[00362] Nonlinear biphasic mixture model: existence and uniqueness results

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D402

Type : Contributed Talk

Abstract : The purpose of this study is to develop a multiphase mathematical model based on interstitial hydrodynamics and tissue deformation mechanics within an in vitro solid tumor. We use classical mixture theory to derive the balance equations for mass and momentum. The study makes a significant contribution by treating hydraulic resistivity as anisotropic and heterogeneous, which leads to strongly coupled and nonlinear PDEs. We further establish existence and uniqueness result in a weak sense.

Classification : 76Txx, 76Zxx, 35Q74, 35D30, Analysis of nonlinear partial differential equations

Format : Talk at Waseda University

Author(s) : Meraj Alam (Mahindra University, Hyderabad) Adrian Muntean (University of Karlstad) Raja Sekhar G P (Indian Institute of Technology Kharagpur India)

[00363] Neighborhood effects, college education, and social mobility

Session Time & Room : 3C (Aug.23, 13:20-15:00) @G402

Type : Contributed Talk

Abstract : This study models the impact of environmental factors on upward social mobility, where the educational environment is measured by the proportion of college-educated individuals, and social mobility is measured by a change in the proportion of people in different income classes. The dynamics of the educational environment are modeled using a modified version of the invasion/extinction ecological model of Richard Levins. The educational environment influences the educational choices of poor people, becoming effective only after a threshold point is reached. The rate of growth in influence is modeled using a monotonically increasing saturation function, which includes a delay parameter referred to as handling time, that measures the speed of influence. Our simulations indicate that poor people choose to become educated at a rate that primarily depends on the density of the local environment.

Classification : 34-11, 37N40, 92B05

Author(s) : Cesar Montalvo (University of Virginia)

[00365] Advancing Computerized Tomography: Deep-Learning based Regularization in Diffuse Optical Tomography

Session Time & Room : 2D (Aug.22, 15:30-17:10) @E709

Type : Contributed Talk

Abstract : X-rays Computed Tomography is a main pillar of medical imaging which at present is experiencing a strong innovation phase. While new tomographic systems try to minimize X-rays exposure, non-trivial challenges exist, mainly increased noise levels and the need for dealing with low and high contrast regions. In this talk we will refer about our research on new algorithms able to efficiently deal with this tradeoff, with specific reference to Diffuse Optical Tomography.

Classification : 65Z05, 65N20, 65N80, 68T07

Format : Talk at Waseda University

Author(s) : Paola Causin (University of Milano) Andrea Aspri (University of Milano)

[00374] Recent numerical and theoretical advances in the study of matrix sequences

Session Time & Room : 2E (Aug.22, 17:40-19:20) @G305

Type : Contributed Talk

Abstract : We present recent developments in the study of the spectral behaviour of structured matrix sequences. For example, all PDE discretizations, such as FEM, FDM, and DGM, generate these types of sequences. We will mainly discuss matrix-less methods for non-Hermitian sequences, where the generating symbol does not describe the eigenvalue distribution; we can now numerically approximate, with high accuracy, the spectral symbol describing the eigenvalue distribution. Standard double precision eigenvalue solvers typically fail for these matrices.

Classification : 15Axx, 35Pxx, 65Fxx

Format : Talk at Waseda University

Author(s) : Sven-Erik Ekstrm (Uppsala University)

[00375] Modelling Typhoid Fever Transmission: Optimal control and Cost-Effectiveness Analysis

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A601

Type : Industrial Contributed Talk

Abstract : Typhoid fever has been a public health challenge globally, most especially in the developing countries where sanitation and personal hygiene are not taken serious coupled with non-availability of safe-drinking water. In this paper, a deterministic mathematical model of direct and indirect mode of transmission of Typhoid fever dynamics is formulated to investigate the influence of limited clinical efficacy of antibiotics administer to patients suffering from the disease with optimal control and cost-effectiveness analysis.

Typhoid fever has been a public health challenge globally, most especially in the developing countries where sanitation and personal hygiene are not taken serious coupled with non-availability of safe-drinking water. In this paper, a deterministic mathematical model of direct and indirect mode of transmission of Typhoid fever dynamics is formulated to investigate the influence of clinical efficacy of antibiotics administer to patients suffering from the disease. The basic reproduction number is analytically computed, and existence and local stability condition of disease-free equilibrium is investigated. Subsequently, the global sensitivity analysis of the model parameters is computed. The optimal control and cost-effectiveness analysis

were also computed. Our results suggest that hygiene practice and awareness campaign, and disinfection or sterilization or bacteria decay control is the most cost-effective in eliminating the disease from the population and from preventing the susceptible individuals from contracting the bacteria disease.

Classification : 92BXX, 92-XX, 92-10, 91-XX, 91-10, Mathematical modeling of infectious disease(Biomathematics)

Author(s) : kazeem Austin TIJANI (Federal University of Agriculture(J. S Tarka university) , Makurdi) Chinwendu Emilian MADUBUEZE (Federal university of Agriculture Makurdi Nigeria) Iortyer Reuben GWERYINA (Federal university of Agriculture(J.S. Tarka University) , Makurdi))

[00376] Adaptive Optimal Market-Making Strategies with Inventory Liquidation Costs

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A510

Type : Contributed Talk

Abstract : An optimal market-making strategy for a high-frequency market maker under a discrete-time Limit Order Book model is presented. Interestingly, the optimal market-making strategy adapts to the past arrivals of market orders, making it adapted to previous market information. Admissibility and optimality of the optimal strategy are also proved. Finally, we test our assumptions empirically and compare the optimal strategy to one used under a non-adaptive framework where only the average past information is considered.

Classification : 91G15, 93E20, 91B70, 91G30, 49J55

Format : Talk at Waseda University

Author(s) : Jonathan Allan Chvez Casillas (University of Rhode Island) Jos Enrique Figueroa Lpez (Washington University in St. Louis) Chuyi Yu (Washington University in St. Louis) Yi Zhang (University of Illinois Urbana-Champaign)

[00383] A kernel-based method for Schrdinger bridges

Session Time & Room : 3E (Aug.23, 17:40-19:20) @D514

Type : Contributed Talk

Abstract : We propose a kernel-based machine learning method for numerical solutions of Schrdinger's bridge problems. In this method, the terminal time distribution constraint is described by a kernel-based metric on the space of probability measures.

Classification : 93E20
Format : Talk at Waseda University
Author(s) : Yumiharu Nakano (Tokyo Institute of Technology)

[00388] Numerical solution of distributed order time-fractional diffusion equations.

Session Time & Room : 3C (Aug.23, 13:20-15:00) @G601

Type : Contributed Talk
Abstract : In this work, we solved distributed order time-fractional diffusion equation with the help of a wavelet approximation scheme and the Gauss quadrature rule. First, we construct wavelet-based operational matrices of distributed order fractional derivatives and integer order derivatives. After the construction of the operational matrix apply the tau method and convert the original mathematical problem into a system of linear algebraic equations and solve the equations for finding the approximate solutions. For method validation, we have provided some test examples, convergence analysis, and error estimation, and verify with the existing scheme with one of the existing schemes.

Classification : 35J99, 65N35, 65N99
Format : Online Talk on Zoom
Author(s) : Yashveer Kumar (Indian Institute of Technology(BHU) , Varanasi, India.) Vineet Kumar Singh (Department of Mathematical Sciences, Indian Institute of Technology (Banaras Hindu University) , Varanasi, India.)

[00393] Mathematical Modelling of Bilayered Cathodes for Lithium-Ion Batteries

Session Time & Room : 2D (Aug.22, 15:30-17:10) @E709

Type : Contributed Talk
Abstract : Bilayered cathodes are promising candidates to improve lithium-ion battery performance by optimising the electrode design. In this work, lithium iron phosphate and nickel manganese cobalt chemistries are connected in two discrete layers within a cathode, which improves the C-rate performance above 2C compared to uniform cells. To inform the design process we create mathematical model to accommodate multilayers. The model is solved numerically, validated against data and explains how each layer acts.
Classification : 35Qxx, 37Nxx

Format : Talk at Waseda University
Author(s) : Eloise Tredenick (University of Oxford)

[00394] Numerical methods for option pricing: need and challenges

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E504

Type : Contributed Talk
Abstract : The stability analysis of numerical methods is often challenging. In this talk, compact schemes are considered for the variable coefficient PDEs arising in option pricing. A sufficient condition for stability of the schemes has been derived using novel difference equation based approach. The condition number of amplification matrix is also analyzed, and an estimate for the same is derived. An example is provided using MATLAB to support the assumption taken to assure stability.
Classification : 65N12, 65N06, 65N15
Format : Talk at Waseda University
Author(s) : KULDIP SINGH PATEL (Indian Institute of Technology Patna)

[00395] What can be the potential risk of Mpox outbreak in the endemic country?: Non-Markovian stochastic modeling study

Session Time & Room : 5B (Aug.25, 10:40-12:20) @A201

Type : Contributed Talk
Abstract : In 2022, the Mpox outbreak shocked the world, with a completely different pattern and scale compared to past incidences in non-endemic countries, more than 80,000 cases have been confirmed. In this talk, we present how we analyzed the risk of local spread using a non-Markovian stochastic model. Multiple factors, which are suspected to affect the early stage of the outbreak significantly, the contact tracing, self-report-related behavior of the primary case, and secondary infectees were examined.
Classification : 92D30, 60H30, 62M09
Format : Talk at Waseda University
Author(s) : Youngsuk Ko (Department of mathematics, Konkuk university) Victoria May Mendoza (Institute of Mathematics, University of the Philippines Diliman) Renier Mendoza (Institute of Mathematics, University of the Philippines Diliman) Yubin Seo (Hallym University College of Medicine) Jacob Lee (Hallym University College of Medicine) Eunok Jung (Department of mathematics, Konkuk University)

[00396] A Stochastic Approach for the Computation of Large-Scale Matrix Functions

Session Time & Room : 5B (Aug.25, 10:40-12:20) @E505

Type : Contributed Talk

Abstract : Although many scientific problems can be described in term of functions over matrices, their high computational cost and the lack of parallel and scalable numerical tools propel scientists to seek alternative solutions. In this talk, we will introduce a Monte Carlo method that is capable of computing matrix functions for large-scale datasets and in particular present how it can be used to solve time-fractional differential equations.

Classification : 65C05, 35R11, 33E12, 60Gxx, 60K50

Format : Talk at Waseda University

Author(s) : Nicolas Guidotti (INESC-ID, Instituto Superior Tcnico, Lisboa)

[00397] A continuum model for the bulldozing of an immersed granular material in a confined geometry

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E803

Type : Contributed Talk

Abstract : We present a reduced-order continuum model for the bulldozing of an immersed, sedimented granular material by a rigid piston in a fluid filled gap between two parallel plates. In our model, the granular pile and the overlying fluid layer evolves as coupled thin-films. We solve our model numerically for a variety of different scenarios to develop insight into the interactions between wall friction, internal viscous-like stresses, and fluid flow both above and through the pile.

Classification : 74-10, 76-10

Format : Talk at Waseda University

Author(s) : Liam Morrow (University of Oxford) Chris MacMinn (University of Oxford)

[00398] Approximation of Abel type nonlinear fractional integral equations by the use of orthogonal polynomials

Session Time & Room : 3C (Aug.23, 13:20-15:00) @G601

Type : Contributed Talk

Abstract : The nonlinear fractional integral equations of the type Abel are presented in this study with general framework for determining the approximate solution. As basis functions, this method makes use of Lagrangian interpolating polynomials (LIPs) and shifting Legendre polynomials (SLPs). The original problem is converted into a system of algebraic nonlinear equations using operational matrices of SLPs and LIPs, which are first developed. We investigated at the provided techniques' stability and convergence under several significant conditions.

Classification : 35J99, 65N35, 65N99

Author(s) : Aman Singh (Department of Mathematical Sciences, Indian Institute of Technology (Banaras Hindu University)) Vineet Kumar Singh (Department of Mathematical Sciences, Indian Institute of Technology (Banaras Hindu University))

[00403] Exact Penalization at Stationary Points of Sparse Constrained Problem

Session Time & Room : 1E (Aug.21, 17:40-19:20) @F309

Type : Contributed Talk

Abstract : Nonconvex sparse optimization problems with the trimmed l1 norm or truncated nuclear norm, which is a penalty function of cardinality or rank constraint, have been actively studied. A unified framework that includes all the existing trimmed l1-penalized problems is introduced. We show that under mild conditions, any d-stationary point of the penalized problem satisfies the corresponding constraint. Our result is superior to almost all existing results, especially from the viewpoint of practice.

Classification : 90C06, 90C26, 90C30, 90C46, 90C90

Author(s) : Shotaro Yagishita (Chuo University) Jun-ya Gotoh (Chuo University)

[00408] Reducing Complexity of a Population Balance Model for Synthesis of Composite Polymer Particles

Session Time & Room : 1D (Aug.21, 15:30-17:10) @F311

Type : Contributed Talk

Abstract : An accurate prediction of the formation of polymer particles is vital for synthesis of high quality materials, but still not feasible due to its complexity. We present a Population Balance Equations model as a tool targeting the task. Aimed to enhance model performance, we derive a quantitative criterion for locating regions of slow aggregation among particles. Within such a regime, the aggregation terms can be neglected and computational efficiency improves by several orders of magnitude.

Classification : 45Kxx, 70-10, 92Exx

Format : Talk at Waseda University

Author(s) : Simone Rusconi (CUNEF Universidad) Christina Schenk (IMDEA Materials Institute) Arghir Zarnescu (Basque Center for Applied Mathematics) Elena Akhmatskaya (Basque Center for Applied Mathematics)

[00414] Asymptotically Modelling Plastic Deformation during Cold Rolling of Sheet Metal

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D102

Type : Contributed Talk

Abstract : Cold rolling is a metal forming process where strip of metal passes between two rollers and comes out
thinner. We present a multiple-scale asymptotic model of cold rolling. Assuming rigid perfectly-plastic
material and large rolls, we explain how to rederive and go beyond existing theories. Results agree well with
FE simulations, and suggest the origin of residual stress in the resulting strip. This modelling approach has
potential applications in many metal forming processes.

Classification : 74C05, 74M10, 41A60, 35C20, 35Q74

Author(s) : Mozhdeh Erfanian (School of Mathematics, University of Warwick) Ed Brambley (School of Mathematics, University of Warwick) Francis Flanagan (Department of Mathematics and Statistics, University of Limerick) Doireann O'Kiely (Department of Mathematics and Statistics, University of Limerick)

[00415] Finite time horizon mixed control of vibrational systems

Session Time & Room : 2E (Aug.22, 17:40-19:20) @D515

Type : Contributed Talk

Abstract : We consider a vibrational system control problem over a finite time horizon. The performance measure of the system is taken to be p-mixed H_2 norm which generalizes the standard H_2 norm. Our novel procedure efficiently takes into account the structure of the vibrational system. An objective function is represented in terms of integrals which are solved using adaptive quadrature rules. We illustrate our approach by numerical examples concerning an n-mass oscillator with one damper.

Classification : 93C05, 93C15, 74D99, 70Q05

Format : Talk at Waseda University

Author(s) : Zoran Tomljanovic (University of Osijek, Department of Mathematics) Ivica Nakic (epartment of Mathematics, University of Zagreb) Marinela Pilj Vidakovic (University of Osijek, Department of Mathematics)

[00423] Understanding elastic-plastic stress distributions during cold rolling of sheet metal

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D102

Type : Contributed Talk

Abstract : In cold rolling, a metal sheet is passed between two rotating rollers which reduce the thickness of the sheet. In this talk, we present our new elastic-plastic mathematical model for describing the stress distribution during cold rolling, which is an extension of some existing asymptotic models, where elastic effects are neglected. At leading order, our model returns the popular slab-type analysis, but at higher orders, through-thickness variations can be predicted accurately.

Classification : 74C05, 74M10, 41A60, 35C20, 35Q74

Format : Talk at Waseda University

Author(s) : Francis Flanagan (Department of Mathematics and Statistics, University of Limerick) Doireann O'Kiely (Department of Mathematics and Statistics, University of Limerick) Alison O'Connor (School of Engineering, Bernal Institute, University of Limerick) Mozhdeh Erfanian (School of Mathematics, University of Warwick) Ed Brambley (School of Mathematics, University of Warwick)

[00424] A Hydrodynamic Model for Active Polar Liquid Crystals

Session Time & Room : 5B (Aug.25, 10:40-12:20) @D101

Type : Contributed Talk
Abstract : We present a hydrodynamic model of active polar liquid crystals. We consider sheared active polar liquid crystals, and study dynamics of the polar order and shear rheology of the system. We show that shear may increase or decrease the polarization magnitudes. We derive the apparent viscosity formula showing a regime of negative apparent viscosity and a superfluid behavior for pushers, Our results echo previous results from numerical simulations and experiments.
Classification : 76A15, 76A05
Format : Talk at Waseda University
Author(s) : Zhenlu Cui (Fayetteville State University)

[00427] Numerical Analysis of Finite dimensional approximations in Finite Temperature DFT

Session Time & Room : 3C (Aug.23, 13:20-15:00) @G709

Type : Contributed Talk
Abstract : We study the numerical approximation of the ground state solution in finite temperature density functional theory. We formulate the problem with respect to the density matrix, and justify the convergence of the numerical approximations of the ground state. Finally, we give a quasi-optimal a priori error estimate with some mild assumptions. We also present some numerical experiments to support the theory.
Classification : 35Q55, 65N15, 65N25, 65N30
Format : Talk at Waseda University
Author(s) : Ge Xu (Beijing Normal University)

[00429] Mathematical Theory to Maximize Enzymatic Activity Under Thermodynamic Constraints

Session Time & Room : 1C (Aug.21, 13:20-15:00) @D515

Type : Contributed Talk

Abstract : Understanding the relationship between enzymatic activity is critical not only for bioengineering, but also for rationalizing enzyme optimization in nature. Here, we applied the Arrhenius and Bronsted-Evans-Polanyi equations to the Michaelis-Menten model of enzyme catalysis, and show that enzymatic activity is maximized when the binding affinity between the enzyme and the substrate (Km) is equal to the substrate concentration.

Classification : 92C45

Format : Talk at Waseda University

Author(s) : Hideshi Ooka (RIKEN) Yoko Chiba (RIKEN) Ryuhei Nakamura (RIKEN)

[00430] Nearest singular pencil via Riemannian optimization

Session Time & Room : 1E (Aug.21, 17:40-19:20) @G304

Type : Contributed Talk

Abstract : The problem of finding the nearest complex $($real$)$ singular pencil can be cast as a minimization problem over the manifold $U(n) \times U(n)$ $\left(O(n) \times O(n) \right)$ via the generalized Schur form. This novel perspective yields a competitive numerical method by pairing it with an algorithm capable of doing optimization on a Riemannian manifold.

Classification : 15A22

Format : Talk at Waseda University

Author(s) : Lauri Nyman (Aalto University)

[00433] Markov Decision Processes under Model Uncertainty

Session Time & Room : 4C (Aug.24, 13:20-15:00) @A207

Type : Contributed Talk

Abstract : We introduce a general framework for Markov decision problems under model uncertainty in a discrete-time infinite horizon setting.

By providing a dynamic programming principle we obtain a local-to-global paradigm, namely solving a local, i.e., a one time-step robust optimization problem leads to an optimizer of the global (i.e. infinite time-steps) robust stochastic optimal control problem, as well as to a corresponding worst-case measure.

Moreover, we apply this framework to portfolio optimization involving data of the S&P 500. We present two different types of ambiguity sets; one is fully data-driven given by a Wasserstein-ball around the empirical measure, the second one is described by a parametric set of multivariate normal distributions, where the corresponding uncertainty sets of the parameters are estimated from the data.
It turns out that in scenarios where the market is volatile or bearish, the optimal portfolio strategies from the corresponding robust optimization problem outperforms the ones without model uncertainty, showcasing the importance of taking model uncertainty into account.

Classification : 90C40, 91G10, Robust Finance

Format : Talk at Waseda University

Author(s) : Julian Sester (National University of Singapore) Ariel Neufeld (Nanyang Technological University) Mario iki (University of Zurch)

[00434] Three pieces Riemann problem for 2-D full Euler system in the Noble-Abel gas

Session Time & Room : 4D (Aug.24, 15:30-17:10) @G602

Type : Contributed Talk

Abstract : We present Riemann problem governed by 2-D full Euler system in the Noble-Abel gas. Riemann data, consisting three constants, are distributed in three distinct regions with an assumption that two adjoining regions can be connected by only one planar elementary wave. We present criteria for existence of different configurations of elementary waves for isentropic, as well as full, Euler system. We also discuss the effect of the Noble-Abel gas and the angle of regions on elementary waves and corresponding stream curves.

Note: The present article has been published on 17 May 2022 in the journal "Mathematical Methods in the Applied Sciences"/ Volume 45, Issue 16 with DOI:10.1002/mma.8377.

Classification : 35L65, 35L67, 35Q30, 35Q31, 35Q35, Hyperbolic Conservation Laws, Shocks and Singularities for Hyperbolic equations, Navier-Stokes equations, Euler equations, PDEs in connection with fluid mechanics.

Format : Talk at Waseda University

Author(s) : Harsita Srivastava (Dr. B. R. Ambedkar National Institute of

Technology Jalandhar, Punjab) M. Zafar (Dr. B. R. Ambedkar National Institute of Technology Jalandhar, Punjab)

[00438] Network stability in co-evolved spatially-explicit model ecological communities

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A511

Type : Contributed Talk

Abstract : The self-assembly of ecological communities on complex spatial networks from an initial species can be mathematically modelled by a combination of ecological and evolutionary processes. We investigate how the topology of the spatial network influences the structure of the co-evolved populations, and hence the stability of the resulting meta-community of species against perturbations including invasion, extinction, patch removal, and alterations to the spatial environment. In response, different nature reserve configurations can simulate biodiversity conservation strategies.

Classification : 92-10, 37N25

Format : Online Talk on Zoom

Author(s) : Gavin Michael Abernethy (University of Stirling)

[00439] Successive Approximations for Fractional BVPs with Non-local Boundary Conditions

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G306

Type : Contributed Talk

Abstract : In joint work with Dr. Kateryna Marynets, we adapt a numerical-analytic technique for constructing approximations to a system of nonlinear fractional differential equations with integral boundary conditions. The boundary conditions are parametrized, and the parameter values, which govern the solutions behavior, are calculated numerically. The convergence of the method is improved using a dichotomy-type approach, and its applicability is extended to a wider class of problems. Our results are confirmed by a model example.

Classification : 34A08, 34B10, 37M99, Fractional boundary value problems

Format : Talk at Waseda University

Author(s) : Dona Pantova (TU Delft) Kateryna Marynets (TU Delft)

[00440] SIMULATION OF SHALLOW WATER EQUATIONS WITH DEPTH PERTURBATIONS AND WITH AND WHITHOUT THE CORIOLIS EFFECT

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D502

Type : Contributed Talk

Abstract : Shallow water equations are a system of partial differential equations that describe the superficial layer of a fluid with hydrostatic equilibrium derived from the Navier-Stokes equations which are used to describe fluid movements based on characteristics such as density, etc. We perform simulations of the evolution of water surface with various bottom variations, with and without the Coriolis effect using finite differences to analyze and understand how these variations affect the fluid dynamics.

Classification : 76-02, 76-05, 76-10, 68R99

Format : Talk at Waseda University

Author(s) : Daniel Francisco Sanabria Bernal (Universidad Militar Nueva Granada)
Maria Isabel Romero Rodriguez (Universidad Militar Nueva Granada)

[00442] On the dynamical properties of a max-plus model identified with the Lozi map

Session Time & Room : 2E (Aug.22, 17:40-19:20) @G709

Type : Contributed Talk

Abstract : We focus on a max-plus discretized model that is identified with the Lozi map in this talk. The max-plus model can be derived from the generalized Selkov model composed of non-linear differential equations via tropical discretization and ultradiscretization. Based on the Poincare mapping method and the estimation of Lyapunov exponents, the dynamical properties of the max-plus model and its transformation from the generalized Selkov model are discussed.

Classification : 37M20, 37M15, 65P40, 68Q80, 37J70

Format : Talk at Waseda University

Author(s) : Shousuke Ohmori (Waseda University) Yoshihiro Yamazaki (Waseda University)

[00446] Beyond Empirical Risk Minimization: Minimax Risk Classifiers

Session Time & Room : 4E (Aug.24, 17:40-19:20) @E711

Type : Contributed Talk

Abstract : The empirical risk minimization (ERM) approach for supervised learning has been the workhorse of machine learning. However, ERM methods strongly rely on the specific training samples available and cannot easily address scenarios affected by distribution shifts and corrupted samples. This talk presents a learning framework based on the generalized maximum entropy principle that leads to minimax risk classifiers (MRCs). MRC learning is based on expectation estimates and does not strongly rely on specific training samples.

Classification : 68Q32, 68T05, 68T37, 68T01, Machine Learning, Supervised Classification

Format : Talk at Waseda University

Author(s) : Santiago Mazuelas (Basque Center for Applied Mathematics (BCAM))

[00451] Transmission problems for composite layered elastic structures containing interfacial cracks

Session Time & Room : 5C (Aug.25, 13:20-15:00) @G302

Type : Contributed Talk

Abstract : We investigate mixed transmission problems of the generalized thermo-electro-magneto elasticity theory for complex elastic multi-layered structures containing interfacial cracks. We apply the potential method and the theory of pseudodifferential equations and analyze smoothness properties and asymptomatic behaviour of solutions near the edges of cracks and near the curves where different type boundary conditions collide. We describe the stress singularity exponents explicitly.

Classification : 74A15, 74H35, 74F05, 74F15

Format : Talk at Waseda University

Author(s) : David Natroshvili (Georgian Technical University)

[00456] Network representations of attractors for surrogates generation and change detection

Session Time & Room : 2E (Aug.22, 17:40-19:20) @G709

Type : Contributed Talk
Abstract : Attractors arising from delay embedded time-series can characterise system dynamics. However, extracting useful representations is challenging for systems with high-dimensional or complex structure. We propose a data-driven method to represent attractors as networks, where dynamics are encoded as node transition probabilities. The usefulness of this representation is demonstrated in two tasks: (1) surrogate data generation; and (2) change point detection. These methods are applied to chaotic time-series, and experimental ECG data for heart attack detection.
Classification : 37M10, 37M22, 94C12
Format : Talk at Waseda University
Author(s) : Eugene Tan (The University of Western Australia) Shannon Dee Algar (The University of Western Australia) Debora Correa (The University of Western Australia) Thomas Stemler (The University of Western Australia) Michael Small (The University of Western Australia)

[00457] On limit cycles of discrete dynamical systems with positivity

Session Time & Room : 2E (Aug.22, 17:40-19:20) @G709

Type : Contributed Talk
Abstract : We focus on limit cycles of discretized Sel'kov model derived from continuous Sel'kov model via tropical discretization. The discretized model possesses a parameter for time step. We numerically found, by varying the parameter, that density profile of phase in the limit cycles transits between continuous and ultradiscrete, and that the ultradiscrete state corresponds to a max-plus dynamical system. In this talk, we discuss these findings from the viewpoint of nonlinear dynamical systems.
Classification : 37M20, 37M15, 65P40, 68Q80, 37J70, ultradiscretization, max-plus dynamical system, bifurcation
Format : Talk at Waseda University
Author(s) : Yoshihiro Yamazaki (Waseda University) Shousuke Ohmori (Waseda University)

[00459] Tropical linear regression and mean payoff games: or, how to measure the distance to equilibria

Session Time & Room : 2E (Aug.22, 17:40-19:20) @G304

Type : Contributed Talk
Abstract : We study a tropical linear regression problem consisting in finding a best approximation of a set of points by a tropical hyperplane. We establish a strong duality theorem, showing that the value of this problem coincides with the maximal radius of a Hilbert's ball included in a tropical polyhedron. We show that this problem is polynomial-time equivalent to mean payoff games. We illustrate our results by solving an inverse problem from auction theory.
Classification : 14T90, 91A25, 91B26
Format : Talk at Waseda University
Author(s) : Omar Saadi (College of Computing, Mohammed VI Polytechnic University) Marianne Akian (INRIA and CMAP, cole polytechnique) Stphane Gaubert (INRIA and CMAP, cole polytechnique) Yang Qi (INRIA and CMAP, cole polytechnique)

[00460] A Multigrid Method for Many-Electron Schrodinger Equations with ACE

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E606

Type : Contributed Talk
Abstract : We parameterize the many-electron wave functions by atomic cluster expansion $($ACE$)$ approach and calculate ground-state energies and electron densities of some molecule systems within the variational Monte Carlo framework. Compared with the neural-network-based representations, the novelty of our method lies in $($i$)$ a convenient and accurate linear polynomial expansion; $($ii$)$ a hierarchical structure that applies naturally to a multigrid variation; and $($iii$)$ possibly revealing the correlation of the system by increasing the body-order.
Classification : 35Q40, 65N25, 65N35, 81Q05
Format : Talk at Waseda University
Author(s) : Dexuan Zhou (Beijing Normal University)

[00461] hp/Spectral Element Methods for Elliptic Boundary Layer Problems

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E709

Type : Contributed Talk

Abstract : Elliptic boundary layer problems arise in many applications including fluid dynamics, gas dynamics, plate and shell problems in structural mechanics, modeling of semiconductor devices and many more.
We propose a least-squares hp-spectral element method for 1D elliptic boundary layer problems. The regularity estimates are stated and the main stability theorem is obtained using non-conforming spectral element functions. For the hp-version we use a 3 element mesh which allows us to resolve the boundary layers completely by placing very thin needle like elements near the boundary layer and a coarse mesh away from the layer. Numerical scheme and error estimates are obtained which are robust i.e. independent of the boundary layer parameter and decay exponentially in terms of the degree of the approximating polynomials. Numerical results confirm convergence results with various combinations of the boundary layer thickness, degrees of the approximating polynomials, and layers in the mesh.

Classification : 65N35, 65N20, 65N50

Author(s) : Akhlaq Husain (Jamia Millia Islamia New Delhi) Akhlaq Husain (BML Munjal University Gurgaon)

[00463] A kinetic model of crowd evacuation dynamics coupled with infectious disease contagion

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A511

Type : Contributed Talk

Abstract : We propose a kinetic theory model coupling crowd evacuation and disease spreading. Movement of individuals is modeled by a description of interactions among individuals. Interactions among healthy and infectious individuals may generate disease spreading if exposure time is long enough. Immunization of the population and awareness to contagion is also considered.
The model is qualitatively studied and different scenarios related to gathering formation within indoor venues under the spread of an infectious disease are explored.

Classification : 92-10, 92C60, 92D30

Format : Talk at Waseda University

Author(s) : Juan Pablo Agnelli (CIEM CONICET & FaMAF Universidad Nacional de Crdoba) Bruno Buffa (FaMAF Universidad Nacional de Crdoba) Damian Alejandro Knopoff (CONICET, Argentina & Intelligent Biodata SL, Spain) German Torres (IMIT CONICET & FaCENA UNNE)

[00464] Predicting the role of poroelastic coatings for cell therapies via an asymptotic approach

Session Time & Room : 1C (Aug.21, 13:20-15:00) @D515

Type : Contributed Talk

Abstract : Cell therapies are a promising alternative for treating liver disease. Encapsulation modulates the mechanical cues inflicted on a cell, which can increase engraftment at the injury site. We model an individual, hydrogel-coated stem cell translating axially along a fluid-filled channel due to a Stokes flow, obtaining semi-analytic solutions in the limit of a stiff coating. We conduct a parametric study to predict the role of coatings and discuss implications for biological cells.

Classification : 92C37, Poroelasticity, Fluid-structure interaction, asymptotics

Format : Talk at Waseda University

Author(s) : Simon Mark Finney (University of Oxford) Sarah Louise Waters (University of Oxford) Andreas Muench (University of Oxford) Matthew Gregory Hennessy (University of Bristol)

[00469] A Mathematical and Exploratory Data Analysis of Malaria Disease Transmission Through Blood Transfusion

Session Time & Room : 3E (Aug.23, 17:40-19:20) @A511

Type : Contributed Talk

Abstract : Malaria is a mosquito-borne disease spread by an infected vector (infected female Anopheles mosquito) or through transfusion of plasmodium-infected blood to susceptible individuals. The disease burden has resulted in high global mortality, particularly among children under the age of five. Many intervention responses have been implemented to control malaria disease transmission, including blood screening, Long-Lasting Insecticide Bed Nets (LLIN), treatment with an anti-malaria drug, spraying chemicals/pesticides on mosquito breeding sites, and indoor residual spray, among others. As a result, a SIR (Susceptible - Infected - Recovered) model is developed to study the impact of various malaria control and mitigation

strategies. The associated basic reproduction number and stability theory is used to investigate the stability analysis of the model equilibrium points. The global stability of the malaria-free equilibrium is investigated by constructing an appropriate Lyapunov function. By determining the direction of bifurcation, the implicit function theorem is used to investigate the stability of the model endemic equilibrium. Using R and MATLAB, the model is fitted to malaria data from Benue State, Nigeria. Estimates of parameters were made. An optimal control model is then developed and analyzed using Pontryaging's Maximum Principle. The malaria-free equilibrium point is locally and globally stable if the basic reproduction number (R_{0}) and the blood transfusion reproduction number (R_{α}) are both less or equal to unity. The study of the sensitive parameters of the model revealed that the transmission rate of malaria from mosquito-to-human (β_{mh}), transmission rate from humans-to-mosquito (β_{hm}), blood transfusion reproduction number (R_{α}) and recruitment rate of mosquitoes (b_{m}) are all sensitive parameters capable of increasing the basic reproduction number (R_{0}) thereby increasing the risk in spreading malaria disease. The result of the optimal control shows that five possible controls are effective in reducing the transmission of malaria. The study recommended the combination of five controls, followed by the combination of four and three controls is effective in mitigating malaria transmission. The result of the optimal simulation also revealed that for communities or areas where resources are scarce, the combination of Long Lasting Insecticide Treated Bednets (u_{2}), Treatment (u_{3}), and Indoor insecticide spray (u_{5}) is recommended. Numerical simulations are performed to validate the model's analytical results.

Classification : 93-xx, 93-10, Mathematical modeling or simulation for problems pertaining to systems and control theory

Author(s) : Michael Olaniyi Adeniyi (Lagos State University of Science and Technology) Raphael Oluwaseun Aderele (Lagos State University of Science and Technology) Olajumoke Y Oludoun (Department of Mathematics, Bowen University, Iwo, Nigeria) Matthew Iwada Ekum (Lagos State University of Science and Technology) Segun Isaac Oke (Department of Mathematics, Ohio University, Athens, OH 45701-2979, USA)

[00470] Mathematical and Exploratory Data Analysis on Blood Transfusion Transmitted Malaria

Session Time & Room : 3E (Aug.23, 17:40-19:20) @A511

Type : Contributed Talk

Abstract : Malaria is a disease spread by an infected mosquito or through transfusion of plasmodium-infected blood to susceptible individuals. Many interventions have been implemented to control malaria transmission, including blood screening, Long-Lasting Insecticide Bed Nets (LLIN), treatment with an anti-malaria drug, spraying chemicals/pesticides on mosquito breeding sites, and indoor residual spray, among others. As a result, a deterministic model is developed to study the impact of various malaria control and mitigation strategies against malaria transmission.

Classification : 93-xx, 93-10, Mathematical modeling or simulation for problems pertaining to systems and control theory

Author(s) : Michael Olaniyi Adeniyi (Lagos State University of Science and Technology) Raphael Oluwaseun Aderele (Lagos State University of Science and Technology) Olajumoke Y Oludoun (Department of Mathematics, Bowen University, Iwo, Nigeria) Matthew Iwada Ekum (Lagos State University of Science and Technology) Segun Isaac Oke (Department of Mathematics, Ohio University, Athens, OH 45701-2979, USA)

[00476] Hierarchical Sampling Techniques and Goal-Oriented Adaptive Finite Element for Elliptic PDE with Lognormal Coefficients

Session Time & Room : 5B (Aug.25, 10:40-12:20) @E505

Type : Contributed Talk

Abstract : We propose our Adaptive Multilevel Monte Carlo (AMLMC) method to solve an elliptic partial differential equation with lognormal random input data where the PDE model has geometry-induced singularities.

This work combines (MLMC) and the dual-weighted-residual goal-oriented adaptive finite element. Specifically, for a given input coefficient realization and an accuracy level, the (AMLMC) constructs its approximate sample as the ones using the first mesh in the sequence of pre-generated, non-uniform meshes satisfying the sample-dependent bias constraint.

Classification : 65C05, 65N50, 65N22, 35R60

Format : Talk at Waseda University

Author(s) : Joakim Beck (King Abdullah University of Science and Technology) Yang Liu (King Abdullah University of Science and Technology) Erik von Schwerin (King Abdullah University of Science and Technology) Raul Tempone (King Abdullah University of Science and Technology)

[00477] Relaxation process of CahnHilliard equations with dynamic boundary conditions

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E702

Type : Contributed Talk

Abstract : This talk is concerned with a numerical analysis of the initial value problem for the CahnHilliard equation with dynamic boundary conditions in one-dimensional space, using a structure preserving scheme based on the discrete variational derivative method. We discuss the relationship between the parameter related to the time evolution on the boundary and the time it takes for the numerical solution to approach a stationary solution.

Classification : 65M22, 82C26, 65M06

Format : Talk at Waseda University

Author(s) : Keiichiro Kagawa (RIES, Hokkaido University) Yoshihiro Yamazaki (Waseda University)

[00480] Mathematics, the Mind and Alzheimer's disease: Systematical progression on brain graphs

Session Time & Room : 3D (Aug.23, 15:30-17:10) @A601

Type : Contributed Talk

Abstract : Neurodegenerative diseases, Alzheimer's disease (AD) in particular, present a clear challenge to modern medicine due to brain delicate in vivo environment and limited insight from the human whole nervous system. Mathematical network models of dementia, such as AD, offer a path forward that can be deployed using the multitude of anatomical brain-graph data from real human patients. The dynamical processes of the model support front-like propagation on networks, where an initial localized perturbation grows and systematically invades all nodes in the network. The main question is to understand its overall dynamics. For instance, if a process starts at a seed location, how long will it take to appear at other locations, and then develop through a full-scale invasion, leading to dementia for the brain? The arrival-time problem, that consists in determining the time it takes for a quantity of interest to reach a certain level at each node, greatly depends on the coupling dynamics between nodes. In this talk, I address a question to extract estimates for the dynamics motivated by the study of toxic protein propagation in neurodegenerative diseases: if a single node is seeded at a small concentration, when will other nodes reach the same initial concentration? My research demonstrates that different estimates can give

their important insights to understand the dynamics and, in particular, analytical methods to estimate and compute the arrival times are extremely powerful and can capture essential features in AD.
Classification : 92B05, General biology and biomathematics
Format : Talk at Waseda University
Author(s) : Prama Setia Putra (Mathematical Institute, University of Oxford) Prama Setia Putra (Mathematical Institute, University of Oxford) Alain Goriely (Mathematical Institute, University of Oxford)

[00485] Adaptive event-trigger based disturbance rejection technique for nonlinear systems

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D515

Type : Contributed Talk
Abstract : In this work, the stabilization and disturbance rejection problem for a nonlinear system is discussed. In order to
reduce the communication burden, adaptive event-triggered based control is proposed. Further, an improved
equivalent-input disturbance estimate technique is incorporated to suppress the effects of external disturbances. A set of essential conditions are developed by applying Lyapunov stability theory to ensure the system is stable. Numerical examples with engineering significance are demonstrated to emphasize the effectiveness.
Classification : 93CXX, 37MXX, 37N35, 34H05, 34H15
Format : Online Talk on Zoom
Author(s) : Asha Safana Mohamed (Anna University) Marshal Anthoni S (Anna University)

[00487] A strongly nonlinear anisotropic parabolic-elliptic system: analysis and numerical simulation

Session Time & Room : 2E (Aug.22, 17:40-19:20) @G502

Type : Contributed Talk
Abstract : We study the existence of a capacity solution to a nonlinear coupled parabolic-elliptic system.
This system is a generalization of the so-called thermistor problem which models a temperature
dependent electrical resistor.
In this analysis we have considered the case where Au is an operator of the

Leray-Lions
class defined in an anisotropic Sobolev space.
We also show some numerical simulations of this problem and we discuss the obtained results.

Classification : 35K55, 35J70, 46E35
Format : Talk at Waseda University
Author(s) : Francisco Ortegn Gallego (Universidad de Cdiz) Manar Lahrache (Moulay Ismail University) Mohamed Rhoudaf (Moulay Ismail University) Hajar Talbi (Moulay Ismail University)

[00489] Curvature related properties of Finsler manifolds and applications

Session Time & Room : 5D (Aug.25, 15:30-17:10) @F402

Type : Contributed Talk
Abstract : Finsler manifolds are important generalizations of Euclidean and Riemannian ones with applications in different domains of mathematics, physics and engineering. In the present talk we are going to present some recent results concerning Finsler connections, curvature and relation with statistical models in the real world. We suggest possible development of information geometry on Finsler manifolds that would allow a wide range of applications.
Classification : 53C60
Format : Talk at Waseda University
Author(s) : Sorin Sabau (Tokai University)

[00492] Asymptotic convergence of heterogeneous first-order aggregation models: from the sphere to the unitary group

Session Time & Room : 5C (Aug.25, 13:20-15:00) @G401

Type : Contributed Talk
Abstract : We provide the detailed asymptotic behavior for first-order aggregation models of heterogeneous oscillators. Due to the dissimilarity of natural frequencies, one could expect that all relative distances converge to definite positive value and furthermore that each oscillator converges to a possibly different stationary point. In order to establish the desired results, we introduce a novel method, called dimension reduction method that can be applied to a specific situation when the degree of freedom of the natural

frequency is one. In this way, we would say that although a small perturbation is allowed, convergence toward an equilibrium of the gradient flow is still guaranteed. Several first-order aggregation models are provided as concrete examples by using the dimension reduction method to study the structure of the equilibrium, and numerical simulations are conducted to support theoretical results.

Classification : 34C15, 34D06, 34C40

Format : Talk at Waseda University

Author(s) : Dohyun Kim (Sungkyunkwan University) Dohyun Kim (Sungshin Women's University)

[00494] A two-grid discontinuous Galerkin method to nonlinear time-fractional diffusion equations

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E605

Type : Contributed Talk

Abstract : A two-grid algorithm for discontinuous Galerkin method is proposed for nonlinear time-fractional diffusion initial-boundary-value problems. The numerical scheme consists of DG method for the spatial derivatives and L1-scheme for time stepping. Error estimate for the proposed scheme is obtained. The numerical experiments are presented to prove the efficiency of our algorithm.

Classification : 65M60, 65M15

Author(s) : SANDIP MAJI (Indian Institute of Technology Guwahati) Natesan Srinivasan (Indian Institute of Technology Guwahati)

[00495] Input-state finite time stabilization of singular Markov fuzzy system.

Session Time & Room : 1C (Aug.21, 13:20-15:00) @G501

Type : Contributed Talk

Abstract : This work aims to examine the problem of Input-state finite-time stabilization of singular Markov T-S fuzzy systems with input time delay and disturbance. The sampled-data control for a singular Markov T-S fuzzy system with the quantized state has been designed. Using Lyapunov stability theory and linear matrix inequalities we guarantee that the singular fuzzy system is Input state Finite time stable. Finally, a numerical example is used to show the effectiveness of the proposed method.

Classification : 93CXX, 37MXX, 37N35, 34H05, 34H15

Format : Online Talk on Zoom
Author(s) : Keerthana N (Anna University)

[00501] Efficient numerical method for simulation of plasma

Session Time & Room : 1E (Aug.21, 17:40-19:20) @G401

Type : Contributed Talk
Abstract : Understanding the dynamics of plasma is crucial in many concurrent applications. Those include astrophysics, space discovery, and designing fusion reactors. Numerical methods are a great tool for this purpose. In this talk, an efficient numerical method based on Galerkin approximations is presented. The method has high accuracy, capability of capturing shocks and turbulence, and consistency with thermodynamics. We show several interesting numerical simulations to demonstrate those properties.
Classification : 34A45
Format : Talk at Waseda University
Author(s) : Tuan Anh Dao (Uppsala University)

[00502] The Helmholtz-Hodge decomposition of polynomial vector fields

Session Time & Room : 4C (Aug.24, 13:20-15:00) @G502

Type : Contributed Talk
Abstract : The Helmholtz-Hodge decomposition is a fundamental tool in the study of vector fields and has many applications. In this talk, we will focus on the case of polynomial vector fields. First, we will introduce results on the general properties and methods for finding a decomposition. As an application, we will explain the relationship between the Helmholtz-Hodge decomposition and the construction of Lyapunov functions.
Classification : 37B25, 31B99
Format : Talk at Waseda University
Author(s) : Tomoharu Suda (RIKEN) Tomoharu Suda (Keio University)

[00504] Solar Influence on Earth's Seismicity and Applications in Earthquake Forecasting

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G710

Type : Contributed Talk

Abstract : The scientific community is yet to find an effective method to forecast and avoid earthquake hazards, due to the problem complexity. After decades of debate, the Sun has again been recently brought forth as a potential precursor to earthquakes. This study aims to investigate the existence of such relationship from a dynamical systems perspective. Having confirmed the existence, we also show that Sun data can be included in forecasting models to improve forecasting accuracy.

Classification : 37N05, 86A15, 60G55, 37Hxx

Format : Talk at Waseda University

Author(s) : Matheus Henrique Junqueira Saldanha (University of Tsukuba) Matheus Henrique Junqueira Saldanha (University of Tsukuba) Yoshito Hirata (Faculty of Engineering, Information and Systems, University of Tsukuba)

[00508] Imposing Neumann or Robin boundary conditions through a penalization method

Session Time & Room : 5C (Aug.25, 13:20-15:00) @E705

Type : Contributed Talk

Abstract : We will present an n-dimensional extension of a penalization method previously suggested for Neumann or Robin boundary conditions. The existence and uniqueness are obtained using Droniou's approach for non-coercive linear elliptic problems, and we develop a boundary layer approach to establish the convergence of the penalization method. We present two-dimensional numerical examples using adequate schemes suitable for advection dominated problems, and outline the application of this method to population dynamics subject to climate change.

Classification : 65N85, 65M85, 65N06, 65M06, 92D25

Format : Talk at Waseda University

Author(s) : Bouchra Bensiali (cole Centrale Casablanca) Jacques Liandrat (cole Centrale Marseille, I2M)

[00511] Metapopulation network models explain non-Poissonian statistics of intercontact times

Session Time & Room : 5C (Aug.25, 13:20-15:00) @G302

Type : Contributed Talk

Abstract : Intercontact times in empirical data obtained from humans and animals typically obey heavy-tailed distributions as opposed to exponential distributions that would correspond to Poisson processes. We show that this phenomenon is a mathematical property of a most basic metapopulation network model used in epidemiology and ecology modeling, in which individuals move from a patch to another according to the simple or other types of random walks. Our results hold true for any network structure.

Classification : 05C82, 60K20

Format : Talk at Waseda University

Author(s) : Elohim Fonseca dos Reis (State University of New York at Buffalo) Naoki Masuda (State University of New York at Buffalo)

[00512] Rigged Hilbert Space Formulation for Many-Body Quantum Theory

Session Time & Room : 3E (Aug.23, 17:40-19:20) @F311

Type : Contributed Talk

Abstract : The rigged Hilbert space that associates the distribution functions with the Hilbert space is the fundamental one of quantum mechanics to define the bra-ket vectors. Their construction has been attempted mainly for single-particle systems. We are trying to extend the rigged Hilbert space formulation to various realistic quantum systems. In this presentation, we present the result of extending this formulation to quantum many-body systems.

Classification : 47A70, 81Q10, 81V70

Format : Talk at Waseda University

Author(s) : Junichi Takahashi (Waseda University) Shousuke Ohmori (Waseda University)

[00513] The perfectly matched layer for elastic waves in layered media

Session Time & Room : 2C (Aug.22, 13:20-15:00) @E702

Type : Contributed Talk

Abstract : The perfectly matched layer (PML) is widely used to truncate domains in large-scale simulation of wave propagation in open boundaries. PML absorbs outgoing waves without reflection and significantly improves computational efficiency. However, it is very challenging to prove stability of PML models. In this talk, I present our recent contribution on the stability analysis of PML models for the elastic wave equation in layered media modeling seismic wave propagation in the Earth layers.

Classification : 65M06, 65M12, 86-08

Format : Talk at Waseda University

Author(s) : Siyang Wang (Ume University)

[00514] Diffusion approximation of a Markov-modulated infinite-server queue

Session Time & Room : 2C (Aug.22, 13:20-15:00) @E501

Type : Contributed Talk

Abstract : In a queue, overdispersion nature of arrivals and stochastic nature of service times can be captured by incorporating modulation into the queue dynamics. We discuss stochastic approximations for an infinite-server queue, where the stochastic arrival and service rates are determined by a Markovian environment. The incorporation of modulation leads to an Ornstein-Uhlenbeck process as its diffusion approximation with the variance parameter capturing the stochastic variations of both modulating and modulated processes.

Classification : 60K25, 60K37

Format : Talk at Waseda University

Author(s) : Selvaraju Natarajan (Indian Institute of Technology Guwahati, India) Ankita Sen (Indian Institute of Technology Guwahati, India)

[00516] Parameters Estimation For Car Following Models Using Bayesian Inference

Session Time & Room : 2D (Aug.22, 15:30-17:10) @E503

Type : Contributed Talk

Abstract : Car following (CF) models play an important role in traffic simulation software. Estimating their parameters is necessary to enhance predictive performance and is traditionally accomplished through optimisation. In this research, we adopted Bayesian inference which is advantageous for uncertainty quantification. As the CF model depends on its parameters through solution of a delay differential equation, the likelihood is

analytically intractable so we employed an adaptive Markov chain Monte Carlo algorithm to sample from the posterior.

Classification : 62F15, 65Cxx

Format : Talk at Waseda University

Author(s) : Samson Ting (The University of Western Australia) Michael Small (The University of Western Australia) Thomas Stemler (The University of Western Australia) Chao Sun (The University of Western Australia) Thomas Lymburn (The University of Western Australia)

[00518] Unsteady Stokes flow past a sphere with mixed slip-stick boundary conditions

Session Time & Room : 4D (Aug.24, 15:30-17:10) @D401

Type : Contributed Talk

Abstract : A general solution to unsteady Stokes equations for an incompressible, viscous flow past a sphere with mixed slip-stick boundary conditions is given. Faxns laws for drag and torque exerted on the sphere are derived, and the results have been compared in special cases of no-slip and shear-free boundary conditions with the existing literature. We extend this work to bodies of arbitrary shape under the same boundary conditions.

Classification : 76D07, 76D05

Format : Talk at Waseda University

Author(s) : Dimple Satya Sree Dadi (University of Hyderabad) Dimple Satya Sree Dadi (University of Hyderabad) Sri Padmavati B (University of Hyderabad)

[00519] Non-Newtonian fluids with discontinuous-in-time stress tensor.

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G502

Type : Contributed Talk

Abstract : We consider the system of equations describing the flow of incompressible fluids in bounded domain. Here, the Cauchy stress tensor has asymptotically $(s-1)$-growth with the parameter s depending on the spatial and time variable. We do not assume any smoothness of s with respect to time variable. Such a setting is a natural choice if the material properties are instantaneous. We establish the existence of weak solution provided that $s\ge\frac{3d+2}{d+2}$.

Classification : 35K51, 35Q30, 76D05

Format : Talk at Waseda University

Author(s) : Miroslav Bulicek (Charles University) Piotr Gwiazda (Polish

Academy of Sciences) Jakub Skrzeczkowski (University of Warsaw) Jakub Wonicki (University of Warsaw)

[00520] Controllability of Generalized Fractional Dynamical Systems

Session Time & Room : 5B (Aug.25, 10:40-12:20) @A207

Type : Contributed Talk
Abstract : In this paper necessary and sufficient conditions are established for the controllability of
linear fractional dynamical system of the form
\begin{eqnarray}
^CD^{\alpha,\rho}_{0^+}x(t)&=& Ax(t)+Bu(t), \ \ t\in J=

[0,T]\

x(0)&=&x_0
\end{eqnarray}
where $0<\alpha<1,\rho>0, \rho\neq 1$ and $x\in R^n$ is the state vector, $u\in R^m$ is the control vector, $x_0\in R^n$
and A is an $n\times n$ matrix and B is an $n\times m$ matrix.
Here the generalized fractional derivative is taken as
\begin{eqnarray}
^CD^{\alpha,\rho}_{0^+}x(t)=\frac{\rho^{\alpha}}{\Gamma(1-\alpha)}
\int_0^t \frac{1}{(t^{\rho}-s^{\rho})^{\alpha}}x^{\prime}(s)ds
\end{eqnarray}
Further sufficient conditions are obtained for the following nonlinear fractional system
\begin{eqnarray}
^CD^{\alpha,\rho}_{0^+}x(t)&=& Ax(t)+Bu(t)+f(t,x(t)), \
x(0)&=&x_0
\end{eqnarray}
where the function $f:J\times R^n\to R^n$ is continuous.
The results for linear systems are obtained by using the Mittag-Leffler function and the Grammian matrix. Controllability of
nonlinear fractional system is established by means of Schauder's fixed point theorem. Examples are provided to illustrate the results.

Classification : 93B05, 34A08, Controllability, Fractional Dynamical Systems
Format : Talk at Waseda University
Author(s) : Balachandran Krishnan (Department of Mathematics, Bharathiar University, Coimbatore-641046)

[00525] Global effect of COVID-19 disease dynamics on tertiary education system in developing countries

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G710

Type : Contributed Talk

Abstract : A mathematical model that describes the effect of COVID-19 dynamics on the student population of higher learning institutions was studied. Qualitative analyses were done on the model, and numerical simulations were used to evaluate the effects of personal protective, quarantine, treatment, and management measures to mitigate the community spread of COVID-19. Finally, a cost-effectiveness analysis was used to ascertain the most-effective and least expensive strategy required for preventing and controlling the spread of the pandemic.

Classification : 37N25, 37N35, 37N40, 37D10, 34C40

Format : Online Talk on Zoom

Author(s) : John Olajide Akanni (Koladaisi University Ibadan, Oyo State, Nigeria) Afeeze Abidemi (Federal University of Technology, Akure, Ondo State, Nigeria) Oluwole Daniel Makinde (Faculty of Military Science, Stellenbosch University, South Africa)

[00527] A fast Multiplicative Update algorithm for non-negative matrix factorization

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E605

Type : Contributed Talk

Abstract : This work proposes an efficient algorithm called fastMU (Multiplicative Updates) to deal with a Non-Negative Matrix Factorization problem, based on majorization minimization principle. We derive theoretical convergence results and show the effectiveness of our method through comparison with state-of-the-art methods on both synthetic and realistic data. Practical results show that fastMU is often several orders of magnitude faster than the regular MU proposed by Lee and Sung, and can even be competitive with state-of-the-art methods.

Classification : 65Kxx, 90Cxx

Format : Talk at Waseda University

Author(s) : Mai-Quyen PHAM (IMT Atlantique) Jeremy Cohen (CREATIS, CNRS) Thierry Chonavel (IMT Atlantique)

[00531] Calibration of hardening parameters for the absence of hysteresis test-data

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D102

Type : Contributed Talk

Abstract : A mathematical model is developed to estimate combined nonlinear isotropic-kinematic hardening parameters of ductile materials using Ramberg-Osgood constants for monotonic and cyclic stress-strain curves. This compact model can be performed even if the hysteresis curves test results are unavailable for the specimens subjected to high amplitude cyclic loading. The model is applied for AW6082 and HX220-BD, Finite Element simulation results are compared with test results, and very good agreements are obtained.

Classification : 74C15, 74-10

Format : Talk at Waseda University

Author(s) : Eray Arslan (TU Wien) Milan Zigo (MAGNA STEYR Fahrzeugtechnik GmbH & Co KG)

[00532] Pullback Operator Methods in Dynamical Systems: Theory and Computation

Session Time & Room : 4C (Aug.24, 13:20-15:00) @G502

Type : Contributed Talk

Abstract : Koopman operator methods along with the associated numerical algorithms have provided a powerful methodology for the data-driven study of nonlinear dynamical systems. In this talk, we will give a brief outline of how the Koopman group of operators can be generalized beyond function spaces to the space of sections of various vector bundles over the state space. We describe their relationship with the standard Koopman operator on functions as well as describe the new spectral invariants produced by these generalized operators. We then demonstrate how the recently developed spectral exterior calculus framework can be utilized to compute the spectral properties of the generator of the induced operator on sections of the cotangent bundle. We conclude with some applications of the algorithm to some well-known dynamical systems.

Classification : 37C30

Format : Online Talk on Zoom

Author(s) : Allan M. Avila (AIMdyn Inc.)

[00535] Reinforcement Learning with Variable Exploration

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E711

Type : Contributed Talk

Abstract : Reinforcement learning is a powerful machine learning technique, but unreliable when multiple agents learn simultaneously. Our work applies Q learning to the Iterated Prisoner's Dilemma, an ideal setting to study AI cooperation. We investigate how different frameworks for variable exploration rates effect performance by escaping local optima. One result finds shorter learning periods produce more cooperation, potentially indicating incentive alignment. This furthers previous studies by carefully considering the ways exploration rate might vary over time.

Classification : 68T05, 91A26, 37N40, 91A05

Format : Talk at Waseda University

Author(s) : Brian Mintz (Dartmouth College) Feng Fu (Dartmouth College)

[00540] Random product homotopies for decomposing tensors

Session Time & Room : 2E (Aug.22, 17:40-19:20) @G304

Type : Contributed Talk

Abstract : The rank one decomposition of the tensor is considered. The upper bound of rank is derived under which computing the decomposition is equivalent to solving a structured polynomial system that is determined by the full rank factorization of the matricization of the tensor. Under the generic uniqueness conditions, the solutions of the system are isolated and can be efficiently achieved by random product homotopies.

Classification : 13P15, 15A69, 15A72

Format : Talk at Waseda University

Author(s) : Tsung-Lin Lee (National Sun Yat-sen University)

[00541] Reinforcement Learning-based Data Collection and Energy Replenishment in SDIoT

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E711

Type : Contributed Talk

Abstract : In software-defined internet of things (SDIoT) with wireless rechargeable sensor networks, a novel reinforcement learning-based method is proposed for collecting data and scheduling mobile sinks to recharge the sensor nodes. The suggested technique extends the network lifetime while ensuring the QoS of the SDIoT. Finally, the results show that the suggested approach significantly increases the energy efficiency and also increases the network's lifetime.

Classification : 68T05, 68T40, 68T20, 68Q06, Internet of Things; Machine learning; Reinforcement learning

Format : Talk at Waseda University

Author(s) : Vishnuvarthan Rajagopal (Research scholar, Department of Electronics and Communication Engineering, Anna University Regional Campus, Coimbatore.) Bhanumathi V (Assistant Professor, Department of Electronics and Communication Engineering,Anna University Regional Campus, Coimbatore.)

[00542] Approximations of quasi-linear elliptic optimal control problems under variational and virtual discretizations

Session Time & Room : 1C (Aug.21, 13:20-15:00) @F310

Type : Contributed Talk

Abstract : This talk will discuss virtual and variational discretizations for the numerical approximation of optimal control problems governed by the quasi-linear elliptic equation with distributed control. A conforming virtual element method is employed for the discretization of state and co-state equations that appeared in the model problem. The numerical approximation of the control variable is based on two different discretizations: variational and virtual. In the variational approach, the discrete space associated with the control is not discretized explicitly, whereas, for the virtual discretizations, the discrete spaces are taken as virtual element spaces that include linear polynomials and non-polynomials functions over the polygonal mesh, and a discretize-then-optimize approach is used for the computation of control. With the help of certain projection operators, optimal a priori error estimates are established for the control, state, and co-state variables in suitable norms. Numerical experiments are presented under general polygonal meshes to illustrate the performance of the proposed scheme and verify the theoretical convergence rate.

Classification : 49M29, 49M41, 65K15, 90C46

Format : Talk at Waseda University

Author(s) : Anil Kumar (BITS Pilani KK Birla Goa Campus, Goa (India)) Jai Tushar (BITS Pilani KK Birla Goa Campus, Goa (India)) Sarvesh Kumar (ndian Institute of Space Science and Technology, Thiruvananthapuram)

[00544] Quantification of Entangled Bipartite Systems

Session Time & Room : 2D (Aug.22, 15:30-17:10) @E505

Type : Contributed Talk

Abstract : Gauging the distance between a mixed state and its nearest separable state is important but challenging in the quantum mechanical system. We, in this talk, propose a dynamical system approach to tackle low-rank approximation of entangled bipartite systems, which has several advantages, including 1) A gradient dynamics in the complex space can be described in a fairly concise way; 2) The global convergence from any starting point to a local solution is guaranteed; 3) The requirement that the combination coefficients of pure states must be a probability distribution can be ensured; 4) The rank can be dynamically adjusted. The theory, algorithms, and some numerical experiments will be presented in this talk.

Classification : 65F10, 15A24, 65H10, 15A72, 58D19

Author(s) : Matthew M. Lin (National Cheng Kung University) Moody T. Chu (North Carolina State University)

[00546] Recent advances on the conjugate discrete-time algebraic Riccati equation.

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G304

Type : Contributed Talk

Abstract : In this talk, we consider a class of conjugate discrete-time Riccati equations, arising originally from the linear quadratic regulation problem for discrete-time antilinear systems. A constructive proof is given for the existence of the maximal solution. Furthermore, an accelerated fixed-point iteration based on the semigroup property is developed for computing the maximal solution and the convergences is at least R-superlinear. An example is given to demonstrate the correctness of our main theorem.

Classification : 15A24, 65H05, 93A99

Format : Talk at Waseda University

Author(s) : Chun-Yueh Chiang (Center for General Education, National Formosa University) Hung-Yuan Fan (National Taiwan Normal University)

[00547] Fictitious domain methods with finite elements and penalty over spread interface

Session Time & Room : 5C (Aug.25, 13:20-15:00) @E705

Type : Contributed Talk

Abstract : We present a spread interface approach in fictitious domain methods to decipher the elliptic PDEs depicted over curved complex domains. In this approach, we employ the L^2 penalty for a small tubular neighborhood Ω_{δ} near $\partial\Omega$ in $\mathrm{R}\backslash\Omega$ in place of the substantial penalty for the whole fictitious part $\mathrm{R}\backslash\Omega$. We achieve strong convergence results concerning the penalty parameter ϵ in addition to the a priori estimates and stability analysis. We implement the linear finite elements and acquire the expected error estimates. The comprehensive numerical investigations support the mathematical findings, which also anticipate optimal convergence regardless of the convexity and shape of the domain.

Keywords: Fictitious domain methods, Elliptic problems, Curved domain, Error estimates, Uniform mesh.

References:

1. S. Kale, and D. Pradhan, An augmented interface approach in fictitious domain methods, Comput. Math. with Appl., Vol. 125, pp. 238-247, (2022).
2. B. Maury, Numerical Analysis of a finite element/volume penalty method, SIAM J. Numer Anal., Vol. 47(2), (2009), pp. 1126-1148.
3. N. Saito and G. Zhou, Analysis of the fictitious domain method with an L^2-penalty for elliptic problems, Numer. Funct. Anal. Optim., Vol. 36, (2015), pp. 501-527.
4. S. Zhang, Analysis of finite element domain embedding methods for curved domains using uniform grids, SIAM J. Numer. Anal., Vol. 46(6), (2008), pp. 2843-2866.

Classification : 65N85, 65N15, Numerical solutions to partial differential equations

Format : Online Talk on Zoom

Author(s) : Swapnil Kale (Defence Institute of Advanced Technology, Pune)
Debasish Pradhan (Defence Institute of Advanced Technology, Pune)

[00549] On the penalty approach in finite difference methods

Session Time & Room : 5C (Aug.25, 13:20-15:00) @E705

Type : Contributed Talk

Abstract : We introduce a finite difference method with the H^1 and L^2 penalties to solve the elliptic PDEs over curved complicated domains. The sharp convergence of the penalized solution to the original one is provided. The accuracy in both strategies is almost analogous, provided the penalty parameter ϵ is $O(h^2)$ in the H^1 penalty approach and $O(h^4)$ in the L^2 penalty approach. The iterative methods developed for the proposed idea are highly efficient and furnish the theoretical outcomes.

Keywords: Finite difference method, Elliptic PDEs, Penalty, Curved domain, Cartesian mesh.

References:

1. S. Kale, and D. Pradhan, Error estimates of fictitious domain method with an H^1 penalty approach for elliptic problems, Comp. Appl. Math., Vol. 41, (2022), pp. 1-21.
   2.B. Maury, Numerical Analysis of a finite element/volume penalty method, SIAM J. Numer Anal., Vol. 47(2), pp. 1126-1148, (2009).
   3.N. Saito and G. Zhou, Analysis of the fictitious domain method with an L^2-penalty for elliptic problems, Numer. Funct. Anal. Optim. Vol. 36, (2015), pp. 501-527.
   4.H. Suito, and H. Kawarada, Numerical simulation of spilled oil by fictitious domain method, Japan J. Indust. Appl. Math., Vol. 21, (2004), pp. 219-236.

Classification : 65N85, 65N15

Format : Talk at Waseda University

Author(s) : DEBASISH PRADHAN (Defence Institute of Advanced Technology, Pune - 411025, India) Swapnil Kale (Defence Institute of Advanced Technology, Pune)

[00551] Network suppression of the pathogen spread within the healthcare system

Session Time & Room : 1E (Aug.21, 17:40-19:20) @G401

Type : Contributed Talk

Abstract : We consider an impulsive-differential-equation system, based on SIS model, to describe the spread of pathogens in healthcare systems accounting for patient mobility. We propose sufficient conditions guaranteeing network suppression of infection and an algorithm to indicate hospitals prone to high bacteria prevalence and ultimately to ensure the stability of a disease-free state. As an illustration, we present a model of hospital-acquired multidrug-resistant bacteria transmission based on hospital admission records provided by a German insurance company.

Classification : 34A37, 65P40, 92D30

Format : Talk at Waseda University

Author(s) : Monika Joanna Piotrowska (Institute of Applied Mathematics and Mechanics, University of Warsaw) Aleksandra Puchalska (Institute of Applied Mathematics and Mechanics, University of Warsaw) Konrad Sakowski (Institute of Applied Mathematics and Mechanics, University of Warsaw and Institute of High Pressure Physics, Polish Academy of Sciences)

[00557] Three dimensional laminar flow in a dividing channel

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D505

Type : Contributed Talk

Abstract : This talk will describe a mathematical-modelling study concerned with fluid flow within a channel using asymptotic methods to study fluid behaviour on long axial length scales. Although many 3D problems can be solved through direct numerical simulations, it is generally useful to verify them with concrete analytical theory, which this study aims to do. Motivations for this research relate to providing insights into branching flows for cardiovascular vessels, industrial problems and Hele-Shaw cells.

Classification : 76-10, 76d10, 76D27

Format : Talk at Waseda University

Author(s) : Thuy Duong Dang (University College London) Frank Smith (University College London) Christian Klettner (University College London)

[00560] Semiparametric Kernel Estimation with Bayesian Bandwidths for Multivariate Nonnegative Data

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E501

Type : Contributed Talk

Abstract : We introduce a flexible semiparametric kernel method for smoothing distributions on nonnegative supports. This multivariate estimator is guided by a given parametric part, here an uncorrelated exponential distribution estimated by maximum likelihood, and a nonparametric part which is a weight function to be smoothed through multiple gamma kernels. Also, a diagnostic model discusses the choice between the parametric, semiparametric and nonparametric approaches. Finally, practical multivariate semicontinuous datasets illustrate the usefulness of the method.

Classification : 62Gxx, 62Hxx

Format : Talk at Waseda University

Author(s) : Sobom Matthieu Som (Universit Thomas SANKARA) Clestin C. Kokonendji (Universit Bourgogne Franche-Comt)

[00561] Quantum-parallel vectorized data encodings and computations on trapped-ions and transmons QPUs

Session Time & Room : 4E (Aug.24, 17:40-19:20) @E711

Type : Contributed Talk

Abstract : We introduce new quantum data representations derived from uniformly controlled rotation gates.

QCrank encodes a sequence of real-valued data as rotations of the data qubits allowing for high storage density. QBArt directly embeds a binary representation in the computational basis and requires a lower number of quantum measurements. We demonstrate quantum algorithms for DNA pattern matching, Hamming weight calculation, complex value conjugation, and O(400) bits image retrieving executed on Quantiunuum, IBMQ, and IonQ QPUs.

Classification : 68Q12, 81P68, 81P45, 81P16, Quantum encoding and computation on NISQ QPUs

Format : Talk at Waseda University

Author(s) : Jan Balewski (National Energy Research Scientific Computing Center, Lawrence Berkeley National Laboratory) Mercy G. Amankwah (Case Western Reserve University, Cleveland) Roel Van Beeumen (Applied Mathematics and Computational Research Division, Lawrence Berkeley National Laboratory) E. Wes Bethel (Computer Science Department, San Francisco State University) Talita Perciano (Scientific Data Division, Lawrence Berkeley National Laboratory) Daan Camps (National Energy Research Scientific Computing Center, Lawrence Berkeley National Laboratory)

[00565] Resonance with a Delay Differential Equation

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G401

Type : Contributed Talk
Abstract : We propose here a delay differential equation with a linear time coefficient that produces transient resonant behavior. The oscillatory transient dynamics appear and disappear as the delay is increased between zero to asymptotically large delay. Also, for an appropriately tuned value of the delay, the height of the power spectrum goes through the maximum. This resonant behavior contrasts itself against the general behaviors observed with the constant coefficient delay differential equations.
Classification : 34K23, 93C43
Format : Talk at Waseda University
Author(s) : Kenta Ohira (Nagoya University) Toru Ohira (Graduate School of Mathematics, Nagoya University)

[00566] Numerical study of Draw resonance in Fibre spinning using multi-mode constitutive model

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G401

Type : Contributed Talk
Abstract : We study the instability called Draw resonance that occurs in the industrial process of manufacture of thin polymer fibres, called fibre spinning using a multi-mode viscoelastic constitutive equation. We do a linear stability analysis of the equations by carrying out numerical simulations for a varying number of modes in the constitutive equation. We compare our results with those got by using single-mode viscoelastic models and discuss our findings.
Classification : 34B09, 34B60, 65N25, Polymer flows in industrial processes
Format : Talk at Waseda University
Author(s) : Renu Dhadwal (Center for Mathematical Modelling, FLAME University)

[00567] Topology-aware algorithm for constructing cartograms from density-equalising map projections

Session Time & Room : 2E (Aug.22, 17:40-19:20) @F401

Type : Contributed Talk

Abstract : Cartograms are maps in which the areas of enumeration units (e.g. administrative divisions) are proportional to quantitative data (e.g. population). Generating cartograms with density-equalising map projections guarantees that geographic neighbours remain neighbours in the cartograms if all boundaries are infinitely dense sequences of points. However, computers represent boundaries with only finitely many points, often causing invalid topologies in the cartogram. This talk shows how line densification and topology-aware simplification solve this problem.

Classification : 51M30, 53-08, 68-04

Format : Talk at Waseda University

Author(s) : Michael T Gastner (Yale-NUS College) Nguyen Phong Le (Yale-NUS College) Nihal Z Miaji (Yale-NUS College) Adi Singhania (Yale-NUS College)

[00568] PRIMAL HYBRID METHOD FOR QUASILINEAR PARABOLIC PROBLEMS

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E605

Type : Contributed Talk

Abstract : A second-order quasi-linear parabolic initial-boundary value problem is approximated by using primal hybrid finite element method and Lagrange multipliers. Semidiscrete and backward Euler based fully discrete schemes are discussed and optimal order error estimates are established by applying modified elliptic projection. Optimal order error estimates in maximum norm are also derived. Earlier results on maximum-norm superconvergence of the gradient in piecewise linear finite-element approximations of elliptic and parabolic problems are now carried over to quasilinear case using primal hybrid method. Finally, the results on numerical experiments confirm our theoretical findings.

Classification : 65M60

Format : Talk at Waseda University

Author(s) : Ajit Patel (The LNM Institute of Information Technology)

Ravina Shokeen (The LNM Institute of Information Technology) Amiya Kumar Pani (Birla Institute of Technology & Science, Pilani)

[00572] Model uncertainty for statistical arbitrage

Session Time & Room : 2E (Aug.22, 17:40-19:20) @F412

Type : Contributed Talk

Abstract : We consider an optimal stopping problem that addresses \textit{model uncertainty}, which affects the model assumptions, e.g., the parameters embedded in the probability distribution.
The result presented in this talk shows the explicit form of the boundary indicating the optimal stopping time, assuming the portfolio value as an Ornstein-Uhlenbeck process.
Applying our method might make statistical arbitrage more robust because the trading code for statistical arbitrage often depends on incorrect estimation.

Classification : 60G40, 60G10, 91G80

Format : Talk at Waseda University

Author(s) : Daisuke Yoshikawa (Kansai University)

[00576] Modeling the Dispersion of Effluents Discharged into Tidally Coastal Waters

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D402

Type : Contributed Talk

Abstract : Mixing and dispersion of effluents discharged under the spring neap tidal oscillations are studied analytically on a flat seabed and a uniformly sloping bed. The solutions of two-dimensional advection-diffusion equations are presented graphically to visualize and analyze the spreading of effluent plumes in coastal waters, following discharges from a single sea outfall, multiple outfalls, and multiport diffusers, to showcase the model applications of marine outfall systems for disposal from industrial plants in the far field.

Classification : 76Rxx, 35Q35, 76-10

Format : Talk at Waseda University

Author(s) : Anton Purnama (Sultan Qaboos University) Ahmed Al-Kasbi (University of Technology and Applied Sciences)

[00577] Mixed Finite Element Method for Dirichlet Boundary Optimal Control Problem

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E711

Type : Contributed Talk

Abstract : The optimal control problems (OCPs) subjected to partial differential equations (PDEs) have numerous applications in fluid dynamics, image processing, mathematical finance etc. The objective of OCPs is to find the optimal control which minimizes or maximizes the given cost functional with certain constraints being satisfied. There are mainly two types of OCPs available in literature namely, Distributed Control Problems where the control acts on the system through an external force and Boundary Control Problems where the control acts on the system through a Dirichlet or Neumann or Robin boundary conditions. Dirichlet boundary control problems are difficult to handle due to variational difficulty.

In many applications, it is important to obtain accurate approximation of the scalar variable and its gradient simultaneously. A common way to achieve this goal is to use mixed finite element methods. The main aim of my talk is to analyze the mixed finite element method for the second order Dirichlet boundary control problem in which the control is penalized in the energy space. Mixed finite element methods have the property that they maintain the discrete conservation law at the element level. For the variational formulation, the state equation is converted to the mixed system using the mixed variational scheme for second order elliptic equations and then the continuous optimality system is derived. In order to discretize the continuous optimality system, the lowest order Raviart-Thomas space is used to numerically approximate the state and co-state variables whereas the continuous piece-wise linear finite element space is used for the discretization of control. Based on this formulation, the optimal order a priori error estimates for the control in the energy norm and L_2-norm is derived. The reliability and the efficiency of proposed a posteriori error estimator is also discussed using the Helmholtz decomposition. Finally, several numerical experiments are presented to confirm the theoretical findings.

Classification : 65N30, 65N15, 65N12, 65K10

Format : Talk at Waseda University

Author(s) : Divay Garg (Indian Institute of Technology Delhi) Kamana Porwal (Indian Institute of Technology Delhi)

[00578] Secret Sharing Scheme with Perfect Concealment by Quasigroup

Session Time & Room : 4E (Aug.24, 17:40-19:20) @A502

Type : Contributed Talk

Abstract : A secret sharing scheme was introduced by Shamir in 1979. A quasigroup is equivalent to a Latin square. The concept of perfect concealment is also called perfect security. The word security describes a property of a phenomena, and the word concealment describes an action which makes a phenomenon. In this talk, we force an action rather than a property, and we give new construction of secret sharing scheme with perfect concealment by quasigroup.

Classification : 94A62, 05B15, 20N05, 60B99

Format : Talk at Waseda University

Author(s) : Tomoko Adachi (Shizuoka Institute of Science and Technology)
Izumi Takeuti (National Institute of Advanced Industrial Science and Technology)

[00579] Explosion times and its bounds for a system of semilinear SPDEs

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G702

Type : Contributed Talk

Abstract : In this paper, we obtain lower and upper bounds for the blow-up times to a system of semilinear stochastic partial differential equations. Under suitable assumptions, the bounds of the explosion times are obtained by using explicit solutions of an associated system of random PDEs and a formula due to Yor. We provide an estimate for the probability of the finite-time blow-up and the impact of the noise on the solution is investigated.

Classification : 35R60, 60H15, 74H35

Format : Talk at Waseda University

Author(s) : Karthikeyan Shanmugasundaram (Periyar University)

[00583] The empirical measure of invariant fields on sphere-cross-time

Session Time & Room : 2E (Aug.22, 17:40-19:20) @F412

Type : Contributed Talk

Abstract : In this talk we investigate geometric properties of random fields on the two-dimensional sphere evolving over time, that are widely used in several scientific areas to model and analyze data (e.g. in Climate Science related to Earth surface temperature). In particular we study the behavior for large time of their excursion area at any threshold, establishing both asymptotic variances and limit theorems. We will show that phase transitions can occur for specific levels and memory.

Classification : 60G60, 33C55, 60D05, 60F05, 62M15

Format : Talk at Waseda University

Author(s) : Domenico Marinucci (University of Roma "Tor Vergata") Maurizia Rossi (University of Milano-Bicocca) Anna Vidotto (University of Napoli "Federico II")

[00585] Computational and Optimization Frameworks for Tissue Vascularization in Bioprinted Grafts

Session Time & Room : 3E (Aug.23, 17:40-19:20) @F311

Type : Contributed Talk

Abstract : Template channels within tissue-engineered skin grafts can provide a promising tool for faster microvasculature formation and transport of nutrients to cells outside channels. Developing viable grafts requires the optimal design to support cell viability by controlled channel geometry and biomaterial properties. We discuss the recent advances in creating a robust computational framework to simulate physical and biological phenomena in graft samples. The first computational results will speak for future applications to models using laboratory data.

Classification : 49-06, 92-10, 76Z05, 92-08, 92C75

Format : Talk at Waseda University

Author(s) : Chris Bashur (Florida Institute of Technology) Beste Caner (Florida Institute of Technology) Vladislav Bukshtynov (Florida Institute of Technology)

[00591] Convergence rate of RBSDE by penalisation and its financial applications

Session Time & Room : 4C (Aug.24, 13:20-15:00) @E704

Type : Contributed Talk

Abstract : In this paper, we study the convergence of numerical solution of Reflected Backward Stochastic Equations (RBSDEs) by the penalisation approach and we apply this on the pricing problem of American option. Usually the obstacle-related problem is studied by Snell Envelope and penalisation is used on proving existence. Here we fill the gap between penalisation and numerical solution. As result, we proved successfully the convergence rate for both continuous and discrete penalised solution.

Classification : 60Hxx, 65Cxx, 60H35, 65C30, 60G40

Format : Talk at Waseda University

Author(s) : Wanqing WANG (Ecole Polytechnique) Emmanuel Gobet (Ecole Polytechnique) Mingyu Xu (Fudan University)

[00599] Advances on estimation of temperature and moisture of soil using sensor networks.

Session Time & Room : 3C (Aug.23, 13:20-15:00) @G709

Type : Industrial Contributed Talk

Abstract : Given a sensor network set up on an agricultural field, we review methods based on PDE, regression and Principal Component Analysis algorithms to estimate the temperature and moisture of soil.

With PCA it is possible to identify those sensors or groups of sensors which are influential at the time of measuring the temperature or moisture at a given point of the field.

Validation results are provided based on real data from agricultural fields.

Classification : 35Q79, PDE, regression, PCA

Format : Talk at Waseda University

Author(s) : Carlos Fresneda-Portillo (Universidad Loyola Andaluca (Spain)) Carmelina Ierardi (Universidad Loyola Andaluca) Jos Ramn Salvador-Ortiz (Universidad Loyola Andaluca) Javier Prez (Universidad Loyola Andaluca) Diego Luis Orihuela (Universidad Loyola Andaluca)

[00600] A Two Timescale Evolutionary Game Theoretic Approach to Multi-Agent Learning

Session Time & Room : 3D (Aug.23, 15:30-17:10) @D514

Type : Contributed Talk

Abstract : We propose a two timescale evolutionary game theoretic approach to solving multiagent
reinforcement learning problems. This new approach enables us to avoid the computationally
expensive step of solving exact equilibrium in each iteration. It provably converges to epsilon-Nash
equilibria without imposing the global optima or saddle point conditions, two restrictive assumptions
that are typically needed in the literature. The numerical experiments show the computationally
efficiency of the algorithm.

Classification : 91A15, 91A22, 68T05, 37N40, Reinforcement learning; Multi-agent system

Format : Talk at Waseda University

Author(s) : Nan Chen (The Chinese University of Hong Kong) Chengli Ren (The Chinese University of Hong Kong)

[00601] Assessment of Mathematics in Higher Education over the COVID19 pandemic.

Session Time & Room : 3E (Aug.23, 17:40-19:20) @D514

Type : Industrial Contributed Talk

Abstract : A comparative analysis of various assessment methods on Higher Education Mathematics is provided. A discussion on the reliability of these methods is provided with particular emphasis on distance/online (uncontrolled) assessment methods and face to face (controlled) assessment methods. We analyse the data collected from an assessment strategy based on a set of tests before and throughout the COVID pandemic. Results show that online assessment is less reliable for those students with lower academic performance.

Classification : 97D60, Assessment of Mathematics in Higher Education

Format : Talk at Waseda University

Author(s) : Carlos Fresneda-Portillo (Universidad Loyola Andaluca (Spain)) James Maunder (Oxford Brookes University)

[00610] Input-output finite time stabilization for nonlinear networked control systems

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G802

Type : Contributed Talk

Abstract : In this talk, we discuss the problem of input-output finite time stabilization for nonlinear networked control systems with network induced delay. The nonlinear system can be linearized by fuzzy model with weighted membership functions. Memory event-triggering mechanism incorporated to reduce frequent packets transmission. The sufficient stabilization conditions are developed in the form of linear matrix inequalities with aid of Lyapunov stability theory. Finally, numerical example is provided to demonstrate the viability of the suggested approach.

Classification : 37N35, 34A34, 93D15, 93D25, 93C42

Format : Talk at Waseda University

Author(s) : Marshal Anthoni Selvaraj (Anna University Regional Campus Coimbatore)

[00611] Deformations of linear elastic bodies computed using the RBF-PU method

Session Time & Room : 4C (Aug.24, 13:20-15:00) @E711

Type : Contributed Talk

Abstract : In this talk we will present numerical solutions to boundary value problems of linear elasticity, computed using the Radial Basis Function Partition of Unity (RBF-PU) method in the least squares formulation. Specifically, we will show deformations of 3D geometries, including a thin plank under bending and a reconstructed human diaphragm under ventilation conditions. Convergence studies and a comparison of the RBF-PU method to the standard Galerkin Finite Element method (GFEM) will be presented.

Classification : 65N35, 74S25, 74B05

Format : Talk at Waseda University

Author(s) : Andreas Michael (Uppsala University)

[00613] Phase-field systems coupled with large deformations

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E812

Type : Contributed Talk

Abstract : Multiphase dynamical systems coupled with finite strain are used for the mathematical description of many phenomena in soft matter physics and biology, such as swelling and wetting processes of gels. We derive a thermodynamically consistent framework to couple phase fields and mechanics in a gradient flow structure allowing for various dissipation mechanisms. Combining modeling tools, rigorous analytical considerations, and the construction of numerical implementations allows us to understand practical and technical details from different perspectives.

Classification : 74Fxx

Format : Talk at Waseda University

Author(s) : Leonie Schmeller (Weierstrass Institute) Barbara Wagner (Weierstrass Institute) Dirk Peschka (Weierstrass Institute)

[00614] Sparse spectral methods for fractional PDEs

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G701

Type : Contributed Talk

Abstract : Fractional partial differential equations model nonlocal processes such as wave absorption in the brain, long-range geophysical effects, and Lvy flights. We introduce a spectral method for the fractional Laplacian in one dimension that induces sparse linear systems. We only deal with the coefficients of the expansion and thus time-stepping is fast. We consider a number of examples including the fractional heat and fractional wave propagation equations.

Classification : 35R11, 65N35, 65M70, 65R10, Numerical Analysis, Nonlocal PDEs

Format : Talk at Waseda University

Author(s) : Ioannis P. A. Papadopoulos (Imperial College London)

[00617] Low-regularity exponential-type integrators for the Zakharov system under rough data

Session Time & Room : 5C (Aug.25, 13:20-15:00) @E703

Type : Contributed Talk

Abstract : Two low-regularity exponential-type integrators (LREIs) are proposed and analyzed for the Zakharov system (ZS), including a first-order integrator and a second-order one. To my knowledge, it is the first time to propose such LREIs that achieve the first- and second-order accuracy by requiring one or two additional derivatives for the solutions of ZS, respectively. Numerical comparison with other methods demonstrates the superiority of the newly proposed LREIs for rough data.

Classification : 65M70, 65M12, 65M15, 65T50

Format : Talk at Waseda University

Author(s) : Hang Li (Tsinghua University) Chunmei Su (Tsinghua University)

[00619] Optimal Transport for Positive and Unlabeled Learning

Session Time & Room : 4E (Aug.24, 17:40-19:20) @F403

Type : Contributed Talk

Abstract : Positive and unlabeled learning (PUL) aims to train a binary classifier based on labeled positive samples and unlabeled Samples, which is challenging due to the unavailability of negative training samples. This talk will introduce a novel optimal transport model with a regularized marginal distribution for PUL. By using the Frank-Wolfe algorithm, the proposed model can be solved properly. Extensive experiments showed that the proposed model is effective and can be used in meteorological applications.

Classification : 49Q22, 68T01

Format : Talk at Waseda University

Author(s) : Jie ZHANG (University of Hong Kong) Yuguang YAN (Guangdong University of Technology) Michael Ng (University of Hong Kong)

[00620] Development of an ion channel model-framework

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A511

Type : Contributed Talk
Abstract : Ion channels in cell membranes are of ultimate importance in physiology. They control a large fraction of biological processes and are mainly investigated by current-voltage experiments. To support the interpretation of measured results, we develop a model-framework based on non-equilibrium thermodynamics that accounts for various important aspects, e.g., finite-volume effects and the surface charges of the channel. Julia-based numerical simulations are performed to compute current-voltage relations, with varying ion concentrations, applied voltages, and channel properties.
Classification : 92-10, 92C40, 92-08
Format : Talk at Waseda University
Author(s) : Christine Keller (Weierstrass Institute for Applied Analysis and Stochastics (WIAS)) Juergen Fuhrmann (Weierstrass Institute for Applied Analysis and Stochastics (WIAS)) Manuel Landstorfer (Weierstrass Institute for Applied Analysis and Stochastics (WIAS)) Barbara Wagner (Weierstrass Institute for Applied Analysis and Stochastics (WIAS))

[00628] Resource Dependent Competition and Extinction

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G710

Type : Contributed Talk
Abstract : The classical theory of competitive exclusion does not consider the type of interaction between species. We create a new competition model in which the maximum population of a species is dependent on the availability of resources, or food supply, and competition is in the form of competition for these resources. We find this model always leads to stable coexistence and we investigate ways to bring about extinction.
Classification : 37N25, 92D25, 92-10
Format : Talk at Waseda University
Author(s) : Robert Garvey (University of Limerick) Andrew Fowler (University of Limerick)

[00629] Stability Analysis of Split Equality and Split Feasibility Problems

Session Time & Room : 2E (Aug.22, 17:40-19:20) @F401

Type : Contributed Talk
Abstract : In this talk, the stability of solutions to parametric split equality and split feasibility problems is addressed for the first time. Characterizations for the Lipschitz-likeness of solution maps are obtained by exploiting special structures of the problems and by using an advanced result of B.S. Mordukhovich on parametric generalized equations. Examples are presented to illustrate how the obtained results work in practice and to show that extra mild assumptions made cannot be omitted.
Classification : 49J53, 49K40, 65K10, 90C25, 90C31
Format : Talk at Waseda University
Author(s) : Huong Thi Vu (Institute of Mathematics, Vietnam Academy of Science and Technology) Yen Dong Nguyen (Institute of Mathematics, Vietnam Academy of Science and Technology)

[00634] Bifurcation curves for semipositone problem with Minkowski-curvature operator

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G502

Type : Contributed Talk
Abstract : We study the shape of bifurcation curve of positive solutions for the semipositone Minkowski-curvature problem $-\left(u^{\prime }/\sqrt{1-{u^{\prime }}^{2}}\right) ^{\prime }=\lambda f(u),$ in $\left(-L,L\right) $, and $u(-L)=u(L)=0,$ where $\lambda ,L>0$ and $\left(\beta -u\right) f(u) <0$ for $u>0$. We prove that if f is either convex or concave, then the bifurcation curve is C-shaped.
Classification : 34B15, 34B18, 34C23, 74G35
Format : Talk at Waseda University
Author(s) : Shao-Yuan Huang (National Taipei University of Education)

[00637] Wave Scattering from Layers of Random Particulate Materials

Session Time & Room : 5C (Aug.25, 13:20-15:00) @E817

Type : Contributed Talk

Abstract : To characterise any material with sound waves, the wave will propagate through several layers before reaching the material. If that material is a random particulate material, then to date there is no simple model to deal with the layers. In this talk we show how extending the quasi-crystalline approximation (\text{(a technique from statistical physics)}) to layers leads to clear and simple models which separate the influence of the microstructure from the material geometry.

Classification : 74J20, 82D30, 45B05

Format : Talk at Waseda University

Author(s) : Paulo Sergio Piva (The University of Sheffield) Kevish Napal (The University of Sheffield) Artur Gower (The University of Sheffield)

[00648] Bounds for effective conductivity of multimaterial composites

Session Time & Room : 2C (Aug.22, 13:20-15:00) @F312

Type : Contributed Talk

Abstract : The paper discusses the exact bounds for the effective properties of multimaterial composites. We refine Hashin-Shtrikman bounds in the region where the last ones are loose. We show that fields in optimal structures vary in restricted domains, modify the Translation method, and obtain new exact bounds and optimal structures. Different volume fractions of components correspond to topologically different types of optimal structures.

Classification : 49K20

Format : Talk at Waseda University

Author(s) : Andrej Cherkaev (University of Utah)

[00651] Parallel Coordinate Descent Methods for Full Configuration Interaction

Session Time & Room : 2D (Aug.22, 15:30-17:10) @E709

Type : Contributed Talk

Abstract : Solving the time-independent Schrdinger equation gives us full access to the chemical properties of molecules. Among all the ab-initio methods, full configuration interaction (FCI) provides the numerically exact solution under a predefined basis set. However, the FCI problem scales factorially with respect to the number of bases and electrons and suffers from the curse of dimensionality. The FCI problem could be reformulated as an unconstraint minimization problem. This work proposes a novel algorithm to address the minimization problem. The algorithm introduces an extra search dimension to enable the exact linesearch for the multi-coordinate descent method, which could be fully parallelized. Hence, the proposed algorithm benefits from both exact linesearch and parallelization. Numerically, we demonstrate the parallel efficiency of the algorithm. The algorithm achieves better energy and parallelism on systems with approximately a hundred electrons than other existing methods.

Classification : 65Z05, 68Q12
Format : Talk at Waseda University
Author(s) : Yuejia Zhang (Fudan University) Yingzhou Li (Fudan University)

[00655] Finite-time fault-tolerant robust control design for parabolic partial differential equations

Session Time & Room : 2D (Aug.22, 15:30-17:10) @A201

Type : Contributed Talk
Abstract : In this paper, a finite-time fault-tolerant robust control design for parabolic partial differential equations in the presence of uncertainties, actuator faults and external disturbances is discussed. The main aim is to design a non-fragile fault-tolerant control to ensure the robust stabilization of the considered PDEs. By employing Lyapunov method, a novel set of conditions is obtained to ensure the required result. Finally, simulations are provided to demonstrate the effectiveness of the developed control design.
Classification : 93D15, 93D05, 93D40, Robust Control Theory
Author(s) : Sakthivel Rathinasamy (Bharathiar University)

[00659] Understanding persisting onchocerciasis hotspots in Africa using mathematical models

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D514

Type : Contributed Talk
Abstract : Onchocerciasis/river blindness is a vector-borne neglected tropical disease with persistent transmission hotspots despite the repeated distribution of ivermectin in endemic communities in Africa. One of the hypotheses for the persistence of transmission is due to the movement of parasites via infected humans and/or vectors between neighbouring communities. I have explored how vector movement affects transmission using spatially-structured mathematical models informed by genetic and environmental data, which might aid in making public-health decisions to

eliminate onchocerciasis.
Classification : 92-08, 92-10, 92D30, 92D25, 92D40
Format : Talk at Waseda University
Author(s) : Himal Shrestha (La Trobe University) Himal Shrestha (La Trobe University) Shannon Hedtke (La Trobe University) Karen McCulloch (La Trobe University) Warwick Grant (La Trobe University) Rebecca Chisholm (La Trobe University)

[00663] Quantum Monte Carlo algorithm for solving Black-Scholes PDEs for high-dimensional option pricing in finance and its proof of overcoming the curse of dimensionality

Session Time & Room : 1E (Aug.21, 17:40-19:20) @E704

Type : Contributed Talk
Abstract : In this talk, we first provide a brief introduction to quantum computing from a mathematical perspective. No prior knowledge of quantum computing is necessary.
We then introduce a quantum Monte Carlo algorithm to solve high-dimensional Black-Scholes PDEs
with correlation for high-dimensional option pricing. The payoff function of the option is of general form
and is only required to be continuous and piece-wise affine (CPWA), which covers most of the relevant payoff
functions used in finance. We provide a rigorous error analysis and complexity analysis of our algorithm.
In particular, we prove that the computational complexity of our algorithm is bounded polynomially in the
space dimension d of the PDE and the reciprocal of the prescribed accuracy and so demonstrate that our
quantum Monte Carlo algorithm does not suffer from the curse of dimensionality.
This talk is based on a joint work with Yongming Li.
Classification : 65M75, 91G20, Deep Learning method for nonlinear PDEs
Format : Talk at Waseda University
Author(s) : Ariel Neufeld (NTU Singapore) Philipp Schmocker (NTU Singapore) Sizhou Wu (NTU Singapore)

[00664] A New Sampling Technique for Learning with Hypergraph Neural Networks

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E811

Type : Contributed Talk

Abstract : Hypergraphs can represent higher-order relations among objects. Traditional hypergraph neural networks produce high computational cost and timing. We propose a new sampling technique for learning with hypergraph neural networks. The core idea is to design a layer-wise sampling scheme for nodes and hyperedges to approximate original hypergraph convolution. Notably, the proposed sampling technique allows us to handle large-scale hypergraph learning. Experiment results demonstrate that our proposed model keeps a good balance between time and accuracy.

Classification : 68T07, 05C65, 62D05, 68T09, large-scale hypergraph learning, hypergraph neural networks, hypergraph sampling, variance reduction, importance sampling

Format : Talk at Waseda University

Author(s) : Fengcheng Lu (The University of Hong Kong) Michael Kwok-Po Ng (The University of Hong Kong)

[00665] Estimating pressure distribution on a surface via electrical sensing skin

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E820

Type : Contributed Talk

Abstract : Sensing skins allow for monitoring of a surface by electrically imaging a conductive layer on an object. One example is fracture detection of concrete elements by imaging a conductive paint layer. In this talk, we present a way to estimate pressure distribution on a surface by using sensing skin -based techniques.

Classification : 78-05, 78-10, 65Nxx, Electrical Impedance Tomography

Author(s) : Petri Kuusela (University of Eastern Finland) Moe Pour-Ghaz (North Carolina State University) Aku Seppnen (University of Eastern Finland)

[00667] Effect of tumor-associated neutrophils on tumor growth : A mathematical model

Session Time & Room : 5C (Aug.25, 13:20-15:00) @D515

Type : Contributed Talk

Abstract : Tumor-associated neutrophils (TANs) have been under discussion for their dual role on tumor microenvironment, but they are emerging as important agents in tumor invasion. In this study, we divided TANs into two different phenotypes: N1 TANs, the anti-tumor neutrophils and N2 TANs, the tumorigenic neutrophils. We developed a mathematical model to investigate the dynamics of tumor growth between different TANs and responses to various stimuli, and finally to build simulations for brain tumor treatment.

Classification : 92C99, 35Q92, 37N25, Mathematical oncology

Format : Talk at Waseda University

Author(s) : Haneol Cho (Konkuk university) Yangjin Kim (Konkuk university) Junho Lee (Konkuk university)

[00668] Solution of Non-linear Problems Through Variant of Newtons Method with Applications in Engineering

Session Time & Room : 4E (Aug.24, 17:40-19:20) @E506

Type : Contributed Talk

Abstract : Various non-linear problems that formulated from sciences and engineering like Combustion problems, Chemistry of rainwater, Heat problems, etc. are difficult to solve with analytical methods. So, the approximate solution of such non-linear problems is obtained through iterative methods. Hence, we will discuss variant of Newtons method and its validity in terms of a convergence order, minimum computation cost, time, and efficiency over existing techniques.

Classification : 65H10, 41A58, 65Y20, Numerical Analysis

Format : Talk at Waseda University

Author(s) : Sonia Bhalla (Chandigarh University)

[00671] A new drone swarm model for zone occupation

Session Time & Room : 3C (Aug.23, 13:20-15:00) @G709

Type : Contributed Talk
Abstract : We focus on fluid modeling for decentralized fleets of autonomous drones with Newtonian models. The corresponding system of hyperbolic conservation laws is obtained through mean field limit and moments closure assumption. The objective is to reduce the complexity for swarm tasks simulations such as zone occupation. Taking advantage of the macroscopic representation of the density, we introduce a new model for this task accounting for the drones inertia, which has been neglected so far.
Classification : 35Q70, 35B40, 35B45
Format : Talk at Waseda University
Author(s) : Axel Maupoux (ONERA / Institut Mathmatique de Toulouse) Guillaume Dufour (ONERA)

[00676] Recent Advances in 2-Lagrange Multiplier Method for Multiscale PDEs

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E709

Type : Contributed Talk
Abstract : The heterogeneous 2LM method, introduced in Loisel et al., SIAM J. Sci. Comput., 37, 2015, is a domain decomposition method where the coarse space is built using eigenvectors associated with subdomain eigenproblems. In this talk, we provide a new a-priori estimate for the norm of the coarse problem to guarantee further that the method is robust w.r.t the changes in the contrast of the diffusion coefficient. Numerical results are provided to support the theoretical findings.
Classification : 65N55, 65F10, 65N30, 65N22
Format : Talk at Waseda University
Author(s) : Hieu Nguyen (Fulbright University Vietnam) Sbastien Loisel (Heriot-Watt University)

[00677] Mathematical Epidemiology as a decision tool

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A511

Type : Industrial Contributed Talk

Abstract : Mathematics is a powerful tool for tackling real world problems; concretely, we are interested in monitoring epidemics. Some members of the MOMAT Research Group -Complutense University of Madrid- have worked in collaboration with veterinary groups, healthcare companies and public entities of the Spanish healthcare system. In this talk, we present some mathematical models developed by this research group for both animal -e.g., Classical Swine Fever, Bluetongue- and human -e.g., COVID-19, Ebola- infectious diseases.

Classification : 92-10, 92Dxx, Mathematical Epidemiology

Format : Talk at Waseda University

Author(s) : Alicja B. Kubik (Universidad Complutense de Madrid) Benjamin Ivorra (Universidad Complutense de Madrid) Angel M. Ramos (Universidad Complutense de Madrid) Mara Vela-Prez (Universidad Complutense de Madrid) Miriam R. Ferrndez (Instituto de Matemtica Interdisciplinar)

[00678] Monitoring distributed strains on solid surfaces by electrical impedance tomography

Session Time & Room : 1E (Aug.21, 17:40-19:20) @D405

Type : Contributed Talk

Abstract : Measuring strains induced by loads on structural elements is a key component of structural health monitoring (SHM). Current methods are mostly based on localized measurements and offer limited information on distributed strain. We present results on distributed strain monitoring based on electrical impedance tomography (EIT) imaging of a painted, elastic surface coating. The method can extract information on the surface strain field by solving the EIT inverse problem based on measured data.

Classification : 78A46, 78A55, 74Bxx

Format : Talk at Waseda University

Author(s) : Mikko Rsnen (University of Eastern Finland) Aku Seppnen (University of Eastern Finland) Moe Pour-Ghaz (North Carolina State University) Jari Kaipio (University of Eastern Finland)

[00680] Computing p-Harmonic Descent Directions for Shape Optimization

Session Time & Room : 4E (Aug.24, 17:40-19:20) @F403

Type : Contributed Talk

Abstract : Recent development in shape optimization suggests enhanced results by using a p-harmonic approach to determine descent directions. Therefore, we present the extension of an algorithm to solve the occurring vector-valued p-Laplace problem subject to a boundary force without requiring an iteration over the order p and thus compute higher-order solutions efficiently. Results are verified by numerical experiments in a fluid dynamic setting.

Classification : 49Q10, 49M41

Format : Talk at Waseda University

Author(s) : Henrik Wyschka (University of Hamburg) Martin Siebenborn (University of Hamburg) Winnifried Wollner (University of Hamburg)

[00681] A revised Hughes model for pedestrian flow

Session Time & Room : 3C (Aug.23, 13:20-15:00) @G710

Type : Contributed Talk

Abstract : In this talk, we analyse the modified Hughes model for pedestrian dynamics, in which individuals seek to minimize their travel time. We present the existence and uniqueness of the solution and illustrate the behavior of the model with various numerical results. This is joint work with Prof Nader Masmoudi

Classification : 35Q91, 35Q70, 35F21

Format : Talk at Waseda University

Author(s) : Mohamed Ghattassi (NYUAD)

[00682] Cover Temporal Networks with Densest Subgraphs

Session Time & Room : 2E (Aug.22, 17:40-19:20) @G304

Type : Contributed Talk

Abstract : Temporal networks have been introduced to represent the dynamics of a complex system.

In this contribution we consider a problem that asks for a collection of dense temporal subgraphs that covers a given temporal graph. The problem has application in the identification of communities of a complex system, for example of a social network.

We present a result on the computational complexity of the problem and a polynomial-time approximation algorithm.

Classification : 05C85, 05C90, 68R10, 68R05, 68Q25

Format : Talk at Waseda University

Author(s) : Riccardo Dondi (Universit degli Studi di Bergamo)

[00683] Linearized Saint-Venant Equation with Lateral Inflow in a Finite Channel

Session Time & Room : 2E (Aug.22, 17:40-19:20) @F412

Type : Contributed Talk

Abstract : We present a solution for linearized Saint-Venant equations with uniformly distributed lateral inflow for a finite rectangular channel. The discharge is presented as the convolution of the distributed lateral inflow and lateral channel response function. We study the behavior of lateral channel response function for different parameters. To find discharge at any location of a channel for a given channel width, the choice of reference discharge and slope of the channel play a significant role.

Classification : 35Q35, 44A10

Author(s) : Swaroop Nandan Bora (Indian Institute of Technology Guwahati) Shiva Kandpal (Indian Institute of Technology Guwahati)

[00684] Aggregation of Anisotropic Inclusions on Elastic Membranes

Session Time & Room : 2E (Aug.22, 17:40-19:20) @D405

Type : Contributed Talk

Abstract : Elastic interactions mediated by biological membranes are an important class of sorting mechanisms used to organise proteins in living systems and with applications for biotechnology. Proteins that bind to the membrane and generate this curvature are often anisotropic and this broken symmetry yields new phenomena in their interactions. In this talk, I will discuss the many-body structures that can emerge from these elastic, quadrupole-like interactions and explore the consequences of these aggregates.

Classification : 74L15, 92C10, 92C37, 74G10

Format : Talk at Waseda University

Author(s) : Matthew William Cotton (University of Oxford) Jon Chapman (University of Oxford) Alain Goriely (University of Oxford)

[00688] Recovering Battery Ageing Dynamics with Invertible Neuronal Networks

Session Time & Room : 3C (Aug.23, 13:20-15:00) @G709

Type : Contributed Talk

Abstract : Modern Lithium-Ion-Batteries (LIBs) suffer from degradation. This leads to a dependency of the voltage-capacity-curve on the charge-discharge-cycle. However, there are different processes inducing this degradation, each with a different influence on the aforementioned curve. Given such a curve, we recover the ageing dynamic of each effect and identify how much it contributes to the overall degradation using Invertible Neuronal Networks.

Classification : 35Q79, 62F15, 35B27, 65M60

Format : Talk at Waseda University

Author(s) : Alireza Selahi (Weierstra Institute for Applied Analysis and Stochastics) Manuel Landstorfer (Weierstra Institute for Applied Analysis and Stochastics)

[00691] GROWTH TUMOR, PROLIFERATION AND DIFFUSION IN CELL LINES OF OSTEOSARCOMA

Session Time & Room : 4D (Aug.24, 15:30-17:10) @D401

Type : Contributed Talk

Abstract : Osteosarcoma is a bone cancer. According to medical studies, it has a high genetic complexity, with different mechanisms of appearance and evolution. Our goal is to describe how is the diffusive behavior of cell lines at early times, that is, times close to the instant of inoculation and when the volumes are still small compared to the largest experimental volume reached by the cell lines studied.

Classification : 92-XX, 92Bxx, 92B05, Biomathematics

Format : Online Talk on Zoom

Author(s) : Maria Isabel Romero Rodriguez (Universidad Militar Nueva Granada) Mara Isabel Romero Rodrguez (Universidad Militar Nueva Granada) Eduard Leonardo Sierra Balln (Universidad Militar Nueva Granada) Juan Camilo Vargas Pino (Universidad Militar Nueva Granada)

[00693] Enzyme: Fast and Effective Automatic Differentiation for Academia and Industry

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E605

Type : Industrial Contributed Talk

Abstract : Automatic differentiation (AD) is key to training neural networks, Bayesian inference, and scientific computing. Applying these techniques requires rewriting code in a machine learning framework or manually providing derivatives. We present Enzyme, an AD extension for the industry-standard LLVM/MLIR compiler. Enzyme differentiates programs in any LLVM-based language. Unlike traditional tools, Enzyme performs AD on optimized code, resulting in a 4.2x speedup on the CPU and orders of magnitude speedup on the GPU.

Classification : 65Kxx, 65Yxx, 68Vxx

Format : Talk at Waseda University

Author(s) : William Steven Moses (MIT) Valentin Churavy (MIT) Ludger Paehler (TUM) Oleksandr Zinenko (Google)

[00694] Large deviation theory-based adaptive importance sampling for rare events in high dimensions

Session Time & Room : 5B (Aug.25, 10:40-12:20) @E505

Type : Contributed Talk

Abstract : I will discuss our proposed method for estimating rare event probabilities for expensive-to-evaluate numerical models in high dimensions. The approach combines ideas from large deviation theory and adaptive importance sampling. Large deviation theory is used to find a good initial biasing distribution and to identify a low-dimensional subspace that is most informative of the rare event probability. We compare the method with a state-of-the-art cross-entropy-based importance sampling scheme.

Classification : 65C05, 60F10, 62L12, 65F15, 65K10

Format : Talk at Waseda University

Author(s) : Shanyin Tong (Columbia University) Georg Stadler (New York University)

[00697] Vicsek-Kuramoto system in collective dynamics and their macroscopic equations

Session Time & Room : 3D (Aug.23, 15:30-17:10) @A601

Type : Contributed Talk
Abstract : In this project we investigate a 'Vicsek-style' model, where noisy self-propelled particles align orientation and angular velocity through interaction with their neighbours. This work has been inspired by the model introduced by Chen, C. et al. Nature (2017) to describe the behaviour of dense colony of bacteria, which self-organize into robust collective oscillatory motion. The main focus is to investigate how individual-level behaviours influence the emergence of macroscopic patterns.
Classification : 92B05, 82C31
Format : Talk at Waseda University
Author(s) : Carmela Moschella (University of Vienna)

[00698] Rigidity for Sobolev inequalities and radial PDEs on Cartan-Hadamard manifolds

Session Time & Room : 2E (Aug.22, 17:40-19:20) @G402

Type : Contributed Talk
Abstract : We aim at classifying all the Cartan-Hadamard manifolds supporting an optimal function for the p-Sobolev inequality. We prove that, under the validity of the Cartan-Hadamard conjecture, which is known to be true in dimension $n\le 4$, the only such manifold is $\mathbb{R}^n$, up to isometries. We also investigate radial solutions to the related p-Laplace Lane-Emden equation, obtaining rigidity of finite-energy solutions regardless of optimality. Furthermore, we study the asymptotic behavior of infinite-energy solutions.
Classification : 35B53, 35J92, 58J05, 58J70, 46E35
Format : Talk at Waseda University
Author(s) : Matteo Muratori (Politecnico di Milano) Nicola Soave (Politecnico di Milano)

[00705] A boundary integral method for slow free surface flows

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D101

Type : Contributed Talk

Abstract : In this talk we will present a boundary integral method suitable for the solution of creeping flow boundary value problems where the boundary presents singularities in the stresses. We use the method to solve the problem of the planar extrusion of a Newtonian fluid at zero Reynolds number and, in particular, to determine the shape of the free surface in the immediate neighbourhood of the separation point for a range of capillary numbers.

Classification : 76M15, 76D05, 76D07, Free-surface fluid flows, singularities

Format : Talk at Waseda University

Author(s) : Loc Gobet (University of Montreal) Robert Gwyn Owens (University of Montreal)

[00709] Mathematical modeling reveals P2X1 purinoceptor antagonist as a male contraceptive

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D514

Type : Contributed Talk

Abstract : Condoms and vasectomies are the only male contraceptive options with disruption of foreplay and reversibility issues. The vas deferens smooth muscle (VDSM) contracts for sperm transportation. The pharmacological inhibition of VDSM contraction might explore promising new contraceptives. We established a mathematical model of VDSM cell using ordinary differential equations for an insilico electrophysiological investigation. The findings from our mathematical model reveal that the P2X1-purinoceptors antagonist 2-phenyl-5,6,7,8- tetrahydroquinoxaline might be considered as a new male contraceptive.

Classification : 92-08, 92-10, 92-05

Format : Online Talk on Zoom

Author(s) : CHITARANJAN MAHAPATRA (Paris-Saclay Institute of Neuroscience - CNRS) Ashish Kumar Pradhan (Indian Institute of Sciences Bangalore)

[00713] Mathematical Modeling of Lymphatic Filariasis-Buruli ulcer co-infection

Session Time & Room : 3D (Aug.23, 15:30-17:10) @A601

Type : Industrial Contributed Talk

Abstract : A mathematical model for Lymphatic Filariasis -Buruli ulcer co-infection is explored to provide a theoretical analysis of the disease's dynamics. The disease free equilibrium is proved to be locally asymptotically

stable; the model was found to be showing transcritical and backward bifurcation, time dependent controls are incorporated to obtain necessary conditions for optimal control of the diseases. Numerical simulation results suggest best strategy in controlling the diseases is using all the controls at the same time.

Classification : 92B05, 37G10

Author(s) : Helen Olaronke Edogbanya (Federal University Lokoja, Kogi State) Helen Olaronke Edogbanya (Federal University Lokoja) Zamurat Ayobami Adegboye (Institute of Mathematical and Physcical Sciences, IMSP-UAC, Dangbo)

[00716] Resource Efficient Boolean Function Solver on Quantum Computer

Session Time & Room : 4E (Aug.24, 17:40-19:20) @E711

Type : Contributed Talk

Abstract : Grover's algorithm is the best-known quantum search algorithm for problems when classical ones cannot outperform brute-force search. We propose several novel techniques to improve efficiency in solving boolean equations under Grover's algorithm framework. A W-cycle circuit construction strategy and a greedy compression technique are proposed for the oracle to reduce quantum resource usage. A randomized Grover's algorithm further reduces the circuit depth. Numerical results on boolean quadratic equations demonstrate the advantage of the proposed techniques.

Classification : 68Q12, 81P68

Format : Talk at Waseda University

Author(s) : Xiang Li (Fudan University) Hanxiang Shen (Fudan University) Yingzhou Li (Fudan University) Weiguo Gao (Fudan University)

[00722] Scalar auxiliary variable schemes for Cahn-Hilliard systems with mass source

Session Time & Room : 5C (Aug.25, 13:20-15:00) @G502

Type : Contributed Talk

Abstract : The scalar auxiliary variable approach presents a novel way to discretize a large class of dissipative systems. We consider a general Cahn-Hilliard system with mass source that may not admit a known dissipative structure, and so the stability of discrete solutions is not immediate. With a bounded mass source, we show stability and convergence of time discrete solutions for a rst-order scheme, and apply our ideas to systems in tumour growth, image inpainting and segmentation.

Classification : 35K35, 35K55, 65M12, 65Z05
Format : Talk at Waseda University
Author(s) : Andrew Lam (Hong Kong Baptist University) Ru Wang (Hong Kong Baptist University)

[00723] Density Maximum Effect on Natural Convection in a Porous Enclosure

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D403

Type : Contributed Talk
Abstract : The maximum density effect on natural convection in an enclosure filled with porous medium is numerically examined. One of the vertical walls is either fully or partially heated and various thermal boundary walls are considered for the cooling location. The nonlinear partial differential equations are solved by finite volume method together with power-law-scheme using SIMPLE algorithm. The qualitative results are expressed in the graphical form. The motivation for the study is the cooling of equipment.
Classification : 80-XX, 80Axx, 80Mxx, 65Yxx, 76R10, 80 Classical thermodynamics, heat transfer
Format : Talk at Waseda University
Author(s) : NITHYADEVI NAGARAJAN (Bharathiar University)

[00724] Applicability to information engineering using the Satos hyperfunction

Session Time & Room : 3C (Aug.23, 13:20-15:00) @F311

Type : Contributed Talk
Abstract : Wavelet transform and discrete image processing are one of the important subjects in the field of information engineering. However, although the use of the generalised function in Fourier transform is possible, it is difficult to apply to wavelet transform by using the generalised function. On the other hand, the delta function is mainly used in discrete image analysis.
In this study, we have considered their applicability using the Satos hyperfunction.

Classification : 46F15, 32A45, 65T60, 65D18, 46T30
Format : Talk at Waseda University
Author(s) : HIROSHI MURAYAMA HIROSHI MURAYAMA (Graduate School of Science and Engineering, SOKA University) Yoshio ISHII (Faculty

of Science and Engineering, SOKA University)

[00725] Role of CXCL12 in regulation of T cell invasion

Session Time & Room : 3D (Aug.23, 15:30-17:10) @A601

Type : Contributed Talk

Abstract : In this study, we investigate the mutual interactions between the CD8+ T cells and the CXCL12 that prevent T cell invasion by developing mathematical models that involve taxis-reaction-diffusion. We apply the mathematical model to a Boyden invasion assay used in the experiments to demonstrate that the over-expressed CXCL12 can prevent T cell infiltration into tumor. Moreover, we consider tumor-immune dynamics by a hybrid approach and investigate the fundamental mechanism of cytokine shield.

Classification : 92B05, 92C17, 92C45, 92C50

Format : Talk at Waseda University

Author(s) : Junho Lee (Konkuk University) Yangjin Kim (Konkuk University) Chaeyoung Lee (Korea University)

[00728] Descriptions of distribution function and hyperfunction using discretization

Session Time & Room : 1E (Aug.21, 17:40-19:20) @G401

Type : Contributed Talk

Abstract : Nonlinear systems with singular solutions, such as vortices and vortex sequences, can be mathematically described using the distribution function (function). However, it is difficult to numerically analyze the singular solution.

In this study, we have considered approaches to discretize the distribution function and discussed the usefulness of introducing it into numerical analysis. Furthermore, we have carried out some examples of applications to discrete distribution functions and Satos hyperfunction.

Classification : 32A45, 46F15, 46F30, 46T30, 65E05

Format : Talk at Waseda University

Author(s) : Yuya Taki (Graduate School of Science and Engineering, SOKA University) Yoshio Ishii (Faculty of Science and Engineering, SOKA University)

[00729] q-LAPLACE TRANSFORMS FOR THE PRODUCT OF BASIC ANALOGUE FOR H-FUNCTIONS FOR TWO VARIABLES AND THE GENERAL CLASS OF q-POLYNOMIALS

Session Time & Room : 3C (Aug.23, 13:20-15:00) @G402

Type : Contributed Talk
Abstract : The q-Laplace transforms for the product of basic analogue of H-function of two variables and the general class of q-polynomials has been evaluated in the present paper. Few cases of the main outcomes including the applications involving the basic analogues of Foxs H-functions as well as general class of q-polynomial are also evaluated.
Classification : 33D60, 44A10, 44A20
Format : Talk at Waseda University
Author(s) : Vijay Kumar Vyas (Sur University College,Oman) Ali A. AL-JARRAH (Sur University College,Oman)

[00738] Proper Orthogonal Decomposition methods for the Navier Stokes equations

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E508

Type : Contributed Talk
Abstract : In this talk we study numerical approximations to the incompressible Navier-Stokes equations by
means of proper orthogonal decomposition (POD) methods. Several questions are considered:
the influence of including snapshots that approach the velocity time derivative and the influence
of considering different discretizations for the nonlinear term in the full order model and the reduced order model. Error bounds with constants independent of the Reynolds numbers are obtained in the numerical analysis.
Classification : 65M12, 65M15, 65M60
Format : Talk at Waseda University
Author(s) : Julia Novo (Universidad Autnoma de Madrid)

[00741] POINTWISE ADAPTIVE QUADRATIC DG FEM FOR OBSTACLE PROBLEM

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E711

Type : Contributed Talk

Abstract : The obstacle problem, often considered as a prototype for a class of free boundary problems. The elliptic obstacle problem is a nonlinear model that describes the vertical movement of a object restricted to lie above a barrier (obstacle) while subjected to a vertical force. In this talk, we perform a posteriori error analysis in the supremum norm for the quadratic Discontinuous Galerkin(DG) method for the elliptic obstacle problem. Compare with the energy norm estimates, supremum norm estimates gives the pointwise control on the error. We have carried out the analysis on two different discrete sets, one set having integral constraints and other one with the nodal constraints at the quadrature points, and discuss the pointwise reliability and efficiency of the proposed a posteriori error estimator. In the analysis, we employ a linear averaging function to transfer DG finite element space to standard conforming finite element space and exploit the sharp bounds on the Green's function of the Poisson's problem. Moreover, the upper and the lower barrier functions corresponding to continuous solution u are constructed by modifying the conforming part of the discrete solution u_h appropriately. Finally, the numerical results for adaptive FEM are presented in order to exhibit the reliability and the efficiency of the proposed error estimator.

Classification : 65N30, 65N15

Format : Talk at Waseda University

Author(s) : Ritesh Ritesh (Indian Institute of Technology, Delhi) Rohit Khandelwal (Indian Institute of Technology, Delhi) Kamana Porwal (Indian Institute of Technology, Delhi)

[00743] Recent Advances on POD methods for the Navier-Stokes equations.

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E508

Type : Contributed Talk

Abstract : We present some recent advances on proper orthogonal decomposition (POD) methods for the Navier-Stokes equations. Among them, recovering the pressure in a robust manner when the snapshots are discretely divergence-free. We analyze the different sources of error and how they affect the pressure recovery. We also study how to adapt the POD

method for varying values of the Reynolds number.
Classification : 65M12, 65M15, 65M60
Format : Talk at Waseda University
Author(s) : Bosco Garca-Archilla (Universidad de Sevilla)

[00744] On the Burgers-type equations used in soft solid acoustics

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E804

Type : Contributed Talk
Abstract : A strain-rate model of soft viscoelastic solid is presented. The constitutive law accounts for finite strain, incompressibility, material frame-indifference, nonlinear elasticity, and viscous dissipation. Shear waves are governed by a nonlinear viscous wave equation, of which a one-way Burgers-type approximate equation is derived. Analysis of the travelling wave solutions shows that the two equations produce distinct solutions, unless amplitudes are infinitesimal. In the inviscid case, links with simple wave theory are established.
Classification : 74D10, 74J30, 74H10
Format : Talk at Waseda University
Author(s) : Harold Berjamin (School of Mathematical and Statistical Sciences, University of Galway, University Road, Galway, Republic of Ireland)

[00745] Fluid flow and nutrient transport in hollow fibre membrane bioreactors

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A511

Type : Contributed Talk
Abstract : We present an axisymmetric model of fluid flow through a hollow fibre membrane bioreactor for applications in tissue engineering. We derive a reduced model by exploiting the small aspect ratio of bioreactor radius to length. Coupled to a system of reduced-order advection-reaction-diffusion equations for nutrient transport, we reveal how nutrient delivery to cells depends on membrane permeability. We then determine how spatial variations in scaffold permeability can be established to tune nutrient delivery to cells.
Classification : 92-10, 92C35, 76Z05, 92C50, 76D08, Tissue Engineering
Format : Online Talk on Zoom
Author(s) : George Booth (University of Oxford) Mohit Dalwadi (University College London) Cathy Ye (University of Oxford) Pierre-Alexis Mouthuy (University of Oxford) Sarah Waters (University of Oxford)

[00748] New probabilistic algorithms for scientific supercomputing

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E705

Type : Contributed Talk

Abstract : Sustained strong scalability is hard to sustain beyond 10K processors due to the communication and synchronisation involved in domain decomposition for PDEs. Seeking to overcome them, Spigler and Acebrn introduced probabilistic domain decomposition, which inserts stochastic calculus in the formulation---however with slow error convergence. I will present a hybrid idea, SpAc, which retains most of the scope for embarrassing parallelism, while being orders of magnitude faster. Proof of concept supercomputing simulations will be discussed.

Classification : 65Nxx

Format : Talk at Waseda University

Author(s) : Francisco Bernal (Carlos III University of Madrid)

[00750] Bayesian inverse problems for some hyperbolic conservation laws

Session Time & Room : 4D (Aug.24, 15:30-17:10) @G602

Type : Contributed Talk

Abstract : We study some inverse problems for hyperbolic conservation laws. Given observations of the entropy solution, we consider the problem of identifying the initial field or the flux function. Due to shockwaves, direct observations of the entropy solution are not "regulated" enough to fit in the Bayesian framework in Stuart (2010). To get round this, we propose a new approach by studying the trajectories for hyperbolic conservation laws and exploring their existence, uniqueness and stability.

Classification : 35L65, 35R30, 62F15, Partial Differential Equations, Inverse Problems

Format : Talk at Waseda University

Author(s) : Duc-Lam Duong (LUT University) Duc-Lam Duong (LUT University) Masoumeh Dashti (University of Sussex)

[00751] Crack Loading and Growth Analyses with the Virtual Element Method

Session Time & Room : 5C (Aug.25, 13:20-15:00) @E812

Type : Contributed Talk
Abstract : The virtual element method is a modern discretization scheme for solving boundary value problems on polytopal meshes, sparing the explicit knowledge of element shape functions. In the context of numerical fracture mechanics, crack tip loading analyses and in particular crack growth simulations benefit from its ability of handling arbitrary complex meshes straightforwardly. This work aims to discuss challenges and opportunities of implementing concepts of fracture mechanics in the context of the virtual element method.
Classification : 74R10, 74S05, 74A45, Numerical Fracture Mechanics
Format : Talk at Waseda University
Author(s) : Kevin Schmitz (University of Kassel) Andreas Ricoeur (University of Kassel)

[00755] A variational approach for nonlinear elasticity

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E820

Type : Contributed Talk
Abstract : This research concerns the Weighted Energy-Dissipation approach for nonlinear elasticity. We introduce a family of $\epsilon-$dependent functionals defined over entire trajectories and we prove that they admit minimisers which are solutions of the corresponding Euler-Lagrange problem. Considering the limit $\epsilon \rightarrow 0$ we prove that those minimisers converge to the solutions of a specific nonlinear elasticity equation. Eventually, linearized elastic energies are proven to be the Γ-limits of the rescaled nonlinear energies.
Classification : 74B20, 47J30, 47J35, 58E30, 74B15
Format : Online Talk on Zoom
Author(s) : Riccardo Voso (University of Vienna)

[00756] Using photogrammetry for the objective morphological study of early violins

Session Time & Room : 4C (Aug.24, 13:20-15:00) @G301

Type : Contributed Talk

Abstract : Some early violins were reduced during their history to fit imposed morphological standards. We propose an objective photogrammetric approach to differentiate between a reduced and an unreduced instrument by examining 3D meshes, previously validated with a sub-millimetre accuracy through a comparison with CT scans. We show how quantitative and qualitative features can be automatically extracted from the meshes with geometrical, statistical and machine learning tools, allowing to successfully highlight differences between reduced and unreduced instruments.

Classification : 00A65, 51-XX, 68UXX, Photogrammetry, Violin reduction, Geometric analysis, CT scans, Error assessment, Point cloud registration

Format : Talk at Waseda University

Author(s) : Philmon Beghin (UCLouvain) Franois Glineur (UCLouvain) Anne-Emmanuelle Ceulemans (UCLouvain)

[00757] Effect of electrostatic forces and moments on cracked electrostrictive dielectrics

Session Time & Room : 1E (Aug.21, 17:40-19:20) @G304

Type : Contributed Talk

Abstract : Going beyond the scope of solely mechanical considerations, fracture mechanics of smart dielectrics is additionally concerned with the implications of electric fields on crack tip loading. In this work, the oftentimes neglected electric body and surface forces as well as body couples stemming from the Maxwell stress tensor are studied in the context of a crack in an infinite electrostrictive dielectric by exploiting holomorphic potentials and Cauchy's integral formulae within the framework of complex analysis.

Classification : 30E20, 30E25, 74A35, 74R10, 78A30

Format : Talk at Waseda University

Author(s) : Lennart Behlen (University of Kassel) Daniel Wallenta (University of Kassel) Andreas Ricoeur (University of Kassel)

[00762] On the dissolution of particles subject to natural convection

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D502

Type : Contributed Talk

Abstract : The dissolution of a solid spherical particle is a canonical problem that finds many areas of application, including the pharmaceutical industry. In this work, we provide a generalized theory that tackles the role of natural convection in the surrounding dissolving medium. We investigate its effects on hydrodynamics and how it interacts with the diffusion during dissolution to deform the particle geometry whilst altering the release profile of pharmaceutical ingredients, a key aspect in drug delivery.

Classification : 76-10, 76R10, 76R50

Format : Talk at Waseda University

Author(s) : Milton Assuno (University of Limerick) Michael Vynnycky (University of Limerick) Kevin Moroney (University of Limerick)

[00765] V-KEMS: Tackling industrial and COVID problems via virtual study groups

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D501

Type : Industrial Contributed Talk

Abstract : During the pandemic a group of UK mathematicians formed the Virtual Forum for Knowledge Exchange in the Mathematical Sciences (V-KEMS). This ran many online virtual study groups (VSGs), using mathematics to tackle urgent societal challenges. These varied from keeping shops, workplaces, and universities safe, to advising the transport, healthcare, and leisure industries. VSGs were so effective that they informed government policy. My talk will describe how VSGs work, and plans for their future development.

Classification : 90-10, 35Mxx, 34Fxx

Format : Talk at Waseda University

Author(s) : Chris Budd (University of Bath)

[00767] Fractal and Fractional

Session Time & Room : 2E (Aug.22, 17:40-19:20) @G305

Type : Contributed Talk

Abstract : Several physical and natural phenomena are characterized on one hand by the presence of different temporal and spatial scales, on the other by the presence of contacts among different components through rough interfaces like domains with non-smooth boundaries and fractal layers.

The principal aim of the talk is to propose mathematical models to investigate these phenomena as well as their numerical approximation.

Our attention will be focused on fractional Cauchy problems on the random Koch domains with different boundary conditions.

Random Koch domains are domains whose boundary are constructed by mixtures of Koch curves with random scales. These domains are obtained as limit of domains with Lipschitz boundary whereas for the limit object, the fractal given by the random Koch domain, the boundary has Hausdorff dimension between 1 and 2. We point out that Random Koch domains provide a suitable setting to model phenomena - taking place across irregular and wild structures in which boundaries are "large" while bulk is "small"- in which the surface effects are enhanced like, for example, pulmonary system, root infiltration, tree foliage, etc..

Classification : 28A80, 35R11, 26A33, 35J25, 65K15

Format : Talk at Waseda University

Author(s) : Raffaela Capitanelli (Sapienza University of Roma)

[00770] Rellich eigendecomposition of paraHermitian matrices, with applications

Session Time & Room : 1E (Aug.21, 17:40-19:20) @G304

Type : Contributed Talk

Abstract : Let $H(z)$ be paraHermitian, that is, analytic and Hermitian on the unit circle S^1. We prove that $H(z)=U(z)D(z)U(z)^P$ where, for all $z \in S^1$, $U(z)$ is unitary, $U(z)^P=U(z)^*$, and $D(z)$ is real diagonal; moreover, $U(z), D(z)$ are analytic in $w=z^{1/N}$ for some positive integer N, and $U(z)^P$ is the paraHermitian conjugate of $U(z)$. We discuss the implications on the svd of an S^1-analytic matrix and the sign characteristics of unimodular eigenvalues of $*$-palindromic matrix polynomials.

Classification : 15A23, 15A18, 15A54, 15B57

Format : Talk at Waseda University

Author(s) : Vanni Noferini (Aalto University) Giovanni Barbarino (Aalto University)

[00771] New class of Nested Hierarchical matrices and its applications

Session Time & Room : 5B (Aug.25, 10:40-12:20) @E603

Type : Contributed Talk

Abstract : I'll discuss a new class of nested Hierarchical matrices in 2D (HODLR2D^2). This is based on weak admissibility criteria and the compressions are done using NCA. Using this Hierarchical framework, one can perform matrix-vector product that scales almost linearly; hence, large dense linear systems arising out of N body problems can be solved using iterative solvers with almost linear complexity. Also, I'll discuss its performance over other Hierarchical matrices and applications in solving integral equation and radial basis interpolation.

Classification : 65F55, 65R20, 65R10, Numerical Linear Algebra

Format : Talk at Waseda University

Author(s) : Ritesh Khan (Indian Institute of Technology Madras) Sivaram Ambikasaran (Indian Institute of Technology Madras)

[00773] Machine Learning Model for Thin Metal Sheet Counting and Thickness Measurement

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E811

Type : Contributed Talk

Abstract : In this talk we are to discuss about counting stacked metal foils in real time. For the purpose a non-contact method based on broadband X-ray absorption spectra was employed to scan the experimental samples and artificial neural network was built to count and measure thickness of the stacked foil. Further, the attained results are compared with polynomial fitting model and linear regression in order to verify the difference in prediction accuracy of the three models.

Classification : 68T07, 78M32, 82C32, 62J05, 65D10

Format : Talk at Waseda University

Author(s) : Elayaperumal Ayyasamy (Anna University, Chennai)

[00776] Towards a modeling class for port-Hamiltonian systems with time-delay

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G401

Type : Contributed Talk

Abstract : The framework of port-Hamiltonian (pH) systems is a broadly applicable modeling paradigm. In this talk, we extend the scope of pH systems to time-delay systems. Our definition of a delay pH system is motivated by investigating the Kalman-Yakubovich-Popov inequality on the corresponding infinite-dimensional operator equation. Moreover, we show that delay pH systems are passive and closed under interconnection. We describe an explicit way to construct a Lyapunov-Krasovskii functional and discuss implications for delayed feedback.

Classification : 34K06, 37J06, 93C05, 34A09

Format : Talk at Waseda University

Author(s) : Dorothea Hinsen (TU Berlin) Tobias Breiten (TU Berlin) Benjamin Unger (University of Stuttgart)

[00780] Mathematical Modelling of Bidirectional Transport System

Session Time & Room : 1E (Aug.21, 17:40-19:20) @D405

Type : Contributed Talk

Abstract : One of the major issues in real life is evolving vehicular traffic. Recently the totally asymmetric simple exclusion process (TASEP) has been utilized to investigate transport systems. We present a novel generalized two-lane TASEP model with bidirectional movement under a new kind of symmetric coupling between lanes to gain insight into the evolutionary traffic dynamics. We employ the mean-field theory to solve the system theoretically and validate theoretical outcomes through extensively performed Monte Carlo Simulations.

Classification : 82DXX, 82-10, 82M20, 82M60, 82M31, Non-equilibrium Statistical Mechanics, Mathematical Modelling and Simulation, Partial Differential Equations, Stochastic Processes

Format : Talk at Waseda University

Author(s) : Atul Kumar Verma (NIT Trichy, India)

[00784] A Lagrangian-finite difference scheme for solving viscoelastic fluid flows

Session Time & Room : 4E (Aug.24, 17:40-19:20) @D401

Type : Contributed Talk

Abstract : In this work, we will present a new numerical scheme that combines the Generalized Lie Derivative in a Lagrangian framework with the finite difference method. The viscoelastic models with the upper-convected

time derivative term are rewritten in order to improve the stability of the method. Moreover, the proposed scheme can also be applied to study the High Weissenberg Number Problems.

Classification : 76M20, 76A10, 65M50

Format : Talk at Waseda University

Author(s) : jose Alberto Cuminato (University of So Paulo) Cassio Machiavelli Oishi (So Paulo State University) Debora de Oliveira Medeiros (University of So Paulo)

[00788] Using multi-objective evolutionary algorithms when performing preventive maintenance actions

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E820

Type : Industrial Contributed Talk

Abstract : Maintenance has always been a key activity in the manufacturing industry, because of its
economic consequences. Nowadays, its importance is increasing thanks to the `Industry 4.0'' or the`fourth industrial revolution", which promotes automation through computer systems in manufacturing and aims to achieve intelligent or smart factory. There are more and more complex systems to maintain, and to keep all these devices in proper conditions maintenance management must gain efficiency and effectiveness. Within maintenance, Condition-Based Maintenance (CBM) programs can provide significant advantages, but it can be said that often these programs are complex to manage and understand, so several researches propose as simple as possible approaches that can be understood by users and modified by experts. With these context conditions, this paper focuses on CBM optimization in an industrial environment, with the objective of determining the optimal values of preventive intervention limits for equipment under corrective and preventive maintenance cost criteria. It develops a cost-benefit mathematical model that considers the evolution in quality and production speed, along with condition based, corrective and preventive maintenance. The cost-benefit optimization is performed using a Multi-Objective Evolutionary Algorithm. Both the model and the optimization approach are applied to an industrial case.

Classification : 68W50, 68T20, 90C59

Format : Talk at Waseda University

Author(s) : Eilsabete Alberdi (University of the Basque Country UPV/EHU) Aitor Goti (University of Deusto) Aitor Oyarbide-Zubillaga (University of

Deusto) Pablo Garcia-Bringas (University of Deusto) Ana Snchez (Polytechnic University of Valencia)

[00790] Machine learning methods with error analysis for optimal control problems

Session Time & Room : 5D (Aug.25, 15:30-17:10) @F312

Type : Contributed Talk
Abstract : We consider optimal control with partial differential equations (()PDE()) and present a numerical method based on machine learning including control error analysis. Physics-Informed Neural Networks (()PINN()) are used with the cost and penalty terms for the PDE as loss function. The model size is iteratively increased until the a posteriori estimated control error satisfies a given accuracy. The method is illustrated with numerical examples for 1D heat transfer and 3D turbine activation.
Classification : 49M41, 49M25, 68T05, 65G20
Format : Talk at Waseda University
Author(s) : Georg Vossen (Kreleld University of Applied Sciences) Semih Sirin (Kreleld University of Applied Sciences) Nicolai Friedlich (Kreleld University of Applied Sciences)

[00791] FunFact: Tensor Decomposition, Your Way

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G305

Type : Contributed Talk
Abstract : FunFact simplifies the design of matrix and tensor factorization algorithms. It features a powerful programming interface that augments the NumPy API with Einstein notations for writing concise tensor expressions. Given an arbitrary forward calculation scheme, the package will solve the inverse problem using stochastic gradient descent, automatic differentiation, and multi-replica vectorization. It is GPU- and parallelization-ready thanks to modern numerical linear algebra backends such as JAX/TensorFlow and PyTorch. We demonstrate a variety of use cases.
Classification : 15-04, 65F55
Format : Talk at Waseda University
Author(s) : Daan Camps (Lawrence Berkeley National Laboratory) Yu-Hang Tang (NVIDIA)

[00798] Accelerating Low-Order Matrix-Free Finite Element Methods for Geophysics on GPU Architectures

Session Time & Room : 5B (Aug.25, 10:40-12:20) @E703

Type : Contributed Talk
Abstract : Low-order matrix-free FEMs offer an alternative approach that avoids the need to construct a global stiffness matrix. In this study, we compare the performance of low-order matrix-free FEMs with a sparse-matrix approach on GPU architectures for geophysics applications. Our results show that low-order matrix-free FEMs can significantly accelerate the solution of large linear systems on GPU architectures.
Classification : 65M60, 86-08, 65F50
Format : Talk at Waseda University
Author(s) : Yohann Dudouit (Lawrence Livermore National Lab) Randy Settgast (Lawrence Livermore National Lab) Nicola Castelletto (Lawrence Livermore National Lab)

[00803] Epilepsy MEG network TERGM analysis

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G701

Type : Contributed Talk
Abstract : The brain has a complex structure where different neurons are connected. To study brain activity and disorders, it is important to analyze the functional connectivity of the brain through network analysis. Because of high temporal and spatial resolution, MEG$\text{(magnetoencephalography)}$ can provide useful information for brain network analysis. We analyzed functional connectivity using static/temporal network statistics, MCCA$\text{(multiset canonical correlation analysis)}$, and TERGM$\text{(temporal exponential random graph model)}$ with epilepsy MEG data.
Classification : 62H22, 62P10
Format : Talk at Waseda University
Author(s) : Haeji Lee (Duksung women's university) Jaehee Kim (Duksung women's university)

[00805] A Topological Model of Textile Structures

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E504

Type : Contributed Talk
Abstract : Textiles are complex entangled structures made of threads embedded in a thickened plane. From nano to macro scale and high functionality to pure esthetic, they have been studied and fabricated for thousands of years in disciplines as diverse as materials science and art. Currently an active research topic in mathematics, we will present a topological model that aims to define, construct and classify specific textile structures from a knot theory viewpoint and highlight some applications.
Classification : 57K10, 57K12
Format : Talk at Waseda University
Author(s) : Sonia Mahmoudi (Drexel University)

[00809] Mathematical Aspects of Metaheuristics in Medical Imaging and Pattern Recognition

Session Time & Room : 2D (Aug.22, 15:30-17:10) @A201

Type : Contributed Talk
Abstract : Medical imaging and pattern recognition have very important applications in the health and other industrial sectors. In this talk, we will be focusing on the mathematical model that deals with high-order graph matching using a metaheuristic technique. This model has been tested real-life images including identifying white blood cells in human blood. The models work on the idea of artificial intelligence and have a high level of efficiency with good results. The role of AI is in terms of AI-based metaheuristics which are used as search and optimization techniques to address aforementioned problems.
Classification : 68W50, 68U10, 68T42, 68T10, 68T05, Evolutionary Algorithms, Agent Based Systems, Graph Matching
Format : Talk at Waseda University
Author(s) : Anupam Yadav (Dr BR Ambedkar National Institute of Technology Jalandhar)

[00816] Ultraspherical spectral methods for time-dependent problems

Session Time & Room : 1E (Aug.21, 17:40-19:20) @E704

Type : Contributed Talk

Abstract : Spectral methods solve elliptic partial differential equations (PDEs) numerically. Their main advantage is spectral convergence, i.e., error decays exponentially when the solution is analytic. We present numerical schemes for solving some time-dependent linear PDEs utilizing the ultraspherical spectral method in space and time, thus portraying overall spectral convergence. Moreover, they lead to sparse and well-conditioned linear systems. We compare their performance with existing spectral schemes and explore their parallelization in time.

Classification : 65M70, 65L05, 35K20, 35L20, 41A10

Format : Talk at Waseda University

Author(s) : Avleen Kaur (University of Saskatchewan) S, H. Lui (University of Manitoba)

[00817] Understanding Flood Flow Physics via Data-Informed Learning

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E811

Type : Contributed Talk

Abstract : Modeling the dynamics of fast-moving floods has historically been an intractable problem due to the inherent complexity and multi-scale physics of the underlying processes involved. Recent advancements in physics-constrained machine learning indicate that neural networks can be used to effectively model phenomena for which physical laws are poorly understood. By combining real data and first principles, we show that we can enhance knowledge about the underlying physics of flood phenomena via the learned constitutive laws.

Classification : 68T07, 76T99, 86-10

Format : Talk at Waseda University

Author(s) : Jonathan Thompson (University of Colorado Colorado Springs) Radu Cascaval (University of Colorado Colorado Springs)

[00818] BENCHMARKED ASSET MANAGEMENT WITH FIXED INCOME SECURITIES

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A510

Type : Contributed Talk

Abstract : We discuss a continuous-time portfolio optimization problem to beat a stochastic benchmark. In addition to plain equities, the proposed model is suitable to
include fixed-income securities. In the proposed economy, the
dynamics of assets and economic factors are described by non-linear stochastic differential equations, which
make the model vast to account for various interest rate models. We prove the existence and uniqueness of
optimal investment strategies for finite and infinite planning horizons.

Classification : 91G10, 91G30, 91G15, 60G65, 35Q93

Format : Talk at Waseda University

Author(s) : Mayank Goel (Birla Institute of Technology and Science Pilani) Ravi Shankar (Birla Institute of Technology and Science Pilani)

[00820] Chemotaxis system with signal-dependent motility and the singular limit problem

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G502

Type : Contributed Talk

Abstract : We study the reaction-diffusion model that consists of equations that govern the evolution of bio-cells in a chemotactic environment. In our modeling framework, we assume that if the chemical concentration is low, then the cells move actively, whereas if the chemical concentration is high, they become less active. As we take a limit of conversion process, we formally obtain the singular limit problem of Fokker-Planck type diffusion. The aim of this study is to prove the global well-posedness of the singular limit problem and its convergence rigorously.

Classification : 35K51, 35K57, 92C17

Format : Talk at Waseda University

Author(s) : Changwook Yoon (Chungnam National University) Yong-Jung Kim (KAIST)

[00821] ADAPTIVE QUADRATIC DISCONTINUOUS GALERKIN FINITE ELEMENT METHOD FOR THE UNILATERAL CONTACT PROBLEM

Session Time & Room : 4C (Aug.24, 13:20-15:00) @E711

Type : Contributed Talk

Abstract : The proposed title of my talk will be ADAPTIVE QUADRATIC DISCONTINUOUS GALERKIN FINITE ELEMENT METHOD FOR THE UNILATERAL CONTACT PROBLEM . In the talk, I will be discussing about employing discontinuous Galerkin methods (DG) for the finite element approximation of frictionless unilateral contact problem using quadratic finite elements over simplicial triangulation. We shall analyze a posteriori error estimates in the DG norm wherein, the reliability and efficiency of the proposed a posteriori error estimators will be addressed. Further we will show that numerical results substantiate the theoretical findings,

Classification : 65N30, 65N15

Format : Talk at Waseda University

Author(s) : Tanvi Tanvi (Research Scholar) Kamana Porwal (IIT DELHI)

[00823] Weighted Trace-Penalty Minimization for Full Configuration Interaction

Session Time & Room : 4D (Aug.24, 15:30-17:10) @E508

Type : Contributed Talk

Abstract : A novel unconstrained optimization model named weighted trace-penalty minimization (WTPM) is proposed to address the extreme eigenvalue problem arising from the Full Configuration Interaction (FCI) method. The coordinate descent method is adapted to WTPM and results in WTPM-CD method. With the sparse features of both FCI matrices and the global minimizers in mind, the reduction of computational and storage costs shows the efficiency of the algorithm.

Classification : 65F15, Electron Structure Calculation

Format : Talk at Waseda University

Author(s) : Weiguo Gao (Fudan University) Yingzhou Li (Fudan University) Hanxiang Shen (Fudan University)

[00824] Asymptotics for Some Singular Limits

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G501

Type : Contributed Talk
Abstract : The asymptotic behavior of solutions as a small parameter tends to zero is determined for a variety of singular-limit PDEs. In some cases even existence for a time independent of the small parameter was not known previously. New examples for which uniform existence does not hold are also presented.

Some of the results are joint work with Samuel Nordmann.
Classification : 35B25, 35B40
Format : Online Talk on Zoom
Author(s) : Steve Schochet (Tel Aviv University)

[00826] Saffman-Taylor fingers selection mechanism in non-newtonian fluids

Session Time & Room : 5C (Aug.25, 13:20-15:00) @D101

Type : Contributed Talk
Abstract : We present an analytical approach, based on the Wentzel-Kramers-Brillouin technique, to predict the finger width of a simple fluid driving a non-Newtonian, power-law fluid. We find that in the limit of small surface tension, (\nu), the relation between the dimensionless (\nu), viscosity and finger width, (\Lambda), has the form: (\Lambda \sim \frac{1}{2} - \mathrm{O}(\nu ^ {-1/2})) for shear thinning case, and (\Lambda \sim \frac{1}{2} + \mathrm{O}(\nu^{2/(4-n)})) for shear thickening case. A detailed comparison is provided.
Classification : 76E17
Format : Talk at Waseda University
Author(s) : Diksha Bansal (IIIT Delhi)

[00828] Role of NK cells in regulation of lung cancer progression

Session Time & Room : 3E (Aug.23, 17:40-19:20) @A601

Type : Contributed Talk

Abstract : Tumor-associated neutrophils (TANs) and STAT signaling can stimulate or inhibit tumor growth. We developed and analyzed a mathematical model to address the issues of phenotypic transition and nonlinear regulation of NK cells, thus tumor dynamics, in response to various biochemical stimuli. Several optimal tumor prevention strategies including NK cells and Ionizing radiation have been developed to slow tumor growth. Therefore, We suggested how the optimal combination of anticancer treatments.

Classification : 92B05, 92-04, 92-10, Mathematical Biology

Format : Talk at Waseda University

Author(s) : Donggu Lee (Konkuk University)

[00832] Monte Carlo estimation of equity measures for apportionment problem

Session Time & Room : 5B (Aug.25, 10:40-12:20) @E505

Type : Contributed Talk

Abstract : A Markov chain Monte Carlo method is devised for the computation of several equity measures for the apportionment problem of assembly seats to electoral districts. Seat bias and Gini mean difference is of our primary interest in computing. Generating a random walk in the high-dimensional simplex is the key to our algorithm. It is helpful to estimate the mean and several quantiles of the target statistics.

Classification : 65C05, 91G60, 60J22

Format : Talk at Waseda University

Author(s) : Hozumi Morohosi (National Graduate Institute for Policy Studies)

[00833] Exact controllability for imperfect interface problems

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G601

Type : Contributed Talk

Abstract : We study the exact internal and boundary controllability for a second order linear evolution problem defined in a two-component domain. We prescribe a homogeneous Dirichlet condition on the exterior boundary and a jump of the displacement proportional to the conormal derivatives on the interface. This last condition is the mathematical interpretation of an imperfect interface. The results are achieved via a constructive method known as Hilbert Uniqueness Method, HUM for short, introduced by J. -L.

Lions. Unlike classical cases, we find lower bounds for the control times depending not only on the geometry of the domain and on the coefficient matrix of our problems but also on the coefficient of proportionality of the jump with respect to the conormal derivatives.

References
[1] S. Monsurro, A. K. Nandakumaran, C. Perugia, Exact Internal Con- trollability for a Problem with Imperfect Interface, Appl. Math. Op- tim. (2022), 1-33.
[2] S. Monsurro, A. K. Nandakumaran, C. Perugia, A Note on the Exact Boundary Controllability for an Imperfect Transmission Problem, Ric. Mat. 40 (2021), 1-18.

Classification : 35LXX, 35QXX
Format : Talk at Waseda University
Author(s) : Sara Monsurr (University of Salerno)

[00834] Analytical Solution for Linearized Diffusive Wave with Concentrated Lateral Inflow

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G802

Type : Contributed Talk
Abstract : We present a solution for flow depth and discharge at different locations of a finite prismatic channel for linearized diffusive wave approximation with concentrated lateral inflow subjected to water discharge as the upstream boundary and flow depth as the downstream boundary. Laplace transform is used to find the analytical solution. We present some results to show the effect of Peclet number and the point of confluence on discharge and flow depth.
Classification : 44A10, 35Q35, 86A05, Hydraulics, River Mechanics
Format : Online Talk on Zoom
Author(s) : Shiva Kandpal (Indian Institute of Technology Guwahati) Swaroop Nandan Bora (Indian Institute of Technology Guwahati)

[00835] A shifted LOPBiCG method for solving nonsymmetric shifted linear systems

Session Time & Room : 5B (Aug.25, 10:40-12:20) @E603

Type : Contributed Talk

Abstract : Premature convergence of the seed system can lead to shifted systems being unsolved when applying shifted Krylov subspace methods to solve shifted linear systems. To avoid this, a seed-switching technique may be a method of choice; however, the conventional product-type methods cannot use this technique since it requires the collinear residuals between the seed and shifted systems. We propose a variant of the shifted BiCGStab method so that the technique can be applied.

Classification : 65Fxx

Format : Talk at Waseda University

Author(s) : Ren-Jie Zhao (Nagoya University) Tomohiro Sogabe (Nagoya University) Tomoya Kemmochi (Nagoya University) Shao-Liang Zhang (Nagoya University)

[00836] Reynolds-blended weights for BDDC in applications to Navier-Stokes equations

Session Time & Room : 4D (Aug.24, 15:30-17:10) @E504

Type : Contributed Talk

Abstract : We solve incompressible Navier-Stokes equations by the finite element method with one step of the Balancing Domain Decomposition by Constraints (BDDC) method. This method requires a scaling operator at the interface between subdomains. We introduce a new interface scaling tailored to Navier-Stokes equations. The weights in this averaging consider a local Reynolds number. This Reynolds-blended scaling is compared with several existing approaches on 3D lid-driven cavity and backward-facing step problems.

Classification : 65Y05

Format : Talk at Waseda University

Author(s) : Martin Hanek (Czech Technical University in Prague, Institute of Mathematics of the Czech Academy of Sciences)

[00842] Iterative projection methods for solving cone-constrained eigenvalue complementarity problems

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E605

Type : Contributed Talk

Abstract : Cone-constrained eigenvalue complementarity problems are associated with unstable modes and vibrations of dynamic systems in engineering. In this talk, iterative projection methods are proposed to quickly search the corresponding K-eigenvalues and K-eigenvectors. Particularly, it is also designed to find specific solutions of the considered problem. Convergence analysis is studied in detail and the sufficient conditions are given. Numerical results are shown to confirm the advantages of our algorithms.

Classification : 65K15, 15A42

Format : Talk at Waseda University

Author(s) : Nan Li (Nagoya University) Tomohiro Sogabe (Nagoya University) Jun-Feng Yin (Tongji University) Tomoya Kemmochi (Nagoya University) Shao-Liang Zhang (Nagoya University)

[00844] Evidence of Multiple Effective Wavenumbers in Isotropic Random Particulate Materials

Session Time & Room : 5C (Aug.25, 13:20-15:00) @E817

Type : Contributed Talk

Abstract : In random particulate materials, it is generally assumed that if we average over all particle configurations, the averaged wave field satisfies the wave equation with a unique effective wavenumber k. As the medium is homogeneous and isotropic - because the particles have no specific orientation or direction - it is reasonable to assume the presence of one effective wavenumber. However, recent work theoretically predicted the existence of at least two (complex) effective wavenumbers for one fixed frequency. A phenomenon normally observed only in anisotropic media. Our goal is to find clear evidence of these wavenumbers using the Monte-Carlo approach and show how they influence the total field.

Classification : 74J20, 74A40, 78A48, 82D30, 82M31, wave scattering, multiple scattering, random media, ensemble averaging, Monte Carlo methods

Format : Talk at Waseda University

Author(s) : Aristeidis Karnezis (The University of Sheffield) Artur Lewis Gower (The University of Sheffield)

[00846] ESR fractional model with non-zero uniform average blood velocity

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G305

Type : Contributed Talk

Abstract : This article discusses a new solution to the time-fractional ESR model, taking into account the non-zero average blood velocity. We not only obtain an analytic solution to the generalized model of Sharma et al. and da Sousa et al., but also we present some new results which establish that the developed fractional order model is better-suited one by using which predicting the ESR rate can take place more accurately.

Classification : 26A06, 26A33, 33E12, 35R11

Format : Online Talk on Zoom

Author(s) : Abhijit Shit (Indian Institute of Technology Guwahati) Swaroop Nandan Bora (Indian Institute of Technology Guwahati)

[00847] Acute Lymphoblastic Leukemia diagnosis and treatment: a mathematical analysis

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G306

Type : Contributed Talk

Abstract : Despite the recent medical advances, treatments are unsuccessful in 15-20% of cases in Acute Lymphoblastic Leukemia (ALL) patients. The main aim of our study is to analyse data from bone marrow samples and to use artificial intelligence to improve current techniques of diagnosis in ALL protocols. Using machine learning techniques, our results predict bone marrow behavior and allow us to classify patients depending on their relapse risk.

Classification : 34A12, 92-10

Format : Online Talk on Zoom

Author(s) : Ana Nio-Lpez (Department of Mathematics, Universidad de Cdiz) Salvador Chulin (University of Cdiz) lvaro Martnez-Rubio (Department of Mathematics, Universidad de Cdiz) Mara Rosa (Department of Mathematics, Universidad de Cdiz)

[00848] Mathematical modelling of neuroblast migration in the mouse brain

Session Time & Room : 3C (Aug.23, 13:20-15:00) @G710

Type : Contributed Talk

Abstract : This talk is devoted to the mathematical modeling of migration of neuroblasts, precursor cells of neurons, with PDE. The pathway is determined mainly by attraction forces and the heterogeneous mobility of neuroblasts in different regions of the brain. In numerical simulations, the application of novel discontinuous Galerkin methods allows to maintain the properties of the continuous model. We present some successful computer tests including parameter adjust to fit real data from rodent brains.

Classification : 35Q92, 92-10, 65M60

Format : Online Talk on Zoom

Author(s) : Noelia Ortega-Romn (Universidad de Cdiz) J. Rafael Rodrguez-Galvn (Universidad de Cdiz) Daniel Acosta-Soba (Universidad de Cdiz) Francisco Guilln-Gonzlez (Universidad de Sevilla)

[00849] Well-suited upwind DG scheme for a phase-field tumor model

Session Time & Room : 3C (Aug.23, 13:20-15:00) @G710

Type : Contributed Talk

Abstract : This talk is focused on the numerical analysis of a modified diffuse-interface tumor model with degenerate mobility. In particular, we develop a discontinuous Galerkin upwind scheme that conserves the mass, preserves the discrete maximum principle and satisfies an energy law both for the Cahn-Hilliard equation and for the phase-field tumor model. Moreover, we present several numerical experiments that enhance the qualitative behavior of the model and which are in accordance with the theoretical results.

Classification : 35Q92, 65M60, 92-10

Format : Online Talk on Zoom

Author(s) : Daniel Acosta-Soba (Universidad de Cdiz) Francisco Guilln-Gonzlez (Universidad de Sevilla) J. Rafael Rodrguez-Galvn (Universidad de Cdiz)

[00852] Energy stable and positive DG scheme for Keller-Segel equations

Session Time & Room : 5B (Aug.25, 10:40-12:20) @E703

Type : Contributed Talk

Abstract : This work is focused on discretization of the Keller-Segel equations for chemotaxis, a challenging problem due to its convective nature. Specifically, we introduce a new upwind, mass-conservative, positive and energy-dissipative discontinuous Galerkin which is based on the gradient-flow structure of the equations. Also we present some numerical tests in accordance with the aforementioned properties of the discretization, showing a good behaviour in the case of chemotactic collapse, where very steep gradients appear

Classification : 65M60, 35Q92, 92-10

Format : Online Talk on Zoom

Author(s) : J. Rafael Rodrguez-Galvn (Universidad de Cdiz) Francisco Guilln-Gonzlez (Universidad de Sevilla) Daniel Acosta-Soba (Universidad de Cdiz)

[00853] Numerical Approximation of Fractional Burgers Equation with Non-singular Time-Derivatives

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E504

Type : Contributed Talk

Abstract : Fractional Burgers equation (FBE) is a partial differential equation being non-linear in space. This work presents a numerical method to solve a time-FBE with second order of convergence. The fractional time-derivative is taken as non-singular derivative whose kernel contains the Mittag-Leffler function. The discretization of derivatives is done by using finite difference method and Newton iteration method. Developed numerical scheme is stable and convergent in L^ norm. Examples have been illustrated to validate the theory.

Classification : 26A33, 65R10, 35R11

Format : Online Talk on Zoom

Author(s) : Swati Yadav (NTNU Trondheim) Swati Yadav (NTNU Trondheim) Rajesh Kumar Pandey (IIT BHU, Varanasi)

[00855] Mathematical modelling of edge wave on a functionally graded thermo-poro-elastic plate

Session Time & Room : 5C (Aug.25, 13:20-15:00) @E817

Type : Contributed Talk

Abstract : An analysis of flexural edge waves propagating in a thermally affected poroelastic plate supported by a Pasternak foundation is presented.The Kirchhoff plate theory and Moore-Gibson-Thomson (MGT) thermos elasticity theory are applied to study the displacement field of the plate and temperature distribution on edge wave, respectively.There are seven different porosity models considered to compare the edge wave behavior in different porous structures.The grid dispersion is optimized by applying the FDM to the wave equation.The effects of porosity, temperature,elastic foundation,cutoff-frequency, and wavefrequency are investigated numerically.

Classification : 74J20, 35L05, 35L53, 86-10, 74S20

Author(s) : Santanu Manna (Department of Mathematics, Indian Institute of Technology Indore, Simrol, Khandwa road, Indore-453552, M.P., India) Rahul Som (Department of Mathematics, Indian Institute of Technology Indore, Simrol, Khandwa road, Indore-453552, M.P., India) Tanisha Kumari (Department of Mathematics, Indian Institute of Technology Indore, Simrol, Khandwa road, Indore-453552, M.P., India)

[00856] Successive image generation though cyclic transformations using CycleGAN

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E811

Type : Contributed Talk

Abstract : CycleGAN is a deep generative adversarial networks that performs image to image style translation by learning relationship between two image domains.

By using CycleGAN, here we developed a model performing cyclical transformation that generates a series of similar images. This system can be regarded as a dynamical system; it can continuously sample various images along the trajectory of the dynamical system. The chaotic behavior of this deep model was studied.

Classification : 68T07, 37N99

Format : Talk at Waseda University

Author(s) : Takaya Tanaka (Graduate School of Engineering, Fukuoka Institute of Technology) Takaya Tanaka (Graduate School of Engineering, Fukuoka Institute of Technology) Yutaka Yamaguti (Faculty of Information Engineering, Fukuoka Institute of Technology)

[00857] An ecological study of mathematical model on intermittent phytoplankton distribution

Session Time & Room : 1C (Aug.21, 13:20-15:00) @D514

Type : Contributed Talk
Abstract : A microscale ecological study is done using the closure approach to understand the impact of productivity controlled by geographical and seasonal variations on the intermittency of phytoplankton. Parameters are estimated from the nature of productivity and spread of phytoplankton density during field observation done at four different locations of Tokyo Bay. The model validation shows that our results are in good agreement with the field observation and succeeded in explaining the intermittent phytoplankton distribution.
Classification : 92-10, 92D40, Mathematical Biology
Format : Talk at Waseda University
Author(s) : Sandip Banerjee (Indian Institute of Technology Roorkee) Arpita Mondal (Indian Institute of Technology Roorkee)

[00858] An adaptive spectral method for oscillatory second-order linear ODEs with frequency-independent cost

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E606

Type : Contributed Talk
Abstract : I will introduce an efficient method for solving 2nd order, linear ODEs whose solution may vary between highly oscillatory and slowly changing over the solution interval. Within a marching scheme, the solution is generated either via a nonoscillatory phase function (computed by defect correction), or spectral collocation, whichever is more efficient for the current timestep. With numerical experiments I will show that our algorithm outperforms other state-of-the-art oscillatory solvers and has a frequency-independent runtime.

Classification : 65Lxx, 34E05, 65L60, 34-04, 65Gxx
Format : Talk at Waseda University
Author(s) : Fruzsina Julia Agocs (Center for Computational Mathematics, Flatiron Institute) Alex Harvey Barnett (Center for Computational Mathematics, Flatiron Institute)

[00859] A mathematical model of immunotherapy: CD19 relapses in B leukemia

Session Time & Room : 3D (Aug.23, 15:30-17:10) @A511

Type : Contributed Talk
Abstract : B-cell Acute Lymphoblastic Leukemia (B-ALL) is the most common type of pediatric leukaemia. For relapsing patients, a treatment possibility is chimeric antigenic receptor (CAR)-T cells, which recognize target cells with the antigen CD19, expressed in B-ALL. We show a mathematical model based on partial differential equations and focus on how CAR-T cell therapy can lead to positive or negative CD19 relapses. The analysis presented represents real-life scenarios, where optimal treatment can be studied.
Classification : 92-10, 37N25, 35Q92
Format : Online Talk on Zoom
Author(s) : Salvador Chulin (Department of Mathematics, University of Cdiz) lvaro Martnez-Rubio (Department of Mathematics, University of Cdiz) Ana Nio-Lpez (Department of Mathematics, Universidad de Cdiz) Mara Rosa (Department of Mathematics,)

[00860] Probabilistic Domain Decomposition: Challenging Amdahl's curse on partial differential equations.

Session Time & Room : 5C (Aug.25, 13:20-15:00) @E705

Type : Contributed Talk
Abstract : Probabilistic Domain Decomposition allows solving elliptic BVPs with remarkable scalability by taking advantage of probabilistic representations of BVPs. This representation is less convenient when dealing with non linear problems or even unknown in the case of the Helmholtz equation. However, these limitations can be circumvented by introducing some iterative schemes. In this presentation we aim to provide an insight on these algorithms alongside some proof of concept results obtained in FUGAKU and CINECA.

Classification : 65N75, 68W10, 65N55
Format : Online Talk on Zoom
Author(s) : Jorge Morn-Vidal (University Carlos III of Madrid)

[00861] Using elastic waves to measure mechanical stress

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E812

Type : Contributed Talk
Abstract : In principle, elastic waves could be used to assess the stress in a material, as the higher the stress, the faster the wave will propagate. However, the speed also depends on material parameters, which is why there are no robust (non-invasive) measurement techniques. In this talk we show how to overcome these challenges by using universal relationships between stress and wave speeds. This has led to robust measurements with either bulk waves [2] or surface waves [3].

Universal relationships in continuum mechanics are those that hold for any type of material, or constitutive choice [1]. To measure stress, it would be ideal to have a relationship between the wave speed and the stress that holds for any elastic material. However, there is only one such universal relationship: $\rho v_{12}^2 - \rho v_{21}^2 = \sigma_{11} - \sigma_{22}$, where σ_{ij} are the components of the Cauchy stress tensor, and $v_{12} (v_{21})$ is the speed of a shear wave propagating in the $x_1 (x_2)$ direction that is polarised in the $x_2 (x_1)$ direction. Inspired by this identity we propose, and experimentally validate, several new ultrasonic methods.

[1] Truesdell, Clifford, and Walter Noll. "The non-linear field theories of mechanics." The non-linear field theories of mechanics. Springer, Berlin, Heidelberg, 1992. 1-579.
[2] Li, Guo-Yang, Artur L. Gower, and Michel Destrade. "An ultrasonic method to measure stress without calibration: The angled shear wave method." The Journal of the Acoustical Society of America 148.6 (2020): 3963-3970.
[3] Li, Guo-Yang, et al. "Non-destructive mapping of stress and strain in soft thin films through sound waves." Communications Physics 5.1 (2022): 1-7.
Classification : 74J05, 74B10, 74B15, 74J25
Format : Talk at Waseda University
Author(s) : Art Gower (University of Sheffield) Michel Destrade (University of Galway) Guo-yang Li (Harvard Medical School and Wellman Center for Photomedicine)

[00864] Stabilization of time-periodic flows

Session Time & Room : 5C (Aug.25, 13:20-15:00) @A207

Type : Contributed Talk

Abstract : At first, I shall explain the stability and stabilizability of an ODE around a periodic trajectory. A characterization of the stability of ODEs around a periodic trajectory using the Poincare map and Floquet theory will be discussed. Then, I shall explain the extension of the idea to the parabolic type of PDEs. In particular, as an application, the stabilization of the incompressible Navier-Stokes equation around a time-periodic trajectory will be discussed.

Classification : 93B52, 93D15, 35B10, 34H15, 76D55

Format : Talk at Waseda University

Author(s) : Debanjana Mitra (Department of Mathematics, IIT Bombay)

[00865] A novel hybrid microphysicalrheological multiscale constitutive model of ferroelectrics

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E812

Type : Contributed Talk

Abstract : For describing mutually coupled dissipative processes in ferroelectrics, in particular ferroelectric domain switching and viscoelasticity, a hybrid micromechanical - rheological constitutive model is developed and embedded in the framework of a multiscale modeling approach. The mathematical theory is consistent against the background of rational thermodynamics and deals with two types of internal variables. The advanced modeling approach is applied to identify novel energy harvesting cycles exploiting dissipative effects, resulting in a major electric work output.

Classification : 74M25, 74F05, 74M05, 74N30, 74Q15

Format : Talk at Waseda University

Author(s) : Andreas Warkentin (University of Kassel) Andreas Ricoeur (University of Kassel)

[00872] Stability Estimates in Bayesian D-Optimal Experimental Design

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E501

Type : Contributed Talk

Abstract : We studied stability properties of the expected utility function in Bayesian optimal experimental design. We proved a convergence rate of the expected utility with respect to a likelihood perturbation. This rate is uniform over the design space. As an example we have non-linear Bayesian inverse problems with Gaussian likelihood satisfying general assumptions. Theoretical convergence rates are demonstrated numerically in three different examples.

Classification : 62K05, 62F15, 35R30, Bayesian Inverse Problems

Format : Talk at Waseda University

Author(s) : Tapio Helin (Lappeenranta University of Technology) Duc-Lam Duong (Lappeenranta University of Technology) Jose Rodrigo Rojo Garcia (Lappeenranta University of Technology)

[00875] Deep learning based reduced ensemble Kalman inversion for microscopic parameter estimation

Session Time & Room : 2C (Aug.22, 13:20-15:00) @G710

Type : Contributed Talk

Abstract : In the scope of nonlinear multiscale problems, estimating the macroscopic distribution of the microscopic geometrical parameters given macroscopic measurements is of interest. In general, inverse estimation is challenging due to the need of derivatives of the complex forward model and the high cost of the forward solver. We introduce derivative-free ensemble Kalman inversion and deep-learning based model reduction to tackle the aforementioned challenges, and assess the performance of the proposed method on a hyper-elastic problem.

Classification : 35R30, 65N21, 74G75, 65N75, 62F86

Format : Talk at Waseda University

Author(s) : Yankun Hong (Eindhoven University of Technology) Harshit Bansal (Eindhoven University of Technology) Karen Veroy (Eindhoven University of Technology)

[00878] Large-amplitude problem of BGK model

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D101

Type : Contributed Talk

Abstract : BGK equation is a relaxation model of the Boltzmann equation for simulation of various kinetic ow problems. In this work, we study asymptotic stability of the BGK model when the initial data is not necessarily close to global equilibrium pointwisely. Main diculty of the BGK equation comes from the highly nonlinear structure of the relaxation operator. To overcomes this issue, we derive rened control of macroscopic elds to guarantee the system enters quadratic nonlinear regime.

Classification : 76P05, 35B35, 35B40, 82C40

Format : Talk at Waseda University

Author(s) : Gichan Bae (Seoul National University) Gyounghun Ko (POSTECH) donghyun lee (POSTECH) Seokbae Yun (Sungkyunkwan University)

[00880] Disturbance rejection based modified repetitive control design for stabilization of TakagiSugeno fuzzy systems

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G802

Type : Contributed Talk

Abstract : In this talk, the aim is to obtain a disturbance rejection based repetitive control design for the stabilization of TakagiSugeno fuzzy systems in presence of aperiodic disturbances. By employing Lyapunov approach, a new set of conditions is derived in the form of linear matrix inequalities to obtain the control gains for ensuring the robust stabilization of the addressed fuzzy systems. Further, numerical simulations are provided to verify the supremacy of the designed control scheme.

Classification : 37N35, 93B51, 93D15, 93D25, 93C42

Format : Talk at Waseda University

Author(s) : Antony Crispin Sweety Charles Selvaraj (Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore)

[00883] Convergence of the Eberlein diagonalization method

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E603

Type : Contributed Talk

Abstract : The Eberlein method is a Jacobi-type process for solving the eigenvalue problem of an arbitrary matrix. In each iteration two transformations are applied on the underlying matrix, a plane rotation and a non-unitary elementary transformation. In this talk we present the method under the broad class of generalized serial pivot strategies. We provide the proof of the global convergence and give several numerical examples.

Classification : 65F15

Format : Talk at Waseda University

Author(s) : Erna Begovic (University of Zagreb) Ana Perkovic (University of Zagreb)

[00884] Time-Frequency Analysis of Functional Datasets

Session Time & Room : 3C (Aug.23, 13:20-15:00) @F311

Type : Contributed Talk

Abstract : We introduce an operator valued Short-Time Fourier Transform for certain classes of operators with operator window, and show that the transform acts in an analogous way to the STFT for functions. This object reflects the time-frequency behaviour for datasets of functional data in both a intra- and inter-functional manner, showing the function-wise time-frequency distribution and cross correlation of time-frequency concentration between datapoints, hence combining desirable aspects of existing basis selection methods for functional data science.

Classification : 46-XX, 62R10

Format : Talk at Waseda University

Author(s) : Monika Drfler (University of Vienna) Franz Luef (Norwegian University of Science and Technology (NTNU)) Henry McNulty (Norwegian University of Science and Technology (NTNU)) Eirik Skrettingland (NA)

[00885] Hybrid nanofluid of Heimenz flow over electromagnetic surface: Enhancement in thermal energy

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D505

Type : Industrial Contributed Talk

Abstract : Over decades, the Hiemenz ow for heat transfer mechanism has gained a lot of signicant consideration from engineers and researchers owing to the optimal rates of heat transfer, pressure and mass deposition near

stagnation point in high speed ows. The stagnation region ows, initiated by Hiemenz [1], are very frequent and extensively adopted for modeling in considerable elds, such as micro cooling systems, extrusions with a die, continuous casting, jet impingements, and-so-forth.

The novel and advanced concepts of nanofluids offer fascinating heat transfer characteristics compared to conventional heat transfer fluids. Applications of nanofluids in industries such as heat exchanging devices, cool automobile engines and welding equipment and to cool high heat-flux devices such as high power microwave tubes and high-power laser diode arrays. Hybrid nanofluids can also effectively be used for a wide variety of industries, ranging from transportation to energy production and in electronics systems like microprocessors, drug distributors to check the chemical reactions of drugs in blood, as coolants and heat exchangers for better heat transfer, as lubricators, in nuclear reactors for thermal emission and absorption, solar concentrators for absorbing much of the solar radiation, and many more.

The objective of this study to improve the heat transfer rate by solving Hiemenz ow of hybrid nanouid over an electromagnetic surface.

Classification : 76-10, Heat transfer
Format : Online Talk on Zoom
Author(s) : Islam Zari (University of Peshawar) Karlygash Dosmagulova (Ghent University, Belgium) Chinwendu Emilian MADUBUEZE (Federal university of Agriculture Makurdi Nigeria)

[00889] Multiple-Relaxation Runge Kutta Methods for Conservative Dynamical Systems

Session Time & Room : 2E (Aug.22, 17:40-19:20) @E505

Type : Contributed Talk
Abstract : Relaxation Runge-Kutta methods, which are a slight modification of the RK methods, have been introduced to preserve invariants of initial-value problems. So far, this approach has been applied to preserve only one nonlinear functional in the numerical solution of a problem. In this talk, I will present the generalization of the relaxation approach for RK methods to preserve multiple nonlinear invariants of a dynamical system. The significance of preserving multiple invariants and its impact on long-term error growth will be illustrated via several numerical examples.
Classification : 65L04, 65L20, 65M06, 65M12, 65M22
Format : Talk at Waseda University
Author(s) : Abhijit Biswas (King Abdullah University of Science and

Technology (KAUST)) David Isaac Ketcheson (King Abdullah University of Science and Technology (KAUST))

[00892] Predicting response to pediatric leukemia with flow cytometry data

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A601

Type : Contributed Talk

Abstract : 15% of children with B-cell acute lymphoblastic leukemia fail to achieve response or long-term remission. With new treatments being developed to provide an alternative for this subset of patients, an improved risk classification at diagnosis can help to plan and prepare for this eventuality. Flow cytometry is currently used to characterize the leukemic clone but it has no prognosis value. In this work we use flow cytometry data at diagnosis from 250 pediatric patients from hospitals in Spain to find features associated with response by means of an array of computational methods.

Classification : 92Bxx

Author(s) : Alvaro Martnez-Rubio (University of Cadiz) Salvador Chulin (University of Cdiz) Ana Nio-Lpez (Department of Mathematics, Universidad de Cdiz) Vctor Manuel Prez-Garca (University of Castilla-La Mancha) Mara Rosa (University of Cadiz)

[00894] ODE models relating irrigation to kidney bean yield

Session Time & Room : 3D (Aug.23, 15:30-17:10) @A511

Type : Industrial Contributed Talk

Abstract : Chippewa Valley Bean, located in Wisconsin, USA, is the worlds largest processor of dark red kidney beans and works with farmers over several states. Current trends in farming are pressuring producers to generate higher yields with fewer resources, particularly water resources. This project describes our work creating ODE models that describe the relationship between irrigation inputs, soil parameters, and kidney bean yields that CVB can use to advise farmers for productive yet sustainable practices.

Classification : 92-10

Format : Talk at Waseda University

Author(s) : Tyler Skorczewski (University of Wisconsin Stout) Keith Wojciechowski (University of Wisconsin Stout)

[00899] Unlocking the Secrets of Locking

Session Time & Room : 4C (Aug.24, 13:20-15:00) @E711

Type : Contributed Talk
Abstract : For nearly incompressible linear elastic materials, such as rubber, finite element methods sometimes exhibit suboptimal convergence rates for the energy and/or stresses. This type of behavior, termed locking, is still not completely understood. This talk reviews the concept of locking and recent results that show that conforming high order finite elements provide optimal convergence for both the energy and stresses with respect to the mesh size and polynomial degree. Robust preconditioners will also be presented.
Classification : 65N30, 74S05, 65N35
Format : Talk at Waseda University
Author(s) : Charles Parker (University of Oxford) Mark Ainsworth (Brown University)

[00901] Effect of porous layer fitted on a floating bridge in mitigating waveload

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E820

Type : Contributed Talk
Abstract : Scattering of oblique water waves by a floating bridge with porous wall fitted on its vertical sides is studied. Significant changes are noticed in wave reflection due to changes in porosity. It is observed that as the porosity increases, the values of the reflection coefficient decrease. The behavior of various parameters, such as depth, porous wall width, porosity and angle of incidence, on the reflection coefficient are also carried out.
Classification : 76B07, 76B15, 35P10, 76S05, 76B55
Format : Online Talk on Zoom
Author(s) : Shilpi Jain (IIT Guwahati) Swaroop Nandan Bora (Indian Institute of Technology Guwahati)

[00902] Influence of the statistical parameters of random particulate materials on wave propagation

Session Time & Room : 5C (Aug.25, 13:20-15:00) @G302

Type : Contributed Talk

Abstract : Current models predicting the effective properties of random particulate materials neglect the correlation between the particles positions by using the hole correction approximation. A recent method which predicts more than one effective wavenumber is adapted in order to take into account these correlations. The method is validated against Monte-Carlo simulations and the influence of the correlations is demonstrated with computed effective wavenumbers.

Classification : 74A40, 78A48, 82D30

Format : Talk at Waseda University

Author(s) : Kevish Kumar Napal (University of Sheffield) ARTUR LEWIS GOWER (University of Sheffield) Paulo Sergio Piva (The University of Sheffield) Aristeidis Karnezis (The University of Sheffield)

[00903] Port-Hamiltonian form and stochastic Galerkin method for ordinary differential equations

Session Time & Room : 2E (Aug.22, 17:40-19:20) @E505

Type : Contributed Talk

Abstract : We consider systems of ordinary differential equations (ODEs) including random variables. Based on a polynomial chaos expansion, a stochastic Galerkin approach yields a larger deterministic system of ODEs. We investigate port-Hamiltonian formulations of the original systems and the Galerkin systems. A structure-preserving stochastic Galerkin projection is constructed, which produces a larger port-Hamiltonian system. Furthermore, the associated Hamiltonian functions are compared. We present results of numerical computations using a test example.

Classification : 65L05, 34F05, uncertainty quantification

Format : Talk at Waseda University

Author(s) : Roland Pulch (University of Greifswald)

[00904] Quadrature Methods and Error Estimates for Particles in Stokes Flow

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E820

Type : Contributed Talk

Abstract : For axisymmetric particles in Stokes flow, boundary integral methods can be utilized for numerical evaluation of flow velocity on and outside particle surfaces. Precomputation yields a highly efficient and accurate quadrature by expansion $($QBX$)$ method for singular integrals when evaluating on-surface. For evaluation close to the particle surface $($nearly singular integrals$)$, a line interpolation method aided by quadrature error estimates is introduced and compared to QBX in terms of both accuracy and efficiency.

Classification : 65Rxx, 65Dxx, 41Axx, 76-XX

Format : Talk at Waseda University

Author(s) : Pritpal Matharu (KTH Royal Institute of Technology) Anna-Karin Tornberg (KTH Royal Institute of Technology)

[00909] Lipschitz stability of an inverse problem for Tumor Growth Model

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G809

Type : Contributed Talk

Abstract : We address an inverse problem of recovering a space-dependent semilinear coefficient in the
CahnHilliard type system modeling tumor growth described by a system of partial differential equations
with Dirichlet boundary condition using boundary-type measurement. First, we establish a new
higher-order weighted Carleman estimate for the given system and then a suitable regularity of solutions
for this nonlinear system is derived. Finally, we prove Lipschitz type stability for the tumor growth model.

Classification : 35R30, 35K15

Format : Talk at Waseda University

Author(s) : Barani Balan Natesan (Central University of Tamil Nadu)

[00912] Simulation-based Bayesian optimization over categorical covariates

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A206

Type : Contributed Talk

Abstract : Optimizing black-box functions of categorical variables has important applications, including the design of biological sequences with specific properties. Bayesian optimization is widely used in this type of problem. It involves adjusting a probabilistic machine learning model of the objective and using an acquisition function to guide the optimization process. We propose a new algorithm to sequentially optimize the acquisition function inspired in simulated annealing. We address convergence issues and demonstrate its effectiveness on RNA-sequence optimization.

Classification : 90C27, 62F15, 60J20

Format : Talk at Waseda University

Author(s) : Roi Naveiro (CUNEF University)

[00921] Inverse Coefficient Problem - Coupling Fourth and Second Order Equations

Session Time & Room : 4C (Aug.24, 13:20-15:00) @G502

Type : Contributed Talk

Abstract : In this paper, the recovery of the diffusion coefficient from the final time-measured data is carried out using the quasi-solution approach. The inverse coefficient problem is formulated as a minimization problem using an objective functional. The existence of the minimizer is proved, then the necessary optimality condition is derived, and by using that condition, the stability results are proved. To illustrate the efficiency of this method, numerical results are investigated using the conjugate gradient method.

Classification : 35G16, 35R30, 49K35, 49K20

Format : Talk at Waseda University

Author(s) : NAVANEETHA KRISHNAN M (CENTRAL UNIVERSITY OF TAMIL NADU, THIRUVARUR - 610005)

[00922] Matrix Factorization for Change Detection in HyperSpectral Images

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G304

Type : Contributed Talk

Abstract : When hyperspectral images are analyzed, a big amount of data needs to be processed and therefore, specific matrix factorization algorithms are used to express the original problem in suitable subspacesWe show some recent results derived also by using spatial and spectral functions to compute a lower rank approximation of the original matrix and to measure the reconstruction error between the input image and the approximate one, with applications to the task of change-detection.

Classification : 15A23

Format : Talk at Waseda University

Author(s) : Antonella Falini (Universit degli studi di Bari Aldo Moro) Francesca Mazzia (Universit degli studi di Bari Aldo Moro, Italy)

[00927] Bone marrow stem cells and exosomes control doxorubicin-induced CRCC: A mathematical model

Session Time & Room : 3E (Aug.23, 17:40-19:20) @A601

Type : Contributed Talk

Abstract : Doxorubicin (DOX), a widely used chemotherapeutic agent, can cause neurodegeneration in the brain, which leads to cancer-related cognitive changes (CRCC). In fact, CRCC is a deteriorating condition which adversely affects the day-to-day life of cancer survivors. Recent studies reported that bone marrow mesenchymal stem cells (BMSCs) and exosome may significantly affect the CRCC conditions in a combination therapy (DOX+Exosome). In this study, we investigate the interaction among intracellular signaling (NFB-Bcl-2-BAX), DOX, exosome, and IL-6.

Classification : 92B05

Format : Talk at Waseda University

Author(s) : hyungchul Kim (Konkuk University) Donggu Lee (Konkuk University) Haneol Cho (Konkuk university) Junho Lee (Konkuk University) Yangjin Kim (Konkuk University)

[00929] On the continuum limit of epidemic models on graphs

Session Time & Room : 3C (Aug.23, 13:20-15:00) @G710

Type : Contributed Talk

Abstract : We consider an epidemic model defined on graphs and study the asymptotic behavior of the solutions as the number of vertices in the graph diverges. By relying on the theory of (graphons) we provide a characterization of the limit and establish convergence results. We also present approximation results for both deterministic and random discretizations. The analysis applies to dense and sparse graphs, including power-law networks. Extensive numerical results illustrate and assess the analytical findings.

Classification : 35Q92, 05C99, 92D30, 65M22, 35R02

Format : Talk at Waseda University

Author(s) : blanca ayuso de dios (universita milano-bicocca) Simone Dovetta (Politecnico di Torino) Laura Spinolo (IMATI-CNR, Pavia)

[00930] Analysis and numerical approximation of energy-variational solutions to the Ericksen--Leslie equations

Session Time & Room : 5B (Aug.25, 10:40-12:20) @E703

Type : Contributed Talk

Abstract : The Ericksen--Leslie equations are used to model liquid crystals in their nematic phase. We define the concept of energy-variational solutions for the Ericksen--Leslie equations in three spatial dimensions. This solution concept satisfies the weak-strong uniqueness property. We construct an energy-variational solution with the help of an implementable, structure-inheriting space-time discretization. Computational studies are performed in order to provide some evidence of the applicability of the proposed algorithm.

Classification : 65M60, 35A35, 35Q35, 76A15

Format : Talk at Waseda University

Author(s) : Maximilian Elias Vincenzo Reiter (Technische Universitt Berlin)

[00931] The vaginal microbiota and its association with Chlamydia infection

Session Time & Room : 4C (Aug.24, 13:20-15:00) @A601

Type : Contributed Talk

Abstract : Chlamydia trachomatis is the most common bacterial sexually transmitted infection in the U.S. While genital chlamydia infection can beget devastating pathologies, it is unclear why some women are more likely to develop severe infections but others are asymptomatic or remain uninfected after exposure to C. trachomatics. We use mice as a model organism, seek to evaluate the potential impact of the time of day of pathogen exposure on the genital tract microbiome in chlamydia infection.

Classification : 92B05, 92C70

Format : Online Talk on Zoom

Author(s) : Lihong Zhao (University of California Merced) Lihong Zhao (University of California Merced)

[00934] Slab LU, a sparse direct solver for heterogeneous architectures

Session Time & Room : 1E (Aug.21, 17:40-19:20) @E704

Type : Contributed Talk

Abstract : This talk describes a scalable sparse direct solver for linear systems that arise from the discretization of elliptic PDEs in 2D or 3D. The scheme uses a decomposition of the domain into thin subdomains, or ``slabs''. The general framework is easier to optimize for modern heterogeneous architectures than
than traditional multi-frontal schemes. Crucial to the scalability, are novel randomized algorithms that recover structure from matrix-free samples and reduce the dimensionality of large dense matrices.

Classification : 65M70, 65M55, 65M22, 65M06

Format : Talk at Waseda University

Author(s) : Anna Yesypenko (University of Texas at Austin) Per-Gunnar Martinsson (University of Texas at Austin)

[00937] Asymptotic and numerical approaches to degeneracies in Stefan problems

Session Time & Room : 5C (Aug.25, 13:20-15:00) @G502

Type : Contributed Talk

Abstract : This talk discusses how asymptotic analysis and numerics can be combined to devise computational schemes to moving boundary $($Stefan$)$ problems more accurately; in particular, this relates to degenerate situations where the solution domain is initially of zero extent, or where a domain that was initially present disappears completely. A further subtlety concerns whether a new domain starts to form instantaneously or after some delay time.

Classification : 35K40, 35K65, 35K60

Format : Talk at Waseda University

Author(s) : Michael Vynnycky (University of Limerick) Sarah Mitchell (University of Limerick)

[00939] Learning Dynamical Systems from Invariant Measures

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G709

Type : Contributed Talk

Abstract : Standard data-driven techniques for learning dynamical systems struggle when observational data has been sampled slowly and state derivatives cannot be accurately estimated. To address this challenge, we assume that the available measurements reliably describe the asymptotic statistics of the dynamical process in question, and we instead treat invariant measures as inference data. We reformulate the velocity learning as a PDE constrained optimization and present several numerical examples to demonstrate the effectiveness of the proposed approach.

Classification : 37Mxx, 37Axx

Format : Online Talk on Zoom

Author(s) : Jonah Botvinick-Greenhouse (Cornell University) Yunan Yang (ETH Zrich)

[00943] Similarity solutions for cylindrical shock wave in self-gravitating non-ideal gas with axial magnetic field: Isothermal flow

Session Time & Room : 3D (Aug.23, 15:30-17:10) @G601

Type : Contributed Talk

Abstract : The solution using the Lie group of symmetry method for the problem of propagating magnetogasdynamic strong cylindrical shock wave in a self-gravitating non-ideal gas with the axial magnetic field for isothermal flow. Numerical computations were performed for power law and exponential law shock paths, to see the behaviour of flow variables. The study provides how the variations in the various parameter taken in this study affect the propagation of shock and the flow behind it.

Classification : 35L45, 58J45, 35L67, 35Q35, 76L05, Fluid Mechanics

Format : Talk at Waseda University

Author(s) : Nandita . (Dept. of Applied Mathematics & Scientific Computing, IIT Roorkee, Roorkee,India 247667)

[00944] Modelling of healthcare-acquired infection spread in regional healthcare systems

Session Time & Room : 5B (Aug.25, 10:40-12:20) @A201

Type : Contributed Talk

Abstract : A network-compartmental model for simulation of healthcare-associated infection spread in healthcare systems is presented. The model accounts for transmission of the pathogen by inter-hospital patient transfers and colonized patients' readmission. Estimates for basic reproduction number per hospital-community pairs are calculated for multidrug-resistant Enterobacteriaceae for selected German regions. Inter-hospital transfer network is created from anonymized German health-insurance datasets. By numerical simulations, we examine interventions to reduce spread of the pathogen within the healthcare network.

Classification : 92D30, 62P10

Format : Talk at Waseda University

Author(s) : Konrad Sakowski (Institute of Applied Mathematics and Mechanics, University of Warsaw) Monika Joanna Piotrowska (Institute of Applied Mathematics and Mechanics, University of Warsaw) Agata Lonc (Institute of Applied Mathematics and Mechanics, University of Warsaw) Johannes Horn (Institute for Medical Epidemiology, Biometrics, and Informatics, Interdisciplinary Center for Health Sciences, Medical Faculty of the Martin Luther University Halle-Wittenberg, Halle (Saale)) Rafael Mikolajczyk (Institute for Medical Epidemiology, Biometrics, and Informatics, Interdisciplinary Center for Health Sciences, Medical Faculty of the Martin Luther University Halle-Wittenberg, Halle (Saale)) Andr Karch (Institute of Epidemiology and Social Medicine, University of Mnster) Pawe Brachaczek (University of Warsaw) Mirjam Kretzschmar (University Medical Center Utrecht, Utrecht University)

[00947] Statistical analysis of neonatal mortality predictors in Ghana

Session Time & Room : 4D (Aug.24, 15:30-17:10) @E504

Type : Contributed Talk

Abstract : In this study, we identify and investigate the main factors influencing newborn mortality in the Ghanaian locality and predict the occurrence of future infant mortality based on the 2017 Demographic and Health Survey data using logistic regression. Our work shows that the childs weight and sex have a strong correlation with its survival. The study reveals

that mortality is more than 50% greater in underweight children and also, 62.7% infant deaths happen in infant males.

Classification : 62Pxx, 92-11, 92-08, Bio Statistics

Format : Online Talk on Zoom

Author(s) : Elizabeth Dufie Amankwah (Kwame Nkrumah University of Science and Technology) Juliet Amegble Richardson (Kwame Nkrumah University of Science and Technology) Solomon Kyei Mensah (Kwame Nkrumah University of Science and Technology)

[00954] Dynamic Modeling and Optimization of Mixed Hydrogen-Natural Gas Flow in Pipeline Networks

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D501

Type : Contributed Talk

Abstract : We present a dynamic model for the mixing and transport of hydrogen-natural gas blends in a pipeline network. The dynamic model is derived by lumping the partial differential equations to yield a differential algebraic system. The derived system accommodates spatio-temporally heterogeneous gas injections, and is more complex and numerically ill-conditioned than the case of a single gas. Multiple reformulations for the nonlinear and non-smooth equations of mixing are compared using standard optimization solvers.

Classification : 90-10, 37N40, 90C30, Dynamic and Nonlinear Programming

Format : Talk at Waseda University

Author(s) : Saif Kazi (Los Alamos National Laboratory) Anatoly Zlotnik (Los Alamos National Laboratory) Kaarthik Sundar (Los Alamos National Laboratory) Shriram Srinivasan (Los Alamos National Laboratory)

[00956] Inner Structure of Attractors for a Nonlocal Chafee-Infante Problem

Session Time & Room : 1C (Aug.21, 13:20-15:00) @G501

Type : Contributed Talk

Abstract : The structure of the global attractor for the multivalued semiflow generated by a nonlocal reaction-diffusion
equation in which we cannot guarantee the uniqueness of the Cauchy problem is studied. The existence and
properties of stationary points are analysed. Also, the study of the stability and connections between them

are carried out, establishing that the semiflow is a dynamic gradient. As a consequence, the attractor
consists of the stationary points and their heteroclinic connections.

Classification : 35B40, 35B41, 35B51, 35K55, 35K57

Format : Online Talk on Zoom

Author(s) : RUBEN CABALLERO (UNIVERSIDAD MIGUEL HERNANDEZ DE ELCHE)

[00958] Existence results and numerical approximation for a quasilinear elliptic system

Session Time & Room : 2C (Aug.22, 13:20-15:00) @G601

Type : Contributed Talk

Abstract : We analyse, in the context of anisotropic Sobolev spaces, the existence and the numerical simulation of a capacity solution to a coupled nonlinear elliptic system. We consider the case of a non-uniformly elliptic problem with a quadratic growth in the gradient. The system may be regarded as a generalization of the so-called thermistor problem.

Classification : 35J47, 35J70, 47H05, 46E35, 65N12

Format : Online Talk on Zoom

Author(s) : Hajar Talbi (Moulay Ismail University) Mohamed Rhoudaf (Moulay Ismail University) Francisco Ortegn Gallego (Universidad de Cdiz)

[00962] Discontinuous Galerkin method for a high order nonlocal conservation law

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E604

Type : Contributed Talk

Abstract : We consider a Direct Discontinuous Galerkin (DDG) method for solving a time dependent partial differential equation with convection-diffusion terms and a fractional operator of order $\alpha \in (1,2)$. This equation was introduced to describe dunes morphodynamics and was then used for signal processing. For the DDG method, suitable numerical fluxes are introduced. We prove nonlinear stability estimates along with convergence results. Numerical experiments are given to illustrate behaviors of solutions and to verify convergence order.

Classification : 65M12, 65M60, 26A33

Author(s) : Afaf Bouharguane (Universit de Bordeaux/INRIA) Afaf Bouharguane (University of Bordeaux) Nour Seloula (University of Caen)

[00964] The Valuation of Real Options for Risky Barrier to Entry with Hybrid Stochastic and Local Volatility and Stochastic Investment Costs

Session Time & Room : 4E (Aug.24, 17:40-19:20) @D505

Type : Contributed Talk

Abstract : Real options are sorts of investment choices which support agents in making better decisions in management strategic cases as well as reducing uncertainty in investment simultaneously. In this paper, we present the new model for investors to handle uncertain environments in investment flexibly: First, we adopt a hybrid stochastic and local volatility model to efficiently describe the external uncertain environment affecting the value of the project in decision making cases, and we set up the investment cost as geometric Brownian motion to illustrate the value of the opportunity costs which arise from things given up by choosing to invest in complex decision making circumstances. We derive partial differential equations for the value of real options and then use asymptotic analysis to obtain analytical solutions for that of the real options. In addition, we analyze the price accuracy of the approximated formulas compared to the solutions obtained from Monte-Carlo simulation. Finally, we investigate the effects of various parameters related to stochastic volatility on real options numerically to observe economic implications.

Classification : 91G20

Format : Talk at Waseda University

Author(s) : Donghyun Kim (Pusan National University) Yong Hyun Shin (Sookmyung Women's University) Ji-Hun Yoon (Pusan National University)

[00968] Modelling pathogen spreading in a network of hospitals

Session Time & Room : 1E (Aug.21, 17:40-19:20) @G401

Type : Contributed Talk

Abstract : I will introduce an ODE model describing the spread of multidrug-resistant bacteria in a hospital network. I will present the mathematical properties of the model solutions, including the global stability of steady states. Based on simulations for real-life data, I will describe how the parameters affect the process dynamics at both network and hospital levels. Finally, the relations to other types of models describing similar processes will be discussed.

Classification : 34Axx, 34Cxx, 34D23, 92D30

Format : Talk at Waseda University

Author(s) : Agata Lonc (University of Warsaw) Monika Joanna Piotrowska (Institute of Applied Mrsaathematics and Mechanics, University of Waw) Aleksandra Puchalska (Institute of Applied Mathematics and Mechanics, University of Warsaw)

[00971] Quantify the classicality of quantum states

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D404

Type : Contributed Talk

Abstract : In this talk, I will first introduce classicality and quantumness in a given quantum state. As quantumness speeds up quantum algorithms, gauging the "non-quantumness" or so-called "classicality" becomes an important task. Next, I will demonstrate using descent flow on smooth manifolds to resolve the issue. Finally, I will exhibit several numerical experiments to clarify whether our proposed method is reliable and applicable.

Classification : 81P50, 15B10, 53Z99

Format : Talk at Waseda University

Author(s) : BingZe Lu (Mathematics, National Cheng Kung University) YuChen Shu (Mathematics, National Cheng Kung University) Matthew M. Lin (National Cheng Kung University)

[00972] Reducing Communication in Federated Learning with Variance Reduction Methods

Session Time & Room : 4E (Aug.24, 17:40-19:20) @D408

Type : Contributed Talk

Abstract : In Federated Learning (FL), inter-client heterogeneity and partial participation of clients at each communication cause client sampling error. We control this client sampling error by developing a novel single-loop variance reduction algorithm. While sampling a small number of clients, the proposed FL algorithms require provably fewer or at least equivalent communication rounds compared to any existing method, for finding first and even second-order stationarypoints in the general nonconvex setting, and under the PL condition.

Classification : 90Cxx, 68Wxx, 68Txx

Author(s) : Kazusato Oko (The University of Tokyo, AIP RIKEN) Shunta Akiyama (The University of Tokyo) Tomoya Murata (The University of

Tokyo, NTT DATA Mathematical Systems Inc.) Taiji Suzuki (The University of Tokyo, AIP RIKEN)

[00973] Inverse source problem for a seventh-order Kortewegde Vries equation

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G809

Type : Contributed Talk
Abstract : In this talk, we establish the boundary stability result concerning the inverse source problem for a seventh-order Kortewegde Vries (KdV) equation. Initially, we derive a new boundary Carleman estimate for the given system using the DirichletNeumann type boundary conditions. We finally obtain a Lipschitz-type boundary stability estimate of a seventh-order KdV equation using the regularity results of the nonlinear KdV equation and the Bukhgeim-Klibanov method.
Classification : 35R30, 35Q53
Format : Online Talk on Zoom
Author(s) : Arivazhagan Anbu (SRM Institute of Science and Technology, Tiruchirappalli) Arivazhagan Anbu (Indian Institute of Technology Gandhinagar)

[00976] A Multi-phase Model for Silicon Carbide Production

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G501

Type : Contributed Talk
Abstract : We present a multi-phase model to study the reduction of quartz to silicon carbide in a laboratory-scale reactor. We model the transport of gases and solids, and the kinetics of the reactions involved in the reduction process. Through the analysis of the model, we aim to gain a better understanding of the underlying mechanisms driving the reduction of quartz and to identify key parameters that can be controlled to optimize the production of silicon carbide.
Classification : 35B30, 35E15, 35Q49, 35R37
Format : Talk at Waseda University
Author(s) : Brady Metherall (University of Oxford)

[00978] Real-Time Krylov Theory for Quantum Computing Algorithms

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D404

Type : Contributed Talk

Abstract : Here we describe the variational quantum phase estimation (VQPE) method, a compact and efficient real-time subspace algorithm to extract eigenvalues using quantum hardware. We theoretically and numerically explore a generalized Krylov scheme where the Krylov subspace is constructed through a parametrized real-time evolution, applicable to the VQPE algorithm as well as others. We discuss its application to fundamental problems in quantum computation such as electronic structure predictions for strongly correlated systems.

Classification : 81-08, 81-10

Format : Talk at Waseda University

Author(s) : Katherine Klymko Yizhi Shen (Massachusetts Institute of Technology) Norm Tubman (NASA)

[00979] Optimal radio channel assignment to transmitters in a network by graph labeling approach

Session Time & Room : 5C (Aug.25, 13:20-15:00) @G302

Type : Contributed Talk

Abstract : An optimal radio channel assignment to transmitters in a network is modelled by graph labeling approach. A radio labeling of a graph G is a mapping $f : V(G) \rightarrow \{0,1,2,\ldots\}$ satisfying $|f(u)-f(v)| \geq diam(G)+1-d(u,v)$ for all $u,v \in V(G)$. The radio number $rn(G)$ of G is the smallest number k such that G has radio labeling f with $\max\{f(v) : v \in V(G)\}=k$. We present our recent results on optimal radio labelings of graphs.

Classification : 05C78, 05C15, 05C12

Format : Talk at Waseda University

Author(s) : Devsi Dudabhai Bantva (Lukhdhirji Engineering College, Morbi)

[00983] Effective time step analysis of numerical schemes for gradient flows

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E604

Type : Contributed Talk

Abstract : A gradient flow has an important role in PDEs and it has a variety of applications including biological fields. In this talk, we briefly introduce the unconditionally stable numerical schemes for type of gradient flows and analyze them by comparing the real and its rescaled time steps, which has been a critical issue in this field. Some numerical simulations are performed to confirm our result.

Classification : 65M12

Format : Talk at Waseda University

Author(s) : Seunggyu Lee (Korea University)
Woon-Jae Hwang (Korea University)

[00985] A Routing Protocol for Enhancing the QoS in Vehicular Ad hoc Networks

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E804

Type : Industrial Contributed Talk

Abstract : The vehicle ad hoc network (VANET) provides various services for safe driving to the driver. The main problem with VANET is routing, since it has much more variation in network topology and node density than conventional mobile ad hoc networks (MANET). In this paper, we propose a QoS routing protocol based on link state information for VANET. The proposed protocol provides an optimal path using link quality and link stability.

Classification : 68M10, 68M18, 68M15

Author(s) : Jin-Woo Kim (Duksung Womens University) Jaehee Kim (Duksung Womens University)

[00986] Approximation results for Gradient Descent trained Shallow Neural Networks

Session Time & Room : 1C (Aug.21, 13:20-15:00) @F310

Type : Contributed Talk

Abstract : Neural networks show strong performance for function approximation, but provable guarantees typically rely on hand-picked weights and are therefore not fully practical. The aim for a small number of weights in approximation is opposed to over-parametrization by very wide or even infinitely wide networks in contemporary optimization results. The talk reconciles approximation and optimization results and provides approximation bounds that are guaranteed for gradient descent trained neural networks.

Classification : 41A46, 65K10, 68T07

Author(s) : Gerrit Welper (University of Central Florida) Russell Gentile (n/a)

[00987] Role of applied mathematics on optimum MR damper location for LQG controlled framed structure

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G402

Type : Industrial Contributed Talk

Abstract :
This work addresses a Linear Quadratic Gaussian Design (LQG) based semi-active control algorithm for vibration reduction of building structures. The controlled damper force required by the structure has been calculated from an MR damper. A building frame has been selected to illustrate the performance of the proposed algorithm. Four different earthquake acceleration data has been used as input vibration data to the numerical frame

Classification : 34H10, 34H15, 34H20, 70H03, 70H20

Format : Talk at Waseda University

Author(s) : MANIKANDAN RAJASEKARAN (DEPARTMENT OF APPLIED MATHEMATICS BHARATHIYAR UNIVERSITY COIMBATORE TAMIL NADU INDIA) PAYEL CHAUDRI (IIT KHARAGPUR) SAKTHIVEL R (PROFESSOR DEPARTMENT OF APPLIED MATHEMATICS BHARATHIYAR UNIVERSITY COIMBATORE TAMIL NADU INDIA)

[00991] Applied mathematics applications in ocean engineering

Session Time & Room : 3C (Aug.23, 13:20-15:00) @G601

Type : Industrial Contributed Talk

Abstract : A novel controller technique using nonlinear quadratic regulatory framework is proposed, the
algorithm perform the parameterization of the nonlinear model of the system such that the
linearized model remains transversal everywhere to nonlinear model leading to control of original
model. By transversality, linearized and nonlinear solutions intersect at only grid points on time
axis without using Taylor-like expansions and shown its applicability in SWT

Classification : 37D10

Format : Talk at Waseda University

Author(s) : MANIKANDAN RAJASEKARAN (UGC-DR DS KOTHARI POST DOCTORAL FELLOW DEPARTMENT OF APPLIED MATHEMATICS BHARATHIYAR UNIVERSITY COIMBATORE TAMIL NADU INDIA) SATARUPA DEY (Assistant Professor and Head Department of Botany Shyampur Siddheswari Mahavidyalaya (Affiliated to University of Calcutta) West Bengal India) SAKTHIVEL R (DEPARTMENT OF APPLIED MATHEMATICS BHARATHIYAR UNIVERSITY COIMBATORE TAMIL NADU INDIA)

[00993] The effect of extended coupling in transport system

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D404

Type : Contributed Talk

Abstract : Totally Asymmetric Simple Exclusion Process is a stochastic model to recognize the nature of non-equilibrium transport systems. Inspired by the vehicular traffic phenomena, we have actuated a new kind of coupling rule on transport dynamics. The impact of the designed dynamics on system properties has been analyzed over phase diagrams, phase transitions, finite size effect, and shock position. The calculated numerical results from mean-field theory are verified through the ground of Monte Carlo simulation.

Classification : 82C26, 82C70, 65C05, 60G10

Format : Talk at Waseda University

Author(s) : Tamizhazhagan S (National Institute of Technology Tiruchirappalli.) Atul Kumar Verma (NIT Trichy, India)

[00995] Convergence of a Normal Map-Based Prox-SGD Method for Stochastic Composite Optimization

Session Time & Room : 1E (Aug.21, 17:40-19:20) @F309

Type : Contributed Talk

Abstract : In this talk, we present a novel stochastic normal map-based algorithm (nor-SGD) for nonconvex composite-type optimization problems and discuss its asymptotic convergence properties. We first analyze the global convergence behavior of nor-SGD and show that every accumulation point of the generated sequence of iterates is a stationary point almost surely and in an expectation sense. The obtained results hold under standard assumptions and extend the more limited convergence guarantees of nonconvex prox-SGD. In addition, based on the Kurdyka-Lojasiewicz (KL) framework and utilizing an adaptive time window mechanism, we establish almost sure convergence of the iterates and derive convergence rates that depend on the KL exponent and the step size dynamics. The techniques studied in this work can be potentially applied to other families of stochastic and simulation-based algorithms.

Classification : 90C06, 90C15, 90C26

Format : Talk at Waseda University

Author(s) : Andre Milzarek (The Chinese University of Hong Kong, Shenzhen) Junwen Qiu (The Chinese University of Hong Kong, Shenzhen)

[00996] A Decentralized Approach for Dynamic Graph Clustering

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G709

Type : Contributed Talk

Abstract : Interconnected networks characterized by interacting agents can be represented by weighted graphs, with the weight indicating their connection strength. Graph clustering arises naturally in these networks to assist decision making and co-ordination. Among the clustering methods, spectral clustering has emerged as a powerful tool but suffers from slow convergence for large dynamic graphs. Thus, we propose a fast incremental approach for dynamic graphs as an extension of its equivalent decentralized approach based on wave propagation.

Classification : 37Mxx, 05Cxx, 65Fxx
Format : Talk at Waseda University
Author(s) : Hongyu Zhu (Raytheon Technologies Research Center) Hongyu Zhu (Raytheon Technologies Research Center) Tuhin Sahai (Raytheon Technologies Research Center)

[00997] A Normal Map-Based Perspective on Second Order Theory for Composite Problems: Second Order Conditions, Metric Regularity, and Nonsingularity

Session Time & Room : 2C (Aug.22, 13:20-15:00) @F312

Type : Contributed Talk
Abstract : Strong metric subregularity and strong metric regularity of the natural residual and the normal map are of particular importance in the convergence analysis of first-order and second-order algorithms for composite-type optimization problems. In this talk, we characterize the strong metric subregularity of the natural residual and the normal map for a general class of nonsmooth nonconvex composite functions and establish the equivalence between these conditions, the strong metric subregularity of the subdifferential, and the quadratic growth condition. Furthermore, if the nonsmooth part of the objective function has a strictly decomposable structure, then strong metric regularity of the subdifferential is shown to be equivalent to strong metric regularity of natural residual and the normal map and to a counterpart of the so-called strong second-order sufficient conditions. Finally, we provide a link of these conditions to nonsingularity of the generalized Jacobians of the normal map and natural residual.
Classification : 47Nxx, 47Nxx, 47Nxx, 47Nxx, 47Nxx, Variational Analysis
Format : Online Talk on Zoom
Author(s) : Wenqing Ouyang (The Chinese University of HongKong(Shenzhen)) Andre Manfred Milzarek (The Chinese University of Hong Kong, Shenzhen)

[00998] An Optimal Consumption-Portfolio Strategy and Housing Choice Problem with a Loan-to-Value Ratio

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A510

Type : Contributed Talk

Abstract : This paper promotes a housing choice problem with a loan-to-value ratio by an extended dynamic programming approach. Before purchasing a house, an individual agent rents a house to live in. After purchasing a house, the agent owns a house and uses it as collateral for borrowing. One main contribution is that the loan-to-value ratio has positive effects on an individual agent's decisions both before and after the time of purchasing a house. We find that an individual agent with a higher loan-to-value ratio delays the time to buy a house and purchases a larger house. We provide closed-form solutions for each optimal policy. We also demonstrate the solutions numerically and discuss the economic implications.

Classification : 91G10

Format : Talk at Waseda University

Author(s) : Qi Li (Pusan National University) Seryoong Ahn (Pukyong National University) Ji-Hun Yoon (Pusan National University)

[00999] High-order energy stable schemes for the phase-field model by the Convex Splitting Runge-Kutta methods

Session Time & Room : 2C (Aug.22, 13:20-15:00) @E702

Type : Contributed Talk

Abstract : The Convex Splitting Runge-Kutta method is a high-order energy stable scheme for gradient flow which is a combination of the well-known convex splitting method and the multi-stage Runge-Kutta method. In this talk, we will discuss the applications and challenges of CSRK via extensive examples of the phase-field model.

Classification : 65M06, 65M12, 65M70, Phase-field model, Convex splitting method, Runge-Kutta method

Format : Talk at Waseda University

Author(s) : Jaemin Shin (Chungbuk National University) Hyun Geun Lee (Kwangwoon University) June-Yub Lee (Ewha Womans University)

[01001] Recent developments on low-discrepancy point sets for Markov chain quasi-Monte Carlo

Session Time & Room : 5B (Aug.25, 10:40-12:20) @E505

Type : Contributed Talk

Abstract : We consider the problem of estimating expectations by using Markov chain Monte Carlo methods and improving the accuracy by replacing IID uniform random points with quasi-Monte Carlo (QMC) points. In this talk, we present short-period Tausworthe generators for Markov chain QMC optimized in terms of the t-value, which is a criterion of uniformity widely used in the study of QMC methods. In addition, we show the effectiveness in some numerical examples using Gibbs sampling.

Classification : 65C10, 11K45, 65C05

Format : Talk at Waseda University

Author(s) : Shin Harase (Ritsumeikan University)

[01004] An Error Estimate for an Implicit-Upwind Finite Volume Scheme for Boussinesq Model

Session Time & Room : 2E (Aug.22, 17:40-19:20) @E702

Type : Contributed Talk

Abstract : This study contains an error estimate for a Finite Volume Method-based Implicit-Upwind scheme for the d-dimensional(d=2 or 3) Boussinesq Model, which describes several buoyancy-driven Hydrodynamic phenomena such as natural-convection in a cavity and Marsigli Flow. For each time level, the L2- norms of the error for the temperature and velocity components are found to be of order (h + k), where h is the spatial grid size and k is the time step size.

Classification : 65M08, 65M15, 65N08, 65N15

Format : Talk at Waseda University

Author(s) : Chitranjan Pandey (Indian Institute of Technology Kanpur, India) B.V. Rathish Kumar (Indian Institute of Technology Kanpur, India)

[01005] Nonlinear Disturbance Observer-Based Control Design for Markovian Jump Systems

Session Time & Room : 2C (Aug.22, 13:20-15:00) @E702

Type : Contributed Talk

Abstract : This paper addresses the anti-disturbance control problem for time-delayed Markovian jump nonlinear systems with modeled and unmodeled disturbances. Specifically, the modeled disturbance is generated by a nonlinear exogenous system and estimated using a nonlinear disturbance observer. A mode-dependent asymmetric Lyapunov-Krasovskii functional is used to derive sufficient conditions for the existence of the proposed controller and disturbance observer. A numerical example is

included to demonstrate the efficacy of the theoretical results developed.
Classification : 93D05, 93D15, 93E15, LYAPUNOV STABILITY; SYSTEMS AND CONTROL THEORY
Format : Online Talk on Zoom
Author(s) : KAVIARASAN BOOMIPALAGAN (CHUNGBUK NATIONAL UNIVERSITY) OH-MIN KWON (CHUNGBUK NATIONAL UNIVERSITY)

[01006] VMS-based Stabilized FE Analysis of Time-dependent Coupled Unified Stokes-Brinkman-Transport Model

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E604

Type : Contributed Talk
Abstract : We present a Variational Multi-Scale (VMS)-based stabilized FE analysis for completely unified unsteady Stokes-Brinkman model with standard continuity and Beavers-Joseph-Saffman interface conditions, strongly coupled with transient transport equation. The fluids viscosities depend on the solute concentration. A simplified algebraic subgrid multiscale approach with time-dependent sub-scales is employed. A fully-implicit Euler scheme is used for time-discretization. We analyse the stability and convergence properties of the method. Appropriate numerical experiments are conducted to verify the methods credibility.
Classification : 65M12, 65M22, 65M60
Format : Online Talk on Zoom
Author(s) : Manisha Chowdhury (Indian Institute of Technology Jodhpur) B.V. Rathish Kumar (Indian Institute of Technology Kanpur)

[01007] Stability & Accuracy of Free-Parameter Multistep Methods for 1st & 2nd-order IVPs

Session Time & Room : 2E (Aug.22, 17:40-19:20) @E505

Type : Contributed Talk
Abstract : Dahlquist's First Stability Barrier limits the order of stable k-step multistep methods, allowing us to add free parameters. Within the parameter domain where a k-step family of methods is stable, we explore the parameters' effect on error and stability domains. For first-order IVP's, we investigate explicit methods for $k=2,3$ and implicit methods for $k=3,4$, generalizing Adams & BDF methods. For second-order IVP's, we analyze explicit and implicit methods for $k=3,4$, generalizing Strmer & Cowell methods.

Classification : 65L06, 65L07, 65L20

Author(s) : Michelle Ghrist (Gonzaga University) Ben Lombardi (Gonzaga University) Alana Marie Dillinger (Twin Cities in Motion)

[01008] EID estimator-based Control Design for Singular Polynomial Fuzzy Systems

Session Time & Room : 2D (Aug.22, 15:30-17:10) @A201

Type : Contributed Talk

Abstract : This paper studied the disturbance rejection problem for singular polynomial fuzzy system based on equivalent-input-disturbance-estimator-based control approach. The proposed approach is used to compensate the influences of unknown lumped disturbance. To cope the robust stability problems, the augmented closed-loop system is constructed that includes dynamics of the system, observer, and low-pass filter. Lyapunov stability theory is used to develop stability conditions for the resulting system. Finally, numerical examples are provided to validate the theoretical result.

Classification : 93D09, 93D15, 93D25, Robust stability, Lyapunov stability theory, Stabilization of systems by feedback

Format : Online Talk on Zoom

Author(s) : Selvaraj Palanisamy (Chungbuk National University) Kwon Oh-Min (Chungbuk National University)

[01009] A phase transition of various retention rules from multivariate analysis for big datasets.

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E501

Type : Industrial Contributed Talk

Abstract : Estimating the number of significant components(factors, resp.) from principal component analysis(explanatory factor analysis, resp.) in datasets of finance/biology is essential. However, statistical software's default estimation method behaves pathologically for big datasets. We analyze the phase transition of the default rule as to the intra-class correlation of various data-generation models, and introduce a more acceptable estimation by random matrix theory for large sample correlation matrices. We also compare our rule to retention rules proposed to date.

Classification : 60F15, 62H25

Format : Online Talk on Zoom

Author(s) : Atina Husnaqilati (Mathematics Department, Universitas Gadjah Mada)
Yohji Akama (Mathematical Institute, Tohoku University)

[01010] Superconvergent Scheme for a System of Green Fredholm Integral Equations

Session Time & Room : 1E (Aug.21, 17:40-19:20) @G401

Type : Contributed Talk

Abstract : In this study, we consider a system of second kind linear Fredholm integral equations with Greens type kernel function. We propose a piecewise polynomial based Galerkin and iterated Galerkin methods to solve the integral model. We carry out the convergence and error analysis for the proposed methods and establish the superconvergence results for iterated Galerkin method. The theoretical results are supported by numerical tests.

Classification : 34A12, 45F15

Format : Talk at Waseda University

Author(s) : Rakesh Kumar (Indian Institute of Technology, Kanpur (India)) Kapil Kant (Indian Institute of Technology, Kanpur (India)) B.V. Rathish Kumar (Indian Institute of Technology, Kanpur (India))

[01012] Uncertainty and disturbance estimator design for interval type-2 fuzzy systems

Session Time & Room : 2C (Aug.22, 13:20-15:00) @E702

Type : Contributed Talk

Abstract : This article investigates the uncertainty and disturbance estimator-based control problem for the interval type-2 fuzzy systems. By designing the appropriate filter, the proposed control designs can estimate system uncertainties and external disturbances accurately. By using the Lyapunov-Krasovskii stability theorem, the required stability conditions and the control gain matrices for the system under consideration are obtained. Finally, an illustrative example is demonstrated to verify the feasibility of the proposed control method.

Classification : 93D05, 93D09, 93D15, Lyapunov Stability, Systems and Control Theory, Fuzzy Systems

Format : Online Talk on Zoom

Author(s) : KAVIKUMAR RAMASAMY (CHUNGBUK NATIONAL UNIVERSITY) KWON OH-MIN (CHUNGBUK NATIONAL UNIVERSITY)

[01013] Satellite Data Assimilation through Community Land Model to improve Rice Crop Dynamics

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D402

Type : Industrial Contributed Talk
Abstract : The aim of the proposed talk is to discuss evaluation of existing form of Dynamic Generalized Vegetation Model (DGVM) of Community Land Model (CLM) in terms of its bio-geophysics and processes for major agro-ecosystems such as in rice-rice crop rotation in India. Development of new crop-specific growth modules to bring out new version of DGVM suitable for Indian sub-tropics will be explored. This will be followed by its evaluation with respect to surface fluxes. The new modelling system will represent explicit crop growth processes in a terrestrial ecosystem model operable in a stand-alone mode or embedded in a climate model equipped with satellite remote sensing-based data assimilation for large-area prediction of intra-seasonal and inter-annual variability of crop phenology, growth, yield and fluxes of energy, moisture and carbon in the rice based systems at regional scale.
Classification : 76-10, 93-10, 68-XX
Format : Talk at Waseda University
Author(s) : Mahesh Kumar (Sardar Vallabhbhai National Institute of Technology, Surat, India) Ranjan Kumar Jana (Sardar Vallabhbhai National Institute of Technology, Surat, India)

[01014] Fault detection asynchronous filter design for Markovian jump fuzzy systems under cyber attacks

Session Time & Room : 2C (Aug.22, 13:20-15:00) @E702

Type : Contributed Talk
Abstract : This work is concerned with the issue of fault detection asynchronous filter design for a class of discrete-time
Markovian jump fuzzy systems with cyber attacks. Precisely, the cyber attacks phenomenon in the network environment satisfies the Bernoulli distribution. Finally, the applicability and usefulness of the proposed filter design method is verified through a practical example.
Classification : 93D05, 93D09, 93D20, Lyapunov Stability of control systems
Format : Online Talk on Zoom

Author(s) : Sakthivel Ramalingam (Chungbuk National University) Oh-Min Kwon (Chungbuk National University)

[01015] VMSFE Analysis of Transient MHD-NS Flow

Session Time & Room : 2E (Aug.22, 17:40-19:20) @E702

Type : Contributed Talk

Abstract : In this work, a thorough investigation of the transient magnetohydrodynamic Navier-Stokes (MHD-NS) equations is carried out applying variational multiscale stabilized finite element (VMSFE) technique. The convergence characteristics of VMSFE scheme (Apriori Estimate) has been derived in this study. The VMSFE method's credibility is stablished by numerical experiments on multiply driven cavity flow. The flow pattern is traced for various Hartmann, Reynolds, and magnetic force inclination angle values.

Classification : 65L60, 65K15

Format : Talk at Waseda University

Author(s) : Anil Rathi (Indian Institute of Technology, Kanpur (India)) B.V. Rathish Kumar (Indian Institute of Technology, Kanpur (India)) Dipak Kumar Sahoo (Indian Institute of Technology, Kanpur)

[01016] Approximate formula for indefinite convolutions by the DE-Sinc method

Session Time & Room : 4C (Aug.24, 13:20-15:00) @E704

Type : Contributed Talk

Abstract : Approximate formula for indefinite convolutions by means of the Sinc approximation has been proposed by Stenger. The formula is based on his Sinc indefinite integration formula combined with the single-exponential transformation. Recently, the Sinc indefinite integration formula was improved by replacing the single-exponential transformation with the double-exponential transformation. Based on the improved formula, this study proposes a new approximate formula for indefinite convolutions.

Classification : 65D05, 65D15, 65D30, 65D32

Format : Online Talk on Zoom

Author(s) : Tomoaki Okayama (Hiroshima City University)

[01018] VMS Stablized FEA of M-NS Equations For Nano Thermal Fluid

Session Time & Room : 5B (Aug.25, 10:40-12:20) @E703

Type : Contributed Talk

Abstract : In this paper, we present a variable multiscale stabilised finite element metthod for NS equations with
thermal transport for hybrid nano fluid flow. In particular algebraic approach of approximating the
subscales has been considered and then the stabilization parameters are derived using Fourier analysis.
Following that, we have derived an apriori error estimates. Also we have analysed the flow, velocity,
pressure and temperature distribution over the bench mark problems viz. Multiply driven cavity flow.

Classification : 65M60, 65M15, 65M22

Author(s) : Dipak Kumar Sahoo (Indian Institute of Technology, Kanpur) B. V. Rathish Kumar (Indian Institute of Technology, Kanpur) Anil Rathi (Indian Institute of Technology, Kanpur)

[01019] Particle Swarm Optimization Based Reliable Control Algorithm for Wireless Networks

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E804

Type : Contributed Talk

Abstract : This paper deals with the fault-tolerant control problem for Wireless networks based on the particle swarm optimization method. To cope the stability and fault-tolerants simultaneously, a novel fault-tolerant control algorithm is developed. The required conditions of the addressed system are developed with the aid of Lyapunov stability theory. Precisely, the particle swarm optimization algorithm is implemented to optimize the fuzzy controller. Finally, simulation results are provided to demonstrate the effectiveness of the obtained results.

Classification : 68M07, 68M12, 68M15

Format : Online Talk on Zoom

Author(s) : Ponnarasi Loganathan (Bharathiar University) Pankajavalli PB (Bharathiar University)

[01021] A mixed finite element approach to a non-isothermal flow vegetation model

Session Time & Room : 2D (Aug.22, 15:30-17:10) @D404

Type : Contributed Talk
Abstract : We consider a vegetation root-soil model which couples Richards PDE in the soil domain and saturated flow in the roots domain. Scenarios when the flow depends on soil temperature is included. A mixed finite element method is applied to obtain numerical solutions, and the well-posedness for its weak formulation and error estimates are studied. We provide numerical examples using tomography data of root domains and study convergence errors to validate our theoretical results.
Classification : 76Sxx, 65Mxx
Format : Talk at Waseda University
Author(s) : Malgorzata Peszynska (Oregon State University) Nachuan Zhang (Oregon State University)

[01025] EXISTENCE OF OPTIMAL CONTROL FOR TIME VARYING STOCHASTIC DIFFERENTIAL EQUATIONS

Session Time & Room : 1E (Aug.21, 17:40-19:20) @F401

Type : Contributed Talk
Abstract : The work deals with the control problem for linear stochastic time varying system driven by square integrable stochastic process with zero mean and continuous sample paths. The cost functional is considered to be quadratic in the system state and the control. The completion of squares technique is used to establish the existence of optimal control under the family of non-adapted admissible control.
Classification : 49N05, 49N10, 93C05, 93C40
Format : Online Talk on Zoom
Author(s) : Murugan Suvinthra (Bharathiar University)

[01027] A Discussion on Numerical Methods to Solve Structural Engineering Problems

Session Time & Room : 5C (Aug.25, 13:20-15:00) @E812

Type : Contributed Talk

Abstract : A number of numerical methods are developed by researchers to solve the linear/nonlinear, ordinary differential equations (ODEs) / partial differential equations (PDEs) developed for structural analysis such as vibration/bending/buckling/wave-propagation analysis in plates. The present talk is focused on a discussion of numerical approaches and their accuracy and convergence for plate vibrations i.e., linear PDE which can be extended as semi-analytic approaches to solving the nonlinear PDE during critical vibration analysis of plates.

Classification : 74H15, 74S25, 74G15

Format : Talk at Waseda University

Author(s) : Rahul Saini (H N B Garhwal Central University, Srinagar, Uttarakhand, India)

[01032] Memory event-triggered finite-time fault control for neural networks system

Session Time & Room : 1E (Aug.21, 17:40-19:20) @F401

Type : Contributed Talk

Abstract : By wielding METS, this topic explores finite-time issue for neural networks comprise to actuator failures and deception attack. By engaging Lyapunov function and integral inequality technique, sufficient conditions in the structure of linear matrix inequality assures the asymptotic mean-square finite-time boundedness of the considered model. Ultimately, the capability of the proposed control design is demonstrated through two numerical examples.

Classification : 93-XX

Format : Online Talk on Zoom

Author(s) : Karthick SA (National Tsing Hua University) Bor-Sen Chen (National Tsing Hua University)

[01033] Convective instabilities in vertical porous media

Session Time & Room : 5C (Aug.25, 13:20-15:00) @D101

Type : Contributed Talk

Abstract : Stability of natural convection in vertical porous slabs is of significant importance due to its applications in several natural and industrial settings building insulation involving an unventilated air gap and for breathing walls is one of them. In this talk, we will discuss natural convection in a vertical porous slab with a differential temperature between the vertical

walls. We show that a temperature-dependent thermal diffusivity/dynamic viscosity plays an important on the convective stability.

Classification : 76E06, 76S99, 76R50

Author(s) : Satyajit Pramanik (Indian Institute of Technology Guwahati)

[01034] Machine Learning for Two-stage Robust Optimization

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A201

Type : Contributed Talk

Abstract : When dealing with problems under uncertainty, two-stage robust optimization is one of the key approaches: you obtain an optimal robust solution, and adapt to the real scenario. However, these problems are one of the hardest optimization problem classes. To accelerate finding high-quality solutions, we propose a machine learning-based strategy. We experimentally show that with using our strategy you can train based on small problems, and apply them to bigger problems, while still getting good results.

Classification : 90C17, 90C90

Format : Talk at Waseda University

Author(s) : Esther Julien (Delft University of Technology) Krzysztof Postek (Delft University of Technology) Ilker Birbil (University of Amsterdam)

[01035] Reinforcement learning-based routing strategy in IoT applications using MDC

Session Time & Room : 2E (Aug.22, 17:40-19:20) @E803

Type : Contributed Talk

Abstract : WSNs and IoT devices consume more power for data transmission. To reduce energy consumption, most of the traditional learning methodologies need enormous volumes of data and feature engineering, thus raising the learning complexity. A reliable reinforcement learning-based MDC model for effective routing is proposed to lower the learning complexity. Furthermore, the Q-Learning methodology is used to enhance learning along the shortest path. Combining these techniques can improve network stability while also enhancing routing performance significantly.

Classification : 68T01, 68T07, 68T35, Reinforcement learning, Machine Learning

Format : Talk at Waseda University

Author(s) : Muralitharan Krishnan (Sungkyunkwan University) Yongdo Lim (Sungkyunkwan University)

[01038] Study of transitional stresses in rotating disc of materials with different Poisson Ratio under varying temperature

Session Time & Room : 5D (Aug.25, 15:30-17:10) @F312

Type : Contributed Talk

Abstract : The present paper is devoted to a study of stress distribution in rotating disc of different materials with variable Poisson ratio. Seths transition theory is applied to the problems of elastic-plastic stresses in a rotating disc.Yield criteria and the associated flow rule are not taken into consideration for this study that forms the bases for the development of many researchers investigation. The obtained results allied in the direction of rotating disc made of an incompressible materials required higher angular speed for initial yielding as compared to disc made of gold, nickel and cast iron. At the internal surface of the compressible materials however, the circumferential stresses are showing higher values as compared to incompressible materials i.e. gold, nickel and cast iron required maximum circumferential stresses as compared to rubber material (incompressible). Also rotating disc required maximum stresses for the fully plastic state as compared to the initial yielding state.

Classification : 74A10, 74B05, 74B10, 74B15, 74C05

Format : Online Talk on Zoom

Author(s) : Jatinder Kaur (Chandigarh University Mohali , Chandigarh) Sonia - (Chandigarh University Mohali , Chandigarh) Nikita Madaan (Chandigarh University)

[01039] A model of cerebrospinal fluid flow in the cranial subarachnoid space

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D404

Type : Contributed Talk

Abstract : Cerebrospinal fluid fills the subarachnoid space (SAS), which covers the spinal cord and the brain. During the cardiac cycle, it pulsates due to time-varying brain displacements. In this work, we study oscillating and steady streaming flow in cranial SAS in order to understand the mixing processes and waste clearance. We develop a theoretical model of the flow using lubrication theory. The model suggests that steady streaming plays an important role in mixing.

Classification : 76Z05
Format : Talk at Waseda University
Author(s) : Mariia Dvoriashyna (University of Oxord) Alain Goriely (University of Oxford)

[01041] Dynamical Behaviours of a Stochastic Leptospirosis Model with Saturated Incidence Rate

Session Time & Room : 1E (Aug.21, 17:40-19:20) @G402

Type : Contributed Talk
Abstract : Leptospirosis is a zoonotic bacterial disease that is endemic and having high incidence rate in tropical and subtropical regions especially after flooding or heavy rainfall. The objective is to investigate the asymptotic behaviour of a stochastic Leptospirosis model with saturated incidence rate in terms of basic reproduction number using Lyapunov functions. As a first step, a biologically well-posed model perturbed by multiplicative Gaussian noise will be proposed. The existence of a stationary distribution and the ergodicity of solutions of the proposed model will also be established.
Classification : 34D05, 34K50, 60H10, 60J65
Format : Talk at Waseda University
Author(s) : SELSHA S (Research Scholar, Govt College Chittur)

[01042] Preconditioners of Reduced Dimension for Vector Field Problems

Session Time & Room : 2D (Aug.22, 15:30-17:10) @E505

Type : Contributed Talk
Abstract : When designing preconditioners based on domain decomposition methods, the coarse space
plays a key role. In order to keep the scalability, the coarse space of low computational complexity
is essential. We introduce a new coarse space of reduced dimension for vector field
problems. Numerical results for the problems in three dimensions are also presented.
Classification : 65F08, 65F10, 65N30, 65N55
Format : Talk at Waseda University
Author(s) : Duk-Soon Oh (Chungnam National University)

[01044] Nonlinear SPDE models of particle systems

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E502

Type : Contributed Talk

Abstract : Interacting particle systems provide flexible and powerful models that are useful in many application areas. However, particle systems with large numbers of particles are very complex. Therefore, a common strategy is to derive effective equations that describe the time evolution of the empirical particle density.
Our aim is to consider non-Gaussian models that provide approximation of the Dean-Kawasaki equation. This is the joint work with Kremp and Perkowski.

Classification : 60H15, 35Q83, 65M08

Format : Talk at Waseda University

Author(s) : Ana Djurdjevac (Freie Universitt Berlin)

[01045] Advances on intimate partner femicide applying machine learning techniques and algorithms

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E803

Type : Contributed Talk

Abstract : Intimate partner femicide (IPF) is females leading cause of violent death worldwide. The accuracy of existing risk assessment instruments for IPF developed by conventional statistics is not completely competitive. In this study, machine learning techniques and algorithms for classification were used to discriminate between lethal or non-lethal violence against women by intimate partners and to detect which variables discern them the most. The obtained evidenced-based knowledge could assist professionals in predicting and preventing lethality.

Classification : 68Txx

Author(s) : Esperanza Garcia-Vergara (Universidad Loyola Andalucia) Carlos Fresneda-Portillo (Universidad Loyola Andaluca (Spain))

[01046] Flow past a mounted wedge: The three fold structure

Session Time & Room : 2C (Aug.22, 13:20-15:00) @D401

Type : Contributed Talk

Abstract : This talk is concerned with the simulation of flow past a wedge mounted on a wall for channel Reynolds number $Re_c = 6873$ in accelerated flow medium. All three stages of vortex shedding for the accelerated flow, leading to the exceedingly intricate three-fold structure has been captured very accurately. Transition to turbulence have also been resolved which is indicated by the existence of coherent structures.

Classification : 76D05, 76D17, 65M06

Format : Talk at Waseda University

Author(s) : Jiten C Kalita (Indian Institute of Technology Guwahati)

[01047] Large Deviations for Two-Dimensional Stochastic Tidal Dynamics Equations driven by Levy Noise

Session Time & Room : 3C (Aug.23, 13:20-15:00) @G703

Type : Contributed Talk

Abstract :

The objective is to establish a Wentzell-Freidlin type large deviation principle (LDP) for solution of stochastic tidal dynamics equations driven by Levy Noise. The LDP is equivalent to the Laplace principle in a Polish space. The solution space of the considered equation is Polish. Hence Laplace principle will be established for the stochastic tidal dynamics equations using weak convergence approach for non-negative functionals of a general Poisson random measure and Brownian motion.

Classification : 35Q35, 60H15, 60G65, 60F10

Format : Talk at Waseda University

Author(s) : HASEENA A (Assistant Professor, Government College Chittur)

[01048] Analysis of a PoissonNernstPlanckFermi model for ion transport in biological channels and nanopores

Session Time & Room : 1D (Aug.21, 15:30-17:10) @A208

Type : Contributed Talk

Abstract : We analyse a Poisson-Nernst-Planck-Fermi model to describe the evolution of a mixture of finite size ions in liquid electrolytes, which move through biological membranes or nanopores. The global-in-time existence of bounded weak solutions and the weak-strong uniqueness result are proved, via entropy and relative entropy, respectively. Furthermore, an implicit Euler finite-volume scheme for the model is analysed and some simulations are shown.

Classification : 35-XX, Mathematical and numerical analysis of cross-diffusion system via entropy and relative entropy

Format : Online Talk on Zoom

Author(s) : Annamaria Massimini (TU Wien) Ansgar Jngel (TU Wien)

[01051] Moderate Deviations for Shell Model of Turbulence

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E501

Type : Contributed Talk

Abstract : This work establishes the central limit theorem and moderate deviation principle for stochastic shell model of turbulence driven by multiplicative noise. The method of weak convergence introduced by Budhiraja and Dupuis has been followed in order to establish our results. The equivalence of Laplace principle and large deviation principle under Polish spaces contributes to reduce the complexity.

Classification : 60F05, 60H15

Format : Online Talk on Zoom

Author(s) : Sridevi C.S. (Bharathiar University, Coimbatore, Tamil nadu)

[01052] Large systems of linear equations in particle transport problems

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E603

Type : Contributed Talk

Abstract : This work discusses solutions of large linear systems of algebraic equations relevant to establish a solution to the discrete ordinates approximation of the two-dimensional linear Boltzmann equation. Direct and iterative methods are investigated, along with domain decomposition techniques and parallel implementation. The type of the quadrature scheme describing the directions and the class of problems to be solved, neutron or radiation problems, directly affect the final choice of the numerical algorithm.

Classification : 65F22, 65F05, 65F10, 65MXX

Format : Talk at Waseda University

Author(s) : Rudnei Dias da Cunha (Universidade Federal do Rio Grande do Sul) Liliane Basso Barichello (Universidade Federal do Rio Grande do Sul)

[01053] Radial Basis for Solving high-dimensional PDEs in Option Pricing

Session Time & Room : 1C (Aug.21, 13:20-15:00) @

Type : Contributed Talk

Abstract : A Radial Basis Function is used to solve the partial differential equations arising for option pricing problems in very high dimension. For such problems, classical grid-based finite-difference approaches fail to give any numerical solution as the memory requirements grow exponentially with the number of dimensions. Our numerical results are compared to both analytical solutions as well as Monte Carlo Simulations to demonstrate the efficiency of the proposed radial basis approximation.

Classification : 65D12, 35R10, 91G20

Author(s) : Dsir Yannick TANGMAN (University of Mauritius)

[01056] Statistical methodology for functional meta-analysis of sex-based disparities in neurological diseases

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E501

Type : Industrial Contributed Talk

Abstract : Sex-based differences in diverse health scenarios and diseases have been acknowledged for many years but still not thorough-fully analysed. We propose a statistical methodology combining transcriptomics data from different spurces which allows to unveil those disparities at the level of

differentially expressed genes and differentially enriched functions. The methodology uses linear models, meta-analysing the results through the logFC, and has been successfully applied to various diseases such as Multiple Sclerosis, Alzheimers and Parkinsons diseases.
Classification : 62-xx, 62Pxx, 92-04, 92-08, 92-10
Format : Talk at Waseda University
Author(s) : Marta R. Hidalgo (CIPF) Francisco Garcia-Garcia (CIPF) Borja Gomez-Cabaes (CIPF) Carla Perpia-Clerigues (CIPF) Irene Soler-Saez (CIPF) Fernando Gordillo-Gonzlez (CIPF) Gonzalo Anton-Bernat (Universitat de Valncia) Adolfo Lpez-Cerdan (BioBam) Rubn Grillo-Risco (CIPF) Jose Francisco Catal-Senent (INCLIVA)

[01059] EVENT-TRIGGERED CONTROL FOR PARABOLIC PARTIAL DIFFERENTIAL EQUATIONS WITH CYBER-ATTACKS

Session Time & Room : 2D (Aug.22, 15:30-17:10) @A201

Type : Contributed Talk
Abstract : An event-triggered control for parabolic-type partial differential equations subject to disturbances and cyber-attacks is addressed in this talk. To attenuate the disturbances an H performance is considered. By designing an appropriate Lyapunov-Krasovskii functional the stabilization conditions for the considered parabolic type partial differential equations are obtained in the form of linear matrix inequalities. Finally, a numerical example is provided to verify the efficiency of the derived theoretical results.
Classification : 93D05, 93D09, 93D15, Lyapunov Stability, event-triggered control
Format : Online Talk on Zoom
Author(s) : Parivallal Arumugam (Sungkyunkwan University)

[01061] Computation of control for fractional nonlinear systems using Tikhonov regularization

Session Time & Room : 5C (Aug.25, 13:20-15:00) @A207

Type : Contributed Talk
Abstract : Determining the control steering the dynamical system is equally important as it is to examine the controllability of a control system. This study computes the control for the approximately controllable nonlinear system governed by Caputo derivatives. By using operator theoretic formulations, the problem of computing the control gets converted into an ill-

posed problem which is solved for stable approximations using Tikhonov regularization. An example is presented demonstrating the error and truncated control graphs using MATHEMATICA.

Classification : 93B05, 93C10, 47A52, 34K37
Format : Talk at Waseda University
Author(s) : Lavina Sahijwani (Indian Institute of Technology Roorkee, India) N. Sukavanam (Indian Institute of Technology Roorkee, India) D. N. Pandey (Indian Institute of Technology Roorkee, India)

[01067] Stoneley wave propagation at the interface between two initially stressed medium with interface energy

Session Time & Room : 5C (Aug.25, 13:20-15:00) @E812

Type : Contributed Talk
Abstract : The present study investigates the propagation of Stoneley waves at interface of two distinct imperfectly bonded solid half-spaces considering strain and kinetic energies localized at interface. GurtinMurdoch (1975) and Eremeyev (2016) approaches are used to derive interface strain energy density, stress tensor, kinetic energy density accounting for non-perfect interface. Comparative analysis of dispersion curves is done numerically and presented through graphs. The findings have applications in geosciences for non-destructive characterization of thin inter-phases between solids.
Classification : 74H10, 74B05
Format : Online Talk on Zoom
Author(s) : Arindam Nath (Department of Mathematics, School of Sciences, NIT Andhra Pradesh, India) Sudarshan Dhua (Department of Mathematics, School of Sciences, NIT Andhra Pradesh, India)

[01068] Reverse engineering controller area network using the Pearson correlation coefficient

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E505

Type : Industrial Contributed Talk
Abstract : Controller Area Network (CAN) is a communication bus widely adopted in road vehicles. However, car manufacturers adopt proprietary CAN message sets, complicating message decoding by third-party applications, e.g., for indirectly detecting adverse road-weather conditions. This talk presents an algorithm for reverse engineering CAN messages based on the Pearson

correlation coefficient between CAN messages from an annotated and interpolated dataset. The proposed algorithm was experimentally validated with data collected from different vehicle brands.

Classification : 62P30, 68P20, 62-04

Format : Talk at Waseda University

Author(s) : David Rocha (Instituto de Telecomunicacoes, Universidade de Aveiro) Joo Almeida (Instituto de Telecomunicaes, Universidade de Aveiro) Jos Fonseca (Instituto de Telecomunicaes, Universidade de Aveiro) Joaquim Ferreira (Instituto de Telecomunicaes, Universidade de Aveiro)

[01069] Global existence and stability of three species predator-prey system with prey-taxis

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G702

Type : Contributed Talk

Abstract : In this paper, we study the initial-boundary value problem of a three species predator-prey system with prey-taxis which describes the indirect prey interactions through a shared predator in a bounded domain $\Omega \subset \mathbb{R}^n (n\geq 1)$with smooth boundary and homogeneous Neumann boundary conditions. The model parameters are assumed to be positive constants. We first prove the global existence of classical solutions under suitable assumptions on the prey-taxis coefficients χ_1,χ_2 and d. Moreover, we establish the global stability of the prey-only state and coexistence steady states by using Lyapunov functionals and LaSalle's invariance principle.

Classification : 35A01, 35B35, Partial differential equations and Mathematical Biology (To prove Global existence and stability for chemotaxis systems and predator-prey systems)

Format : Talk at Waseda University

Author(s) : GURUSAMY ARUMUGAM (The Hong Kong Polytechnic University)

[01073] About reaction-diffusion systems with exponential growth: Numerical study

Session Time & Room : 4D (Aug.24, 15:30-17:10) @G602

Type : Contributed Talk

Abstract : The modeling and mathematical analysis of concrete phenomena are of great interest to better understand our environment and its evolution. Several analogies between chemistry and biological systems have led researchers to introduce mathematical models of "reaction-diffusion", whose

objective is to follow the evolution of the quantities interacting during the process. In this talk, we are interested in reaction-diffusion systems with exponential growth, modeling an irreversible chemical reaction.
Since the 86's, considerable efforts have been devoted to the study of this systems. We provide a general overview of the different theoretical results obtained, as well as our investigation from a numerical point of view on open cases.

Classification : 35K57, 35K58, 80A25, 80A19

Author(s) : Rajae Malek (Moulay Ismail University, Meknes, Morocco)

[01075] Implementation of Mathematical Proof and Argumentation Learning Activities in Langsa

Session Time & Room : 3E (Aug.23, 17:40-19:20) @D514

Type : Industrial Contributed Talk

Abstract : This study aims to implement learning designs for mastering mathematical proof and argumentation abilities in pre-service mathematics teachers enrolling in one public university in Langsa City, Aceh, Indonesia. Learning activities consist of four core stages, i.e., proofreading, writing resumes, exercises in proving, then reflection and evaluation. The results demonstrated an increase in students' mathematical proof and argumentation abilities from mediocre to excellent.

Classification : 97Dxx, 97Hxx, 97Ixx, 97Exx

Format : Talk at Waseda University

Author(s) : Iden Rainal Ihsan (Universitas Samudra) Natanael Karjanto (Sungkyunkwan University) Guntur Maulana Muhammad (Universitas Samudra)

[01078] DNN-based hybrid ensemble learning strategy for XSS detection and defense

Session Time & Room : 2E (Aug.22, 17:40-19:20) @E803

Type : Contributed Talk

Abstract : Due to the high level of intelligence displayed by attackers, existing web-based security applications have failed. When attackers make changes to an organization's data, it is one of the most dangerous attacks (XSS). Combining ML and DL frameworks is proposed as a way to detect and defend against XSS assaults with high accuracy and efficiency. Using this representation, a new method is developed for integrating stacking ensembles into web-based software, which is called "hybrid stacking".

Classification : 68T01, 68T05, 68T07, Machine Learning, Deep Learning

Format : Online Talk on Zoom

Author(s) : Seethalakshmi Perumal (MIT Campus, Anna University - Chennai)

[01079] Higher order numerical scheme to approximation generalized Caputo fractional derivatives and its application

Session Time & Room : 2C (Aug.22, 13:20-15:00) @G710

Type : Contributed Talk

Abstract : In this paper, a high-order numerical scheme is established to approximate the generalized Caputo fractional derivative using Lagrange interpolation formula. Order of convergence for this scheme is obtained as (4), where (0, 1) is the order of generalized Caputo fractional derivative. The local truncation error of the approximation is also obtained. Further, the developed scheme is used to solve the generalized fractional advection-diffusion equation. Stability and convergence are also discussed for the difference scheme. In the last, numerical examples are discussed to illustrate the theoretical results.

Classification : 35R11, 26A33, 65R10

Format : Online Talk on Zoom

Author(s) : Sarita kumari (Indian Institute of technology (Banaras Hindu University)) Dr. Rajesh Kumar Pandey (Indian Institute of Technology (BHU) Varanasi)

[01080] About Thermistor Problem: numerical study using Discrete Duality Finite Volume

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G602

Type : Contributed Talk

Abstract : We propose a DDFV for a coupled nonlinear parabolic-elliptic equations. The system is known as a generalization of the Thermistor problem which models a temperature dependent electrical resistor.

We first establish some a prior estimates satisfied by the sequences of approximate solutions. Then, it yields the compactness of these sequences. Passing to the limit in the numerical scheme, we finally obtain that the limit of the sequence of approximate solutions is a weak solution to the problem under study.

Classification : 35M30, 35K92, 35J46, 65N08
Author(s) : Manar Lahrache (Moulay Ismail University, Faculty of Science, Meknes, Morocco)

[01082] Analysis of traffic flow models by triangulation of min-plus matrices

Session Time & Room : 2E (Aug.22, 17:40-19:20) @G305

Type : Contributed Talk
Abstract : Cellular automata model for traffic flow can be described in terms of min-plus linear systems. In this talk, we focus on the triangulation of a min-plus matrix, which is defined based on the roots of characteristic polynomial and the algebraic eigenvectors associated with the roots. It plays an important role in the analysis of the asymptotic behavior of the model. Further the algebraic eigenvectors are shown to give us preferable initial states.

Classification : 15A80, 37B15, 76A30
Format : Talk at Waseda University
Author(s) : Yuki Nishida (Tokyo University of Science) Sennosuke Watanabe (The University of Fukuchiyama) Yoshihide Watanabe (Doshisha University)

[01083] The existence and the numerical approximation to a nonlinear coupled system in anisotropic Orlicz-Sobolev spaces

Session Time & Room : 3C (Aug.23, 13:20-15:00) @G601

Type : Contributed Talk
Abstract : We study the existence of a capacity solution for a nonlinear elliptic coupled system
in anisotropic Orlicz-Sobolev spaces. The unknowns are the temperature inside a semiconductor material, and the electric potential. This system may be considered as a generalization of the steady-state thermistor problem. The numerical solution is also analyzed by means of the least squares method in combination with a conjugate gradient technique.
Classification : 35J70, 35J66, 35K61, 46E30, 65N22
Format : Online Talk on Zoom
Author(s) : Hakima Ouyahya (Moulay Ismail University)

[01090] A high order approximation scheme for non-linear time fractional reaction-diffusion equation

Session Time & Room : 3D (Aug.23, 15:30-17:10) @G402

Type : Contributed Talk

Abstract : We discuss a high order numerical scheme for the non-linear time fractional reaction-diffusion equation of order $\alpha\in (0, 1)$. A cubic approximation and compact finite difference schemes are used to approximate the time-fractional and spatial derivatives respectively. The numerical scheme achieves convergence rate of order $4-\alpha$ in the temporal direction and 4 in the spatial direction. Further, numerical experimentation is performed to demonstrate the authenticity of the proposed numerical scheme.

Classification : 26A33, 35R11, 35A35

Format : Online Talk on Zoom

Author(s) : Rajesh Kumar Pandey (Indian Institute of Technology (BHU) Varanasi) Deeksha Singh (Indian Institute of Technology (BHU) Varanasi)

[01091] Nonlinear effects of neighborhood influence over college education, and social mobility

Session Time & Room : 3C (Aug.23, 13:20-15:00) @G402

Type : Industrial Contributed Talk

Abstract : This contagion-effect model studies the impact of environmental factors on upward social mobility, where the educational environment is measured by the proportion of college-educated individuals, and social mobility is measured by a change in the proportion of people in different income classes. The dynamics of the educational environment are modeled using a modified version of the invasion/extinction ecological model of Richard Levins. In addition, the model adapts a version of a SIR-type model to capture the nonlinear effects of the influence of the environment. The educational environment influences the educational choices of poor people, becoming effective only after a threshold point is reached. The growth rate in influence is modeled using a monotonically increasing saturation function, which includes a delay parameter referred to as handling time, that measures the speed of influence generated by educated, successful individuals. The simulations indicate that poor individuals choose to become educated at a rate that primarily depends on the density of educated people acting as role

models in the local environment. (This research has been peer-reviewed, accepted, and published by the Socio-Economic Planning Sciences Journal under the name "Neighborhood effects, college education, and social mobility," and all the authors are aware of the submission. This research is expected to contribute to studying the nonlinear dynamical effects of changing environments over socio-economic outcomes).

Classification : 34-11, 37N40, 92B05

Author(s) : Cesar Montalvo (University of Virginia)

[01094] Variational iteration Method for Shallow Water Waves

Session Time & Room : 4E (Aug.24, 17:40-19:20) @D401

Type : Contributed Talk

Abstract : Variational iteration method, VIM, is employed to solve analytic solutions of shallow water wave equations. For its linearized models we compute a periodic numerical example, and a symbolic one with unprescribed initial conditions and parameters. Both examples are found their explicit exact solutions by VIM. Then we turn to some nonlinear models and obtain their highly accurate approximate solutions. We concluded that VIM is very effective for shallow water wave problems and other nonlinear PDEs.

Classification : 76M30, 35F55, 35C05, 35C10, shallow water wave

Format : Talk at Waseda University

Author(s) : Tzon-Tzer Lu (Department of Applied Mathematics, National Sun Yat-sen University)

[01096] Stability modulationby a reaction in Navier-Stokes flow

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E817

Type : Contributed Talk

Abstract : Channel/pipe flows mathematically modeled by the Navier-Stokes equation can be stabilized or destabilized by a slight viscosity stratification. We perform linear stability analysis (LSA) and non-linear simulation (NLS) for such flow, where a reaction changes the viscosity. The analysis involves a WENO-based diffuse-interface method for NLS and the Chebyshev spectral method for LSA. This talk will discuss how varying parameters representing the physical forces present in the system can control flow instabilities.

Classification : 76Vxx, 80Axx, 35Qxx, 65Mxx, Navier-stokes equation, Reaction effects in flows, Chemically reacting flows, Finite volume methods for initial value and initial-boundary value problems involving PDEs
Format : Talk at Waseda University
Author(s) : Manoranjan Mishra (Indian Institute of Technology Ropar, India) Surya Narayan Maharana (Indian Institute of Technology Ropar)

[01097] Versal deformations as a tool of matrix analysis

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G304

Type : Contributed Talk
Abstract : Reductions of matrices or matrix pencils to canonical forms are unstable operations: both the corresponding canonical forms and the reduction transformations depend discontinuously on the entries of an original matrix or pencil. This issue complicates the use of canonical forms for numerical purposes. Therefore V.I. Arnold introduced a notion of versal deformations. We will discuss versal deformations and their use in codimension computations, investigation of possible changes in eigenstructures, and reduction to structured perturbations.
Classification : 15A63, 15A21
Format : Talk at Waseda University
Author(s) : Andrii Dmytryshyn (rebro University) Andrii Dmytryshyn (rebro University)

[01101] Supersonic Pre-Transitional Disturbances in Boundary Layers on Porous Surfaces

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E817

Type : Contributed Talk
Abstract : The effect of wall permeability on the response of pre-transitional supersonic boundary layers subject to low-amplitude, free-stream vortical disturbances is investigated via asymptotic methods and numerically. Equally-spaced cylindrical pores couple the pressure and wall-normal velocity fluctuations when the spanwise diffusion is negligible, thereby reducing the growth of low-frequency laminar streaks and Grtler vortices on concave porous walls. Highly-oblique Tollmien-Schlichting waves that develop further downstream are instead enhanced. This finding is confirmed by a triple-deck analysis.
Classification : 76N20, 76N25, 35C20
Format : Talk at Waseda University

Author(s) : Ludovico Foss (The University of Sheffield) Pierre Ricco (The University of Sheffield)

[01102] Independent Study in Designing Mathematics Learning Using GeoGebra AR

Session Time & Room : 3E (Aug.23, 17:40-19:20) @D502

Type : Industrial Contributed Talk

Abstract : This research examines the implementation of one program from the Indonesian Ministry of Education, Culture, Research, and Technology, i.e., independent studies, in the Department of Mathematics Education at a public university in Langsa, Aceh, Indonesia. The activities focused on compiling learning designs that apply the GeoGebra Augmented Reality (AR) to geometrical concepts in secondary schools by adopting the ADDIE Model. The aim is for pre-service mathematics teachers to explore learning activities independently in mastering Technological Pedagogical Content Knowledge (TPACK) when teaching mathematics. Our findings suggest the implementation of such an independent study because of its advantages and program improvisation as a form of program development.

Classification : 97Gxx, 97Hxx, 97Uxx

Format : Online Talk on Zoom

Author(s) : Guntur Maulana Muhammad (Universitas Samudra) Natanael Karjanto (Sungkyunkwan University) Iden Rainal Ihsan (Universitas Samudra)

[01103] Mechanoelectric effects in cardiac function

Session Time & Room : 3D (Aug.23, 15:30-17:10) @A511

Type : Contributed Talk

Abstract : To date the role of the different mechanoelectric feedback $($MEF$)$ mechanisms is not clear in the cardiac function. Using a multiscale $($from cellular to organ level$)$ 3D-0D closed loop fluid-electromechanical framework implemented in the Cardiac Arrhythmia Research Package $($CARP$)$ software, we perform computer simulations to explore the effect of two MEF mechanisms in healthy cardiac function and under the Left Bundle Branch Block pathology.

Classification : 92-10, 92Bxx

Format : Talk at Waseda University

Author(s) : Argyrios Petras (RICAM-Johann Radon Institute for Computational and Applied Mathematics) Matthias AF Gsell (Medical

University of Graz) Christoph M Augustin (Medical University of Graz) Jairo J Rodriguez Padilla (Centre Inria dUniversit Cte dAzur) Alexander Jung (Medical University of Graz) Marina Strocchi (King's College London) Frits Prinzen (Maastricht University) Steven Niederer (King's College London) Gernot Plank (Medical University of Graz) Edward J Vigmond (Liryc, Electrophysiology and Heart Modeling Institute)

[01104] Generation of hp-FEM Massive Databases for Deep Learning Inversion

Session Time & Room : 2D (Aug.22, 15:30-17:10) @E506

Type : Contributed Talk

Abstract : Deep Neural Networks are employed in many geophysical applications to characterize the Earths subsurface. However, they often need to solve hundreds of thousands of complex and expensive forward problems to produce the training dataset.

This work presents a robust approach to producing massive databases at a reduced computational cost. In particular, we build a single hp-adapted mesh that accurately solves many FEM problems for any combination of parameters within a given range.

Classification : 65N30, Finite Element Method, Deep Neural Networks, Goal-Oriented Adaptivity

Format : Talk at Waseda University

Author(s) : Julen Alvarez-Aramberri (University of the Basque Country (UPV/EHU)) Vincent Darrigrand (CNRS-IRIT, Toulouse) Felipe Vinicio Caro (Basque Center for Applied Mathematics (BCAM) , University of the Basque Country (UPV/EHU)) David Pardo (University of the Basque Country (UPV-EHU) , Basque Center for Applied Mathematics (BCAM) , Ikerbasque)

[01105] SIPG Method for boundary control problems governed by parabolic PDEs

Session Time & Room : 5C (Aug.25, 13:20-15:00) @E703

Type : Contributed Talk

Abstract : We present a posteriori error analysis of adaptive finite element approximations for parabolic boundary control problems with bilateral box constraints that act on a Neumann boundary. The discretization is followed by using the symmetric interior penalty Galerkin (SIPG) technique. Both reliable and efficient residual-based error estimators are deduced. The implementation of these error estimators serves as a guide for the adaptive

mesh refinement process. The numerical experiment shows the effectiveness of the derived estimators.
Classification : 65M60, 65M15
Format : Talk at Waseda University
Author(s) : Ram Manohar (Indian Institute of Technology Kanpur) Rathish Kumar Venkatesulu Bayya (Indian Institute of Technology Kanpur) Kedarnath Buda (Indian Institute of Technology Kanpur) Rajen Kumar Sinha (Indian Institute of Technology Guwahati)

[01106] An alternative approach to generating the Covid-19 dynamics

Session Time & Room : 5B (Aug.25, 10:40-12:20) @A201

Type : Contributed Talk
Abstract : The dynamics of the mysterious Covid-19 spread are interesting for further exploration and investigation. We propose a generating dynamic operator of cumulative case functions to recover all the dynamics of the SEIR model. This approach can also provide estimates of unrecorded cases based on the dynamics of the Covid-19 test, IFR, CFR, and recorded cases. This approach directly measures daily transmission indicators, which can be used effectively for day-to-day epidemic control.
Classification : 92D30, 92B05, 92D25
Format : Online Talk on Zoom
Author(s) : Muhammad Fakhruddin (Bina Nusantara University) Kamal Khairudin Sukandar (Institut Teknologi Bandung) Andy Leonardo Louismono (Institut Teknologi Bandung) Metra Volisa (Institut Teknologi Bandung) Rudy Kusdiantara (Institut Teknologi Bandung) Muhammad Fakhruddin (The Republic of Indonesia Defense University) Nuning Nuraini (Institut Teknologi Bandung) Edy Soewono (Institut Teknologi Bandung)

[01110] Patient-specific simulation of veno-venous Extra Corporeal Membrane Oxygenation (ECMO)

Session Time & Room : 1C (Aug.21, 13:20-15:00) @D515

Type : Contributed Talk
Abstract : Veno-Venous ECMO is a well-established procedure used in Intensive Care Units for patients with pulmonary failure. The patient blood is drained via a cannula in the inferior vena cava, oxygenated and reinserted via another cannula in the superior vena cava. Still, its efficacy is very limited, mainly due to recirculation between the two cannulas. In this talk we present a patient-specific, CFD-based computational model to assess the efficacy of

the procedure and quantify recirculation.
Classification : 92C50, 92C35, 65ZXX, 92CXX
Format : Talk at Waseda University
Author(s) : Massimiliano Leoni (RICAM) Johannes Szasz (Kepler University Klinikum) Jens Meier (Kepler University Klinikum) Luca Gerardo Giorda (Johannes Kepler University Linz)

[01114] Modeling Covid-19 Cases and Vaccination Interplay through Time-Varying Copula Approach

Session Time & Room : 3C (Aug.23, 13:20-15:00) @F312

Type : Contributed Talk
Abstract : Currently, the Indonesian government has made various efforts to reduce the number of Covid-19 cases, one of which is through administering vaccines. This study aims to model the interplay between the number of Covid-19 cases and the number of citizens who have been vaccinated, especially in term of the temporal relationship, using the time-varying copula approach.
Classification : 60Exx, 62Hxx, 62Pxx, Multivariate Modeling, Copula Modeling
Format : Online Talk on Zoom
Author(s) : Atina Ahdika (Universitas Islam Indonesia)

[01117] Non-Linear Study of Interaction of Viscous Fingering Instability and Chemical Reaction

Session Time & Room : 1E (Aug.21, 17:40-19:20) @E704

Type : Contributed Talk
Abstract : We investigate a chemically reactive front A+BC involving the radial miscible displacement in porous media. It is a non-linear phenomenon that is mathematically modeled by Darcys law coupled with convection-reaction-diffusion equations. A chemical reaction may result in a change in the viscosity profile, which may lead to the interfacial instability known as viscous fingering, which occurs when a low-viscosity fluid displaces a high-viscosity fluid in a porous medium. The instability enhances the fluid mixing.
Classification : 76Exx, 76Sxx, 76Vxx
Format : Talk at Waseda University
Author(s) : Priya Verma (Indian Institute of Technology Ropar) Manoranjan Mishra (Indian Institute of Technology Ropar)

[01118] Finite Element Analysis of a Non-equilibrium Model for Hybrid Nano-Fluid

Session Time & Room : 4C (Aug.24, 13:20-15:00) @E711

Type : Contributed Talk

Abstract : A theoretical and computational finite element study of modified Navier-Stokes
Equations coupled with energy conservation governing the flow and heat transfer
in complex domain with hybrid nanofluid is carried out. The apriori error estimates providing the convergence analysis for the finite element scheme is derived in the H1-norm. The effect of hybrid nano-particles volume fraction, Rayleigh Number, Prandtl Number, Darcy number, porosity are analyzed to trace
the physics related to flow and heat transfer.

Classification : 65N30, 80A05, 76R99, Finite element analysis and numerical computations with its application to hybrid nano-fluid

Format : Online Talk on Zoom

Author(s) : SANGITA DEY (Ph.D Student of Indian Institute of Technology Kanpur) Rathish Kumar Venkatesulu Bayya (Indian Institute of Technology Kanpur)

[01119] Miscible Flows Based On Darcy-Stokes-Brinkman Model: Existence and Uniqueness

Session Time & Room : 4D (Aug.24, 15:30-17:10) @D401

Type : Contributed Talk

Abstract : Flows in a porous or vuggy medium are encountered in several physical phenomena, including oil recovery. A vast literature use the unsteady Brinkman andcontinuityequations for numerical modeling of such flow systems. We couple these equations with a convection-diffusion equation for the solute concentration to take the miscibility of fluids into account. For the first time, we show the well-posedness of this problem by employing regularized Galerkin method and hemivaritional inequalities.

Classification : 76Dxx, 76Sxx, 35Qxx, 35Dxx

Format : Talk at Waseda University

Author(s) : Sahil Kundu (Indian Institute of Technology Ropar,Ropar, India)

Manoranjan Mishra (Indian Institute of Technology Ropar, India) Surya Narayan Maharana (Indian Institute of Technology Ropar)

[01123] Parameterized Douglas-Rachford dynamical systems for generalized DC programming

Session Time & Room : 4D (Aug.24, 15:30-17:10) @D408

Type : Contributed Talk
Abstract : In this work, we consider the difference of convex functions (DC) programming problems which are the backbone of nonconvex programming and global optimization. The classical problem contains the difference between two proper convex and lower semicontinuous functions. This paper deals with the generalized DC programming problem, which deals with the minimization of three convex functions. We propose a novel parametrized Douglas Rachford dynamical system to solve the problem and study its convergence behavior in the Hilbert space. Moreover, we also conduct numerical experiments to support our theoretical findings.
Classification : 90C26, 90C30
Format : Online Talk on Zoom
Author(s) : Avinash Dixit (Kirori Mal College, University of Delhi, Delhi) Pankaj Gautam (NTNU) Tanmoy Som (IIT (BHU) , Varanasi)

[01125] Generalized Optimization Algorithms for M-Estimation of Complex Simulation Models

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E503

Type : Contributed Talk
Abstract : We provide a new optimization algorithm for simulation-based models with highly irregular objective functions, like those of network or agent-based models. The approximate inexact Newton method (AINM) is based on approximating the first two derivatives of the function through a polynomial regression. We provide new general results concerning approximate Netwon methods, we extensively discuss the theoretical and computational aspects of the AINM, and support the theory by Monte Carlo experiments and two applications.
Classification : 90Cxx, 62F10, 62J05
Format : Talk at Waseda University
Author(s) : Raffaello Seri (Universit degli Studi dell'Insubria) Mario Martinoli (Scuola Superiore Sant'Anna Pisa) Fulvio Corsi (Universit di Pisa)

[01133] Surface wave propagation in coated poro-elastic layer due to point source

Session Time & Room : 5D (Aug.25, 15:30-17:10) @F312

Type : Contributed Talk

Abstract : The impact of an internal energy source on an anisotropic fluid-saturated poro-elastic layer over a non-homogeneous semi-infinite medium is presented. The poroelastic layer is coated with a thin elastic layer. The Fourier transform and Greens function techniques are applied to analyse the velocity profile of Love-type wave propagation. Error analysis between phase velocity with and without damping has been shown. It is found that the dispersiveness is caused by the non-homogeneity of the semi-infinite medium.

Classification : 74-10, 74B10, 74H05, 74H45, 74J15

Format : Online Talk on Zoom

Author(s) : Dipendu Pramanik (Department of Mathematics, Indian Institute of Technology Indore) Santanu Manna (Department of Mathematics, Indian Institute of Technology Indore)

[01134] A propagating edge wave on a crack plate

Session Time & Room : 5D (Aug.25, 15:30-17:10) @F312

Type : Contributed Talk

Abstract : The study analyzes the characteristics of the bending edge wave on a semi-infinite Kirchhoff plate having a stationary crack on the plate and supported by an elastic foundation. The non-local elasticity theory is used to investigate the effect of non-local stress on the propagation of edge waves on the crack plate. Due to the presence of the crack, the stress intensity factor related to the edge wave propagation will be discussed via numerical analysis.

Classification : 74-10, 74J15, 74K20, Surface waves in elastic plate

Format : Online Talk on Zoom

Author(s) : Rahul Som (Department of Mathematics, Indian Institute of Technology Indore, India) Santanu Manna (Assistant Professor, Indian Institute of Technology Indore)

[01135] Computational framework for design, optimization, and control of sintering process

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E605

Type : Contributed Talk

Abstract : Optimization and control of sintering, which is governed by macroscopic coupled electro-thermo-mechanical model, is critical for additive manufacturing. To reduce time in making process design decisions, we present a hybridized model-based and data-driven computational framework. In particular, we demonstrate an inverse estimation strategy combining offline-online efficient data assimilation and surrogate modeling. We test the performance of the proposed method in accelerating the estimation of sintering process parameters and hard-to-measure material properties like viscosity.

Classification : 65M32, 65F55, 74H15, 60-08, 74D99

Author(s) : Rahul Dhopeshwar (TU Eindhoven) Harshit Bansal (TU Eindhoven) Karen Veroy (TU Eindhoven)

[01137] Stability and Dispersion analysis for Rayleigh-type waves in non-local media

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D102

Type : Contributed Talk

Abstract : We present the non-local elastic behavior of Rayleigh-type surface waves in a layered media comprising an inhomogeneous medium and a fiber-reinforced layer. The dispersion equation is derived using an approximate asymptotic displacement solution of the governing wave equation. Using the Finite Difference Scheme, the stability conditions are determined for the equations of group velocity and phase velocity.The effects of various defining parameters on propagation are discussed and graphically depicted.

Classification : 74-10, 74B10, 74H05, 74H45, 74J15

Format : Online Talk on Zoom

Author(s) : Manasa Bhat (Department of Mathematics, Indian Institute of Technology Indore.) Santanu Manna (Department of Mathematics, Indian Institute of Technology Indore)

[01139] Adaptive sampling and transfer learning techniques for solution of PDEs

Session Time & Room : 2E (Aug.22, 17:40-19:20) @G402

Type : Contributed Talk

Abstract : An adaptive sampling technique applied to the deep Galerkin method (DGM), and separately a transfer learning algorithm also applied to DGM is examined, aimed to improve, and speed up the training of the deep neural network when learning the solution of partial differential equations (PDEs). The proposed algorithms improve the DGM method. The adaptive sampling scheme implementation is natural and efficient. Tests applied to selected PDEs discussing the robustness of our methods are presented.

Classification : 35-04, 65-04, Deep learning for the solution of PDEs

Format : Online Talk on Zoom

Author(s) : Andreas Aristotelous (The University of Akron)

[01141] On tensor-based training of neural networks

Session Time & Room : 5B (Aug.25, 10:40-12:20) @E802

Type : Contributed Talk

Abstract : In this work by resorting to the continuous model of a shallow neural network, we present a novel training approach, that is based on a suitable approximate solution of a Fredholm integral equation of the first kind. Here, we concentrate on least-squares collocation, functional tensor networks and alternating ridge regression. Application of the algorithm to some supervised learning tasks is on par with other state-of-the-art approaches.

Classification : 65R20

Format : Talk at Waseda University

Author(s) : Patrick Gel (Zuse Institute Berlin) Aizhan Issagali (Freie Universitt Berlin) Ralf Kornhuber (Freie Universitt Berlin)

[01142] Thermodynamically Consistent Finite Volume Schemes for Electrolyte Simulations

Session Time & Room : 2E (Aug.22, 17:40-19:20) @E702

Type : Contributed Talk

Abstract : In order to account for finite ion sizes and solvation effects, the classical Nernst-Planck-Poisson system describing ion transport in electrolytes needs to be enhanced by cross-diffusion - like terms. For this situation, we present a space discretization scheme which adapts the classical Scharfetter-Gummel exponential fitting upwind flux for the Voronoi box finite volume method. Numerical examples use the Julia package VoronoiFVM.jl which takes advantage of automatic differentiation to handle the strong nonlinearities of the system.

Classification : 65M08, 65M12, 78A57, 65N08, 35Q81

Format : Talk at Waseda University

Author(s) : Jrgen Fuhrmann (Weierstrass Institute for Applied Analysis and Stochastics) Benoit Gaudeul (Univ. Paris Saclay)

[01146] Steady-State Analysis of a Single Server Queueing System Subject to Differentiated Vacations and N-Policy

Session Time & Room : 2C (Aug.22, 13:20-15:00) @E501

Type : Contributed Talk

Abstract : An M/M/1 queueing system subject to differentiated vacations and N-policy is studied. When there are no customers, the server takes a vacation and returns to the system if N or more customers are found. Still, if the number of customers in the system is less than N, the server takes another vacation type. The explicit expression for steady-state probabilities of the system size is obtained. The exact solutions for some performance measures are also derived.

Classification : 60K25, 68M20, 90B22, Queueing theory

Format : Online Talk on Zoom

Author(s) : SURANGA SAMPATH MIYANAWATHURA IHALA GAMAGE (Wayamba University of Sri Lanka)

[01150] Optimizing Tool Assignment Using Smart Lockers

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E811

Type : Industrial Contributed Talk

Abstract : A logistics operator adopted smart lockers to distribute 150 commercial tools such as tablets and scanners to employees, working in 3 shifts. The lockers gather significant data like tools deficiencies, breakdowns, usage time, punctuality. The assignment policy to deliver tools must minimize downtime using two figure of merit, one classifying employees according to their ability to handle tools, and another measuring the frequency of deficiencies and breakdowns. The proposal is inspired in genetic algorithms.

Classification : 68T20, 90B06

Format : Talk at Waseda University

Author(s) : Jose Alberto Fonseca (Instituto de Telecomunicaes - Universidade de Aveiro) Joaquim Ferreira (Instituto de Telecomunicacoes, Universidade de Aveiro) Ricardo Bandeira (Microio,Lda) Fernanda Coutinho (Instituto Superior de Engenharia de Coimbra - IPP)

[01151] Structure-Preserving Neural Networks for Hamiltonian Systems

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E606

Type : Contributed Talk

Abstract : When solving Hamiltonian systems using numerical integrators, preserving the symplectic structure is crucial. We analyze whether the same is true if neural networks (NN) are used. In order to include the symplectic structure in the NN's topology we formulate a generalized framework for two well-known NN topologies and discover a novel topology outperforming all others. We find that symplectic NNs generalize better and give more accurate long-term predictions than physics-unaware NNs.

Classification : 65Lxx, 68T07, 85-08

Format : Talk at Waseda University

Author(s) : Philipp Horn (Eindhoven University of Technology) Barry Koren (Eindhoven University of Technology) Veronica Saz Ulibarrena (Leiden University) Simon Portegies Zwart (Leiden University)

[01153] Analysis of drivers behavior and average flow on traffic dynamics

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E503

Type : Contributed Talk

Abstract : In this work, a new lattice model is proposed by considering the drivers behavior (timid or aggressive) and downstream average flow on traffic dynamics. The stability condition is determined through stability analysis. Nonlinear analysis forms the modified Korteweg-de Vries (mKdV) equation to describe traffic density wave propagation near the critical point. Theoretical results are verified with numerical simulations, and it is concluded that driver behavior and average flow can stabilize traffic flow dynamics.

Classification : 65P40, 65K05, Traffic flow

Author(s) : Nikita Madaan (Chandigarh University) Nikita Madaan (Thapar Institute of Engineering and Technology) Sonia - (Chandigarh University)

[01156] Row completion of polynomial matrices

Session Time & Room : 1E (Aug.21, 17:40-19:20) @G304

Type : Contributed Talk

Abstract : Perturbation problems arise frequently in applications, as in structural changes of the dynamics of a system or in pole placement problems in control theory.

Perturbation problems of matrices are closely related to completion problems. We present a solution to the row-completion problem of a polynomial matrix, prescribing the eigenstructure of the resulting matrix and maintaining the degree.

Classification : 15A22, 15A83

Author(s) : Agustzane Amparan (Universidad del Pas Vasco, UPV/EHU) Itziar Baragaa (Universidad del Pas Vasco, UPV/EHU) Silvia Marcaida (Universidad del Pas Vasco, UPV/EHU) Alicia Roca (Universitat Politcnica de Valncia)

[01157] The boundary domain integral method for boundary value problems with variable coefficients

Session Time & Room : 1E (Aug.21, 17:40-19:20) @F309

Type : Contributed Talk

Abstract : The boundary domain integral equation method is an important tool to formulate (in terms of integral operators) boundary value problems with variable coefficients. Although the theory of boundary domain integral equations has been largely developed, there is a lack of results in numerical

implementations.
The aim of this talk is to enumerate the different boundary domain formulations for several boundary conditions and present discretizations of the integral equation systems and comparisons between the numerical behavior of the approximated solutions.

Classification : 31B10, 65Rxx, boundary domain integral methods

Author(s) : Nahuel Domingo Caruso (National University of Rosario - CIFASIS-CONICET) Carlos Fresneda-Portillo (Universidad Loyola Andaluca (Spain))

[01160] A mathematical study of cancer and radiotherapy towards personalized medicine

Session Time & Room : 3E (Aug.23, 17:40-19:20) @A601

Type : Contributed Talk

Abstract : We present a mathematical model that describes the growth of a tumor mass, considering the interaction between the microenvironment abiotic factors and the epigenetic composition of the cancer cell population. We show the dynamics of its effects on radiotherapy treatment.
Results reveal the predictive and diagnostic value of the use of mathematical models as an aid to the medical image in outlining patient-specific therapeutic protocols and optimizing the effectiveness and relapse control.

Classification : 92B05, 65M60

Format : Online Talk on Zoom

Author(s) : Giulia Chiari (Politecnico di Torino)

[01163] An infinite class of shocks for compressible Euler

Session Time & Room : 5B (Aug.25, 10:40-12:20) @G401

Type : Contributed Talk

Abstract : We consider the two dimensional compressible Euler equations with azimuthal symmetry and construct an infinite class of shocks by establishing shock formation for a new Hlder family of so-called pre-shocks for all nonnegative integers. Moreover, a precise description of the dominant Riemann variable in the Hlder space is given in the form of a fractional series expansion.

Classification : 35L67, 35Q31, 76N15, 76L05

Format : Talk at Waseda University

Author(s) : Calum Rickard (University of California, Davis) Sameer Iyer

(University of California, Davis) Steve Shkoller (University of California, Davis) Vlad Vicol (New York University)

[01164] Infection spreading in tissue as a delayed reaction diffusion wave

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D515

Type : Contributed Talk

Abstract : In this work, we have discussed the stationary solution of a delayed reaction diffusion system for the concentrations of uninfected cells, infected cells, and virus cells. We have also discussed the existence of waves for the corresponding monotone system and found the minimal wave speed of the system. We have observed that when the death rates of uninfected and infected cells were the same, the virus propagation gradually decreases, but when the death rates are different, the wave propagation initially increases and then decreases. It is also observed that as the time delay increases the initial oscillations also increases. Next, we convert the system into a single diffusion equation using a quasi-stationary approximation, study the existence of the wave, and find the analytical expression for the minimal wave speed. We have also performed comprehensive simulations to compare and validate the results for both cases.

Classification : 93C10, 93C43, 35AXX

Format : Talk at Waseda University

Author(s) : Moitri Sen (National Institute of Technology Patna) Saddam Hussain (National Institute of Technology Patna) Vitaly Volpert (Institut Camille Jordan, UMR 5208 CNRS, University Lyon 1)

[01169] Physical properties of seed maize versus open market maize

Session Time & Room : 1C (Aug.21, 13:20-15:00) @

Type : Contributed Talk

Abstract : Accurate kernel dimensions are crucial to designing efficient screen cleaners in maize processing. Reported dimensions in literature are determined for individual varieties. Unfortunately, the open maize market in Ghana contains a mixture of varieties, making literature-reported dimensions impractical for efficient screen designs. We present a comparative analysis of individual variety and open market maize dimensions using Analysis of Variance (ANOVA) and Least Significant Difference (LSD) tests to inform on efficiency of maize screen-cleaning systems.

Classification : 00A06, 00A69, 00A79, 62B99, 62C99

Author(s) : Martin Apraku Amankwah (Sunyani Technical University) Komla Agbeko Dzisi (Kwame Nkrumah University of Science & Technology, Kumasi) Ahmad Addo (Kwame Nkrumah University of Science & Technology, Kumasi)

[01171] The role of the autoregulation mechanism in hypertension and hypotension in humans

Session Time & Room : 1C (Aug.21, 13:20-15:00) @D515

Type : Contributed Talk

Abstract : We present a nonlinear model for the propagation of the pressure and flow velocity waves in the human cardiovascular system, including deep learning tools with available physiological data. This model is used for understanding the system-level dynamics of the pressure and flow rates. This time-domain analysis is best to describe time-dependent controls, collectively known as the autoregulation mechanism. We discuss an application of our model to the study of the hypertension and hypotension.

Classification : 92C35, 76Z05, 68T07, 49N90

Author(s) : Radu C Cascaval (University of Colorado Colorado Springs)

[01172] Spatio-structural partial differential equation (PDE) modelling for single-cell cancer data

Session Time & Room : 2D (Aug.22, 15:30-17:10) @E709

Type : Contributed Talk

Abstract : Melanoma routinely develops resistance to targeted therapies, leading to unfavourable prognosis for patients. We introduce a novel approach to modelling single-cell RNA-seq data obtained from melanoma tumours, using partial differential equations (PDEs) to represent the tumour as a spatio-structural population. We show how non-spatial data can be used to predict spatially heterogeneous distributions of cell types, within the tumour, and explore combination therapies and treatment strategies to overcome traditional patterns of resistance.

Classification : 35Q92, 37N25, 62P10, 92-10, 35G20, Mathematical Oncology, PDEs

Author(s) : Arran Hodgkinson (Queen's University Belfast) Arran Hodgkinson (Queen's University Belfast) Dumitru Trucu (University of Dundee) Matthieu Lacroix (Institut de Recherche en Cancerologie de

Montpellier) Laurent Le Cam (Institut de Recherche en Cancerologie de Montpellier) Ovidiu Radulescu (Universite de Montpellier)

[01173] Turing Patterns as a Model for Brain Folding

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D514

Type : Contributed Talk

Abstract : Folding patterns of every human brain are unique with no consensus among neurobiologists regarding the mechanism for folding pattern formation. We present a Turing reaction-diffusion model that uses an activator and inhibitor, and incorporates parameters that influence genetic control, brain growth, and domain scale. Our results study static and dynamic domain growth, and we investigate domain shape to compare results to brain diseases with excessive folding or lack of folding such as polymicrogyria and lissencephaly.

Classification : 92C15, 92B05, 92-10, 37N25, 35B36, Turing Pattern Formation, Brain Development, PDEs, Modeling, Dynamical Systems

Format : Talk at Waseda University

Author(s) : Monica K. Hurdal (Florida State University)

[01179] Applications of a Tiled Monte Carlo Algorithm to the Computation of Matrix Functions

Session Time & Room : 5B (Aug.25, 10:40-12:20) @E603

Type : Contributed Talk

Abstract : We extend our prior work on Monte Carlo algorithms for solving large linear systems to compute other matrix functions such as exponential and logarithm. Our recent algorithm that computes with matrix tiles is shown to guarantee convergence for sufficiently large tiles. We compute matrix functions by summing a polynomial approximation (e.g. Taylor, Chebyshev). We investigate the convergence conditions for each function and optimize the algorithm by adjusting the parameters.

Classification : 65F60, 65C05

Format : Talk at Waseda University

Author(s) : Hyeji Choi (Stony Brook University)

[01182] Optimizing the manufacturing process of a cutting machine in iron industry

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D501

Type : Contributed Talk

Abstract : In this talk we discuss a multi-criteria optimization framework designed for the cooperation with a prominent company, leader in the production of automatic machines employed in iron manufacturing. The optimized machine process counts several steps, starting by cutting the bars at specified lengths and moving them into two temporary buffers. Afterwards, bars are relocated through pliers to parallel depots through a lengthwise movement and gathered by order to facilitate the subsequent transfer to downstream steps.

Classification : 90-08, 90-10, 90-04

Format : Talk at Waseda University

Author(s) : Andrea Pizzuti (Universit Politecnica delle Marche) Fabrizio Marinelli (Universit Politecnica delle Marche)

[01183] Development of algebraic preconditioners based on multiscale domain decomposition methods

Session Time & Room : 2D (Aug.22, 15:30-17:10) @E505

Type : Contributed Talk

Abstract : This work presents a new algebraic formulation for the Multiscale Robin Coupled Method - MRCM. This domain decomposition method generalizes other mixed multiscale methods by imposing Robin-type boundary conditions on the local problems. The MRCM is flexible and accurate, obtaining near-optimal scalability up to billions of unknowns in high-performance simulations. We propose a new algebraic formulation, allowing the construction of multiscale-based preconditioners for solving non-symmetric linear systems with Krylov subspace methods, such as GMRES.

Classification : 65F08, 65N55, 65N08, 76S05

Format : Talk at Waseda University

Author(s) : Fabricio Simeoni de Sousa (University of Sao Paulo) Franciane F. Rocha (Wikki Brazil) Luca Meacci (Universit degli Studi di Firenze) Rafael T. Guiraldello (Piri Technologies LLC) Roberto F. Ausas (University of Sao Paulo) Gustavo C. Buscaglia (University of Sao Paulo) Felipe Pereira (The University of Texas at Dallas)

[01187] Dynamic, data-driven neurodegeneration: Modelling clearance and proteopathy in Alzheimers disease

Session Time & Room : 3E (Aug.23, 17:40-19:20) @A601

Type : Contributed Talk

Abstract : The clinical research community has raised the alarm on the importance of studying the role of clearance in Alzheimers disease. We heed this alarm by developing and analysing the first network reaction-diffusion dynamical system coupling clearance and proteopathy. Analytical insights, and computational results on high-resolution brain graphs constructed from human data, demonstrate the connections between clearance and neurodegeneration. Our results suggest clearance deficits may play an important role in the onset and trajectory of Alzheimer's.

Classification : 92-10, 37N25

Author(s) : Georgia Staf Brennan (University of Oxford) Alain Goriely (University of Oxford) Marie Rognes (Simula Research Laboratory) Travis Thompson (Texas Tech University) Hadrien Oliveri (University of Oxford)

[01192] Application of MUSIC Algorithm in Microwave Imaging Without Switching Device

Session Time & Room : 1E (Aug.21, 17:40-19:20) @D405

Type : Contributed Talk

Abstract : Although the MUltiple SIgnal Classification (MUSIC) algorithm has demonstrated suitability as a microwave imaging technique for identifying unknown anomalies, there is a fundamental limit that it requires a switching device to be used which permits a dipole antenna for signal transmission and reception. In this contribution, we design a MUSIC-type imaging function and explore its mathematical structure. Considering the investigated structure, we confirm that the imaging performance is highly dependent on the antenna arrangement and suggest an optimal antenna arrangement to improve the imaging performance. Simulation results with real-data are displayed to support the theoretical result.

Classification : 78A46

Format : Talk at Waseda University

Author(s) : Won-Kwang Park (Kookmin University)

[01193] Cost-effectiveness and Public Health Impact of HPV Vaccination Strategies with consideration of cross-immunity in Japan

Session Time & Room : 2C (Aug.22, 13:20-15:00) @G304

Type : Contributed Talk

Abstract : We assessed the epidemiological and economic impact of potential health advantages of the HPV vaccination in Japan among girls and boys of ages 1216. An age-structured mathematical model of HPV transmission was constructed. Compared to halted vaccination, girls-only vaccination programs with either 4vHPV or 9vHPV are cost-effective, but gender-neutral vaccination programs are less so. Adding boys to an existing successful girls-only program is not cost-effective since men are protected by herd immunity.

Classification : 92B05

Format : Talk at Waseda University

Author(s) : Wongyeong Choi (Soongsil University) Eunha Shim (Soongsil University)

[01196] Deep Solvers in Shape Optimization

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E811

Type : Contributed Talk

Abstract :

We introduce a novel mesh-free method for computing the shape derivative in PDE-constrained shape optimization problems. Our approach is based on a probabilistic deep solver, which can be shown to converge for a wide class of seminilinear PDEs, and a suitable representation of the shape gradient. In contrast to finite element, volume and difference methods, our approach does not require a discretization of the domains interior. We also present examples for performance illustration.

Classification : 68T07, 65N99

Format : Talk at Waseda University

Author(s) : Maximilian Wrschmidt (Trier University) Frank Seifried (Trier University) Luka Schlegel (Trier University) Volker Schulz (Trier University)

[01201] How differential geometry and extremum seeking systems reveal the decades- long mystery of optimized flight of soaring birds

Session Time & Room : 3E (Aug.23, 17:40-19:20) @A511

Type : Contributed Talk

Abstract : The optimized flight physics of soaring birds such as albatrosses have always been fascinating to biologists, physicists, mathematicians, and engineers. How can soaring birds fly in that effective way without spending almost any energy? The decades-long literature of the problem has not been successful in providing frameworks that can work in real time similar to the birds themselves. Recently, a breakthrough took place in providing a simple, real time extremum seeking method that characterizes this phenomenon and implements it in real time. Mathematical analysts using differential geometric methods have been successful in supporting these new results.

Classification : 92-10, 93-10, 93B05, 53Z05

Format : Talk at Waseda University

Author(s) : Sameh Eisa (University of Cincinnati)

[01203] Existence and regularity results for nonlinear elliptic equations with degenerate coercivity

Session Time & Room : 5B (Aug.25, 10:40-12:20) @G502

Type : Contributed Talk

Abstract : In this research we drive the existence and regularity results for solutions of some nonlinear degenerate Dirichlet problems containing two lower order terms, the fi rst is a nonlinear convection term satisfying an optimal growth conditions and without any hypothesis of coercivity and the second is a zero order perturbation term, which called the hardy potential, that creates an obstruction to the existence of a solution. Not also that for right hand side,

it is assumed that to be an L^m-function with m1.

Classification : 35J60, 35K65, 35J70

Format : Online Talk on Zoom

Author(s) : Fessel Achhoud (MISI Laboratory Hassan First University of Settat) Abdelkader Bouajaja (MISI Laboratory Hassan First University of Settat)

[01207] Optimal analysis of ecological-economic model with fishing tax and tourist entry-fee

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A508

Type : Industrial Contributed Talk

Abstract : A market-based fishing strategy in a multi-species fishery with a fair taxation policy may provide long-term sustainable growth. Fishery-based ecotourism with an entry fee for the tourist may further contribute to the financial improvement of the local people. Here we have proposed and analyzed a harvesting model that integrates fishery and fishery-based ecotourism with the open market economy theory. We determine the optimal fishing tax and entry fee that maximizes the social benefit.

Classification : 91B76, 92B05, 91B55, 92D25, 92D40

Author(s) : Nandadulal Bairagi (Jadavpur University) Santaanu Bhattacharya (Jadavpur University)

[01216] Neural network in option pricing

Session Time & Room : 4E (Aug.24, 17:40-19:20) @D505

Type : Contributed Talk

Abstract : Black-Scholes model is the universally accepted model for computing option prices. While its is robust and easy to use, it has many flaws. Moreover, it failed spectacularly in 1987 during the wall street crash. This has led to proliferation of many extensions to the Black-Scholes model. Most extensions focus on relaxing the constant volatility assumption by incorporating randomness in the volatility. Whilst it provides slightly better estimation to option prices, it is computationally expensive to implement. Moreover, most of these models do not have closed-form solutions

With advancement in computational techniques, neural network has been increasingly used to price options. Not only, does it outperform conventional stochastic volatility models, it does not require assumption on the statistical characteristics of assets and volatility distribution. A typical neural network consists of three layers: input, hidden, and output. It uses a supervised learning method based on the generalisation of the least mean square error (LMS) algorithm. A gradient descent method is used to minimise the cost function, which is the mean square difference between the target and actual net output. More advanced neural networks (deep learning architectures), such as a Recurrent Neural Network (RNN) and its variant Long Short-Term Memory (LSTM), are useful for taking care of the time-series nature of financial data. The general architecture of the convolutional neural network-

based LSTM model includes an input layer, one or more convolutional layers, long short-term memory layer(s), dense layer(s), and an output layer. In this research, we will attempt to predict Strait Times Index (STI) which is one of the most regularly traded options in Singapore Exchange (SGX).

After pre-processing and cleaning the data, the input (stock price, time to maturity and volatility and output (option prices) , variables will be extracted for training and testing the models. Various hyperparameters (optimizers, learning rate, hidden layers, activation functions, etc.) will be optimised to generate the best model for the prediction of the option pricing. A comparison of the accuracy of the prediction of option pricing will be performed for three models, namely convolutional neural network-based LSTM, Multilayer Perceptron neural network N and the Black Scholes option pricing model. Different metrics (root mean squared error, mean absolute error, and mean absolute percentage error) will be used to compare the performance of the models.

Classification : 91G15, 91G20

Format : Talk at Waseda University

Author(s) : Abby Chee Hong Tan (Universiti Brunei Darussalam)

[01223] Descent hybrid four-term conjugate gradient methods for unconstrained optimization

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A206

Type : Industrial Contributed Talk

Abstract : Conjugate gradient method (CGM) is widely acclaimed to be efficient for solving large-scale unconstrained optimization problems. This study proposes new modified schemes that contain four terms based on the linear combination of the update parameters of classical or early methods depending on the popular two- and three-term CGMs. Hybridized methods have been found to exhibit better performance than the classical methods (Stanimirovic et al., 2018). Several other methods in this category can be found in (Adeleke et al., 2018; Osinuga and Olofin, 2018; Stanimirovic et al., 2018).

In continuation of the previous results, we propose hybrid methods for the solution of large-scale unconstrained optimization problems as motivated and inspired by (Alhawarat et al., 2021, Yao et al.,2020, Stanimirovic et al.,2018). Modified methods are defined using appropriate combinations of the search directions and included parameters. In this case, our methods are hybridizations of HS and DY methods. In addition, we propose a class of Dai-Liao CGMs developed using new search directions developed using different values of included parameter.

Under some certain assumptions, descent and convergence properties were established with the underlying strong Wolfe line search. The results of the new schemes showed superior performance over the existing ones in the sense of performance profiles of Dolan and More (2002).

Keywords: unconstrained optimization, strong Wolfe line search, descent property, global convergence.
AMS subject classification. 49J52, 49J53, 90C30

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Classification : 90C30, 65K05, 90C26, Nonlinear Optimization
Format : Online Talk on Zoom
Author(s) : Idowu Ademola Osinuga (Federal University of Agriculture, Abeokuta, Nigeria) Moses Oluwasegun Olubiyi (Federal University of Agriculture, Abeokuta) Semiu Akinpelu Ayinde (Babcock University, Ilishan-Remo)

[01224] Collision-induced amplitude dynamics of nD solitons in a perturbed saturable nonlinear medium

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G501

Type : Contributed Talk
Abstract : We study the amplitude dynamics of two-dimensional (2D) fast solitons in an interaction under a framework of coupled (2+1)D nonlinear Schrodinger equations with a saturable nonlinearity and weak perturbation. We derive a theoretical expression for the collision-induced amplitude dynamics in a fast collision of two 2D solitons. Our perturbative approach is mainly based on the analysis of the collision-induced change in the envelope of the perturbed 2D soliton. The theoretical results are validated by numerical simulations with the coupled perturbed nonlinear Schrodinger equations with saturable nonlinearity.
Classification : 35C08, 35Q51, 35Q60, 78A10, 78M10
Format : Online Talk on Zoom
Author(s) : Quan Minh Nguyen (International University, Vietnam National University Ho Chi Minh City) Toan Thanh Huynh (Department of Mathematics, University of Medicine and Pharmacy at Ho Chi Minh City, Vietnam)

[01226] Health Care: Robotic Dog for Navigation of a Rehabilitation Robot

Session Time & Room : 5B (Aug.25, 10:40-12:20) @E603

Type : Contributed Talk

Abstract : One of the more recent technological advancements is assistive robots, which can improve patient-centered care in the health sector. This paper presents a unique set of continuous nonlinear control laws derived from a Lyapunov-based control scheme for navigation of an assistive robot and a rehabilitation wheelchair robot together modeled as a new autonomous robotic dog and rehabilitation wheelchair system. The computer simulations also present a qualitative analysis of the effectiveness of the control laws.

Classification : 70B15, 93C85, 93D05, 93C10

Author(s) : Bibhya Nand Sharma (The University of the South Pacific) Sandeep Kumar (The University of the South Pacific)

[01232] A MESH-LESS, RAY-BASED DEEP NEURAL NETWORK METHOD FOR THE HELMHOLTZ EQUATION WITH HIGH FREQUENCY

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E605

Type : Contributed Talk

Abstract : We develop a mesh-less, ray-based deep neural network method to solve the Helmholtz equation with high frequency. This method does not use an adaptive mesh refinement method, nor does it design a numerical scheme using some specially designed basis function to calculate the numerical solution, but it has the advantages of easy implementation and no mesh. We have carried out various numerical examples to prove the accuracy and efficiency of the proposed nnumerical method.

Classification : 65K05

Format : Online Talk on Zoom

Author(s) : andy L yang (DutchFork High school)

[01233] A Study of the Spectra-Cutoff Imaging Method of Multiple Scattering in Isotropic Point-Like Discrete Random Media

Session Time & Room : 2C (Aug.22, 13:20-15:00) @G601

Type : Contributed Talk

Abstract : Imaging in random media is an important and interesting subject of inverse problems, relevant to a wide range of physical and engineering contexts, such as seismic imaging, remote sensing, medical imaging, wireless communications, and nondestructive testing.

In this talk, we show that imaging becomes difficult to perform in random media when multiple scattering is too strong to cause image distortion arising from the underlying interactions of multiply scattered waves at resonance frequencies.

The Foldy-Lax-Lippmann-Schwinger, (FLLS), formalism, which is employed for the multiply scattered waves, in the frequency domain, in the case of an ensemble of randomly distributed point-like scatterers. The scattering matrix representing the (FLLS) formalism is a non-Hermitian Euclidean random matrix.

According to the eigenvalue distribution of the scattering matrix, we present our approach to restore the distorted images by cutting off the sharp frequency responses in the resonance regime due to strong multiple scattering.

Finally, we show the use of this approach for imaging in discrete random media with numerical simulations and also discuss the limitations and future research direction.

Classification : 35J05, 35P15, 35P25, 47B06, 78A46

Format : Talk at Waseda University

Author(s) : Ray-Hon Sun (Stanford University (while working on this research))

[01239] Convergence analysis of the discrete consensus-based optimization algorithm

Session Time & Room : 2E (Aug.22, 17:40-19:20) @G709

Type : Contributed Talk

Abstract : We study stochastic convergence of the discrete Consensus-Based Optimization, called CBO algorithm, in almost-sure sense and in expectation. CBO is a mathematical toy example for non-gradient multi-point optimizer which tries to find the global minimum point of a given cost function. The convergence analysis guarantees the termination of the optimization process. The main result is a joint work with Seung-Yeal Ha, Shi Jin, and Doheon Kim.

Classification : 37M99, 65p99

Format : Talk at Waseda University

Author(s) : Dongnam Ko (The Catholic University of Korea)

[01240] Machine Learning based Optimization Algorithm for Stress Prediction

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E804

Type : Contributed Talk

Abstract : In this work, an efficient optimization algorithm is developed to predict the stress of a person. The algorithm uses sensor data which are extracted from persons physiological parameters. The proposed work uses various
techniques for smoothing the data and to identify the features from the extracted data. Different experiments are done by considering various output metrics. Based on the comparison with the existing classification algorithms, the proposed algorithm identifies the stress prediction with high accuracy.

Classification : 68M18, 68M20, 65-04

Format : Talk at Waseda University

Author(s) : Pankajavalli Palanisamy Balamani (Bharathiar University)

[01241] Crossing Sea States in Layered and Stratified Fluids

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D403

Type : Contributed Talk

Abstract : Crossing sea states are common phenomena in the oceans, and have been suggested as one possible generation mechanism for rogue waves. Modeling studies are conducted for (a) a two-layer fluid with long wave-short wave resonance, and (b) the triad resonance in a continuously stratified fluid with constant buoyancy frequency. Modulation instability will be enhanced. There is a preferred inclination of oblique wave propagation for a maximum growth rate, suggesting the occurrence of rogue waves.

Classification : 76E30, 35Q35, 76-10
Format : Talk at Waseda University
Author(s) : Qing Pan (The University of Hong Kong)

[01247] Gradient-push algorithm for distributed optimization with event-triggered communications

Session Time & Room : 2C (Aug.22, 13:20-15:00) @F312

Type : Contributed Talk
Abstract : Decentralized optimization problems consist of multiple agents connected by a network. The agents have each local cost function, and the goal is to minimize the sum of the functions cooperatively. In this work, we propose a gradient-push algorithm involving event-triggered communication on a directed network. The convergence of the algorithm is established under suitable decays and summability conditions on a stepsize and triggering threshold.

Classification : 47Nxx, 65Kxx, Decentralized Optimization
Format : Talk at Waseda University
Author(s) : jimyeong kim (Sungkyunkwan University) Woocheol Choi (Sungkyunkwan Univeristiy)

[01248] Reduction of Computational Cost with Optimal Accurate Approximation for Boundary Layer Originated Two Dimensional Coupled System of Convection Diffusion Reaction Problems

Session Time & Room : 2D (Aug.22, 15:30-17:10) @E702

Type : Contributed Talk
Abstract : In this talk, I will consider a generalized form of a coupled system of time dependent convection diffusion reaction problems having arbitrary small diffusion terms, which lead to boundary layers. The numerical approximations of these problems require adaptive mesh generation for uniformly convergent approximation. In the present talk, I will provide an algorithm which will reduce the computational cost of the system solver by converting the system of discrete equations to a tridiagonal matrix form. This approach together with an adaptive mesh generation technique will preserve

the optimal convergence accuracy. This convergence is proved to be independent of diffusion terms magnitude.

Classification : 65M06, 65M50, 65N50, Computational Cost Reduction, Error Analysis, Adaptive Mesh Generation, Coupled System of Time Dependent PDEs, Two Dimension

Format : Online Talk on Zoom

Author(s) : Pratibhamoy Das (Indian Institute of Technology Patna) Pratibhamoy Das (Indian Institute of Technology Patna) Shridhar Kumar (Indian Institute of Technology Patna)

[01251] Integral Equations Techniques for Floating Flexible Membrane

Session Time & Room : 1C (Aug.21, 13:20-15:00) @F311

Type : Contributed Talk

Abstract : Scattering of obliquely incident gravity waves by a horizontal floating flexible porous membrane in the water of finite depth having a variable bottom bed is analyzed. A coupled eigenfunction expansion - boundary element method is used for the solution purpose. The effect of sinusoidally varying bottom topography, membrane porosity and heading angle of the incident wave on the Bragg resonance is analyzed.

Classification : 45B05, 76B15, Integral Equations

Format : Talk at Waseda University

Author(s) : SANTANU KOLEY (Birla Institute of Technology and Science - Pilani, Hyderabad Campus)

[01254] Fast SVD-Preconditioned Eigensolver for 3D Phononic Crystals

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E603

Type : Contributed Talk

Abstract : In this talk, a Fast Linear Elastic Eigenvalue Problem Solver (FLEEPS) is developed to calculate band structures of 3D isotropic phononic crystals. FLEEPS is an iterative eigensolver of quasi-linear complexity to compute the smallest few eigenvalues of the linear elastic eigenvalue problem. The weighted SVD-preconditioned CG method in FLEEPS convergences faster than the AMG-preconditioned CG method by more than 60 times. Band structure calculations of several 3D isotropic phononic crystals demonstrate the strengths of FLEEPS.

Classification : 65F15, 74E10, 74E15

Format : Talk at Waseda University

Author(s) : Tiexiang Li (Southeast University) Heng Tian (Sichuan University of Science and Engineering) Xing-Long Lyu (Southeast University) Wen-Wei Lin (National Yang Ming Chiao Tung University)

[01271] Localized and degenerate controls for the incompressible Navier--Stokes system

Session Time & Room : 2E (Aug.22, 17:40-19:20) @F412

Type : Contributed Talk

Abstract : This talk concerns the global approximate controllability of incompressible Newtonian fluids driven by a physically localized and degenerate interior control. By introducing transported Fourier modes as building blocks, we act on the planar Navier--Stokes system via four scalar controls that depend only on time and appear as coefficients in an effectively constructed driving force supported in a given subdomain. The four unknown parameters can be computed by merely solving a linear transport controllability problem.

Classification : 35Q30, 35Q49, 76B75, 93B05, 93B18

Format : Talk at Waseda University

Author(s) : Manuel Rissel (New York University Shanghai) Vahagn Nersesyan (New York University Shanghai)

[01286] Radiation effect of NDNi nanocomposite, water-filled multiport cavity

Session Time & Room : 2D (Aug.22, 15:30-17:10) @D404

Type : Contributed Talk

Abstract : The control of the thermal radiation influence on free convection of a multiple-port open cavity packed with water supported nanocomposite nanofluid is investigated numerically . One inlet port and two outlet ports are situated on the perpendicular walls. The remaining cavity walls are adiabatic. The heated thin baffle is located inside the cavity. The cavity is crammed with the water-supported nanodiamondnickel nanocomposite. The governing Navierstokes equations are written in the term of vorticity stream function transport. An ADI scheme-based finite difference process is used for discretization of the governing equations. The results are discussed graphically with the various parameters of radiation parameter, Reynolds number, Rayleigh number, solid volume fraction, widths of the opening, and locations of baffle position. It reveals that the average heat transfer rate reduces with the baffle placed far from the inlet.

Classification : 76Sxx, 76Rxx, 76Mxx

Format : Talk at Waseda University
Author(s) : muthtamilselvan murugan (Bharathiar university)

[01288] A WENO-Based Scheme for Simulating Miscible Viscous-Fingering Instability in Highly Convection-Dominated Regimes

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E703

Type : Contributed Talk
Abstract : We develop a Diffuse interface numerical method that simulates the miscible Viscous-Fingering instability in highly convection-dominated regimes (Pclet number > 10000). The developed finite volume scheme uses a two-point flux approximation (TPFA) for Darcy law and a fifth-order Weighted Essentially Non-Oscillatory(WENO) approximation for the convection term of the transport equation. The details of the numerical scheme and simulation results that agree excellently with existing numerical or experimental data will be discussed in this talk.
Classification : 65Mxx, 35Qxx, 76Dxx, 76Sxx, 76Rxx
Author(s) : Surya Narayan Maharana (Indian Institute of Technology Ropar) Manoranjan Mishra (Indian Institute of Technology Ropar, India)

[01299] Mathematical modelling of peristaltic driven two-layered catheterized oesophagus

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D514

Type : Contributed Talk
Abstract : An analytical mathematical model for two-layered catheterized oesophagus is presented in the wave-frame. We take due care to conserve the fluids separately. A linear relationship between pressure and flow rate is discovered for catheterized oesophagus. Pressure and flow rate rise in the presence of a catheter with thinner peripheral layer. So it can be suggested that no patient should be fed anything directly through mouth once a catheter has been inserted into the oesophagus.
Classification : 92C10, 92-10, 35G20, 35G60, 92C35, Biomechanics
Format : Talk at Waseda University
Author(s) : ANUPAM KUMAR PANDEY (Indian Institute of Technology (BHU) , Varanasi) Sanjay Kumar Pandey (Indian Institute of Technology (BHU) , Varanasi)

[01303] Partially Mixed Cooperative Strategies in Evolutionary Games on Networks

Session Time & Room : 3E (Aug.23, 17:40-19:20) @D502

Type : Contributed Talk
Abstract : Cooperation is fundamental for the development of human societies. Different approaches have been proposed to explain the emergence of cooperation or partial cooperation in populations of individuals playing classical types of games. In this talk, we analyze the emergence of a new kind of cooperation, where we have a set of full cooperators and one of the partial ones, for the classical games. We prove conditions for Nash equilibria to be asymptotically stable.
Classification : 91CXX
Format : Online Talk on Zoom
Author(s) : Jean Carlo Moraes (Universidade Federal do Rio Grande do Sul)

[01309] Deep Learning Methods for BSDEs/PDEs in Finance

Session Time & Room : 4E (Aug.24, 17:40-19:20) @E506

Type : Contributed Talk
Abstract : In this work we present both a multistep deep learning method with automatic differentiation for the resolution of nonlinear PDEs and BSDEs and an adaptation of the Deep BSDE method for Quadratic BSDE and HJB equations. An approximation error result and error rate is proved for the schemes when using a class of networks with sparse weights. Applications to finance including CVA, portfolio optimisation under exponential utility and options pricing will be presented.
Classification : 65Cxx, 65Nxx, 60Hxx, 91Gxx, 68T07
Format : Talk at Waseda University
Author(s) : Daniel Bussell (UCL)

[01333] Development of Dynamical Systems-Inspired Metrics to Evaluate Immunotherapy Efficacy

Session Time & Room : 1C (Aug.21, 13:20-15:00) @

Type : Industrial Contributed Talk

Abstract : Immunotherapy emerged as the new paradigm to treat cancer patients. Computational tools that complement clinical practice are increasingly being used. Standardization of these tools is crucial for their adaptation and widespread implementation. This work contributes in this direction by developing new metrics inspired from dynamical systems and enriching a modular platform that predicts therapeutic issues of combination therapies in immune-oncology, and reduce the burden on clinical trials.

Classification : 92C32, 92C42, Quantitative Systems Pharmacology

Author(s) : Fahima Nekka (Universit de Montral) Didier Zugaj (Syneos Health) Frdrique Fenneteau (Universit de Montral) Miriam Schirru (Universit de Montral) Hamza Charef (Universit de Montral) Khalil-Elmehdi Ismaili (Universit de Montral) Pierre-Olivier Tremblay (Syneos Health)

[01340] Mathematical finance without probability

Session Time & Room : 1C (Aug.21, 13:20-15:00) @D514

Type : Contributed Talk

Abstract : We present a non-probabilistic, pathwise approach to continuous-time finance based on causal functional calculus. We introduce a definition of self-financing, free from any integration concept and show that the value of a self-financing portfolio is a pathwise integral and that generic domain of functional calculus is inherently arbitrage-free. We then consider the problem of hedging a path-dependent payoff across a generic set of scenarios. We apply the transition principle of Isaacs in differential games and obtain a verification theorem for the optimal solution, which is characterised by a fully non-linear path-dependent equation. For the Asian option, we obtain explicit solution.

Classification : 91G99, 91-10, Mathematical finance in continuous-time, model uncertainty

Format : Talk at Waseda University

Author(s) : Henry Chiu (Imperial College London)

[01345] Novel Lyapunov-type Inequality Involving Riesz Fractional Derivative

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G401

Type : Contributed Talk

Abstract : In this work, we obtained necessary condition for the existence of solutions to a fractional boundary value problem involving Riesz fractional derivative, which is defined as a two-sided fractional operator. The approach proposed in this work is based on the reduction of the problem considered to a singular integral equation, then we derive the Lyapunov-type inequalities in a weighted Lebesgue space.

Classification : 34B10, 34B16, 34B18

Format : Talk at Waseda University

Author(s) : Rabah Khaldi (Badji Mokhtar Annaba University) Assia Guezane Laakoud (Badji Mokhtar Annaba University)

[01348] Existence and nonexistence of solutions of thin-film equations with variable exponent spaces

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G404

Type : Contributed Talk

Abstract : This works aims at presenting a thin film problem involving variable exponent sources in a bounded domain. Which deals with the existence and nonexistence of solutions under subcritical initial energy. Also determine the global existence of solutions, exponential decay and finite time blow-up of solutions under specific conditions for the proposed model.

Classification : 35B44, 35D30, 35K70

Format : Talk at Waseda University

Author(s) : GNANAVEL Soundararajan (Central University of Kerala) GNANAVEL SOUNDARARAJAN (Central University of Kerala)

[01358] Compartment Models for Ideas on Social Media Networks

Session Time & Room : 3E (Aug.23, 17:40-19:20) @D505

Type : Contributed Talk

Abstract : The concept of virality and the structure of social media networks lend themselves to the use of SIR-like compartment models to study the spread of ideas between users on these platforms. This talk introduces the USBA - Unexposed, Sending, Bored, and Acclimated - family of discrete compartment models as a means of simulating how ideas reach and affect users and change the network structure, leading to the formation of echo chambers and polarization in sentiment.

Classification : 91D30, 91D10, 34C60, Internet Studies

Format : Online Talk on Zoom

Author(s) : Adam Mark Furman (University of Oxford Mathematical Institute)

[01362] Nanoparticle Shape Effect On a SodiumAlginate Based Cunanofluid Under a Transverse Magnetic Field

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D404

Type : Contributed Talk

Abstract : Sodium-alginate based nanofluids represent a new generation of fluids with improved performances in terms of heat transfer. This work examines the influence of the nanoparticle shape on a nonNewtonian viscoplastic Cunanofluid pertaining to this category. In particular, a stretching/shrinking sheet subjected to a transverse magnetic field is considered. The proposed Cunanofluid consists of four different nanoparticles having different shapes, namely bricks, cylinders, platelets, and blades dispersed in a mixture of sodium alginate with Prandtl number Pr = 6.45. Suitable similarity transformations are employed to reduce nonlinear PDEs into a system of ODEs and these equations and related boundary conditions are solved numerically by means of a RungeKuttaFehlberg method. Moreover, analytical solutions are obtained through the application of a MAPLE builtin differential equation solver "Dsolve". The behavior of prominent parameters against velocity and temperature is analyzed. It is found that the temperature increases for all shapes of nanoparticles with the viscoplastic parameter and the Eckert number.

Classification : 80A05, Nanofluid

Format : Talk at Waseda University

Author(s) : ABID HUSSANAN (University of Education, Lahore, Pakistan)

[01364] Time-Delay Systems: An Overview

Session Time & Room : 3E (Aug.23, 17:40-19:20) @A601

Type : Contributed Talk

Abstract : Time-delay naturally arises in many real-world systems, due to the fact that the instantaneous rate of change of such systems does not only depend on their current time but rather on their previous history as well. Hence, time-delays are ubiquitous, their introduction often leads to suppression of oscillations, multistability and chaotic motion in the dynamical systems. This talk presents some models with different kinds of time-delays such as discrete, distributed and combination of both discrete and distributed time-delays with special emphasis on the reason of incorporating such delays into the system

Classification : 92-10, 34D20

Format : Talk at Waseda University
Author(s) : Bootan Rahman (University of Kurdistan Hewler (UKH))

[01365] Non symmetric discontinuous Galerkin method for fractional differential equations

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E604

Type : Contributed Talk
Abstract : We study discontinuous Galerkin method for non-autonomous TF-ADR initial boundary value problems (IBVPs) with time fractional derivative of Caputo type. Recently, many efforts have been made to develop effective numerical methods for solving time-fractional problems. One of the typical direct numerical methods is the L1-Scheme, which can be viewed as a piecewise linear approximation to the fractional derivative. We used the classical L1-schemes for time discretization and discontinuous Galerkin method for space variable. Error bounds are established in the discrete energy norm. Finally, the convergence result is verified numerically.
Classification : 65M12, 65M15, 65M60
Format : Talk at Waseda University
Author(s) : GAUTAM SINGH (NIT TIRUCHIRAPPALLI)

[01371] A mixed element scheme of Helmholtz transmission eigenvalue problem for anisotropic media

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E603

Type : Contributed Talk
Abstract : In this paper, we study the Helmholtz transmission eigenvalue problem for inhomogeneous anisotropic media in two and three dimension. Starting with a nonlinear fourth order formulation established by Cakoni, Colton and Haddar in 2009, by introducing some auxiliary variables, we present an equivalent mixed formulation for this problem, followed up with the finite element discretization. Using the proposed scheme, we rigorously show that the optimal convergence rate for the transmission eigenvalues both on convex and nonconvex domains can be expected. Moreover, by this scheme, we will obtain a sparse generalized eigenvalue problem whose size is so demanding even with a coarse mesh that its smallest few real eigenvalues fail to be solved by the shift and invert method. We partially overcome this critical issue by deflating the almost all of the eigenvalue of huge multiplicity, resulting in a drastic reduction of the matrix size without

deteriorating the sparsity. Extensive numerical examples are reported to demonstrate the effectiveness and efficiency of the proposed scheme.

Classification : 65F15, 65M60, 65N25, 78M10

Format : Talk at Waseda University

Author(s) : Qing Liu (School of Mathematics, Southeast University) Tiexiang Li (School of Mathematics, Southeast University) Shuo Zhang (Academy of Mathematics and System Sciences, Chinese Academy of Sciences)

[01384] Adaptive coupling method for multi-domain time integration for lithium-ion battery simulations

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E702

Type : Contributed Talk

Abstract : The multiphysics and multiscale problem of simulating lithium-ion batteries at microscale is approached with a multi-domain time integration technique. The sub-domains of the electrolyte and the solid phase are simulated independently and coupled at certain interval. We obtain the adaptive coupling interval based on the error estimate evaluated on the Bulter-Volmer current density flux at the interface between the electrolyte and solid domains. The results are presented to discuss the computational benefits of such schemes.

Classification : 65M22, 65M12, 65Y99, 65Z05

Format : Online Talk on Zoom

Author(s) : Ali ASAD (CMAP, Ecole Polytechnique) Romain de Loubens (TotalEnergies One Tech) Laurent Franois (ONERA, DMPE) Laurent Sries (CMAP, Ecole Polytechnique) Marc Massot (CMAP, Ecole Polytechnique)

[01389] Exponential Behavior of Nonlinear Stochastic Partial Functional Equations Driven by Poisson Jumps and Rosenblatt Process

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G702

Type : Contributed Talk

Abstract : In this paper, we discuss the asymptotic behavior of mild solutions of nonlinear stochastic partial functional
equations driven by Poisson jumps and the Rosenblatt process in a Hilbert space. The Rosenblatt process is the simplest non-Gaussian Hermite process. It has continuous non-differentiable paths and is self-similar with stationary

increments. It is Murray Rosenblatt who first conceived of it. The results are obtained by using the Banach
fixed point theorem and the theory of resolvent operator developed by Grimmer. Finally, an example is provided
to illustrate the effectiveness of the obtained results.
Classification : 35R60, 60H15, Stochastic Differential Equations
Format : Talk at Waseda University
Author(s) : Anguraj Annamalai (PSG College of Arts & Science, Coimbatore, Tamil Nadu, India)

[01390] Neural Operator for Multidisciplinary Engineering Design

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G501

Type : Contributed Talk
Abstract : Deep learning surrogate models have shown promise in solving PDEs, which enable many-query computations in science and engineering. In this talk, I will first introduce a geometry-aware Fourier neural operator (Geo-FNO) to solve PDEs on arbitrary geometries, inspired by adaptive mesh motion and spectral methods. Furthermore, we study the cost-accuracy trade-off of different deep learning-based surrogate models, following traditional numerical error analysis. Finally, we demonstrate our approach on challenging engineering design problems.
Classification : 35C99, 65M99, 65Z05, 68T07
Format : Talk at Waseda University
Author(s) : Daniel Zhengyu Huang (Caltech) Andrew M. Stuart (Caltech) Elizabeth Qian (Georgia Tech) Maarten de Hoop (Rice University)

[01391] Defect reconstruction in waveguides using resonant frequencies

Session Time & Room : 1E (Aug.21, 17:40-19:20) @D405

Type : Contributed Talk
Abstract : This talk aims at introducing a new multi-frequency method to reconstruct width defects in waveguides. Different inverse methods already exist, but those methods are not using some frequencies, called resonant frequencies, where propagation equations are known to be ill-conditioned. Since waves seem very sensible to defects at these particular frequencies, we exploit them instead. Given partial wavefield measurements, we reconstruct slowly varying width defects in a stable way and provide numerical comparisons with existing methods.

Classification : 78A46, 35B34
Format : Talk at Waseda University
Author(s) : Angle Niclas (CMAP - cole Polytechnique)

[01392] Solving a fractional pantograph delay equation

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G401

Type : Contributed Talk
Abstract : We study a pantograph delay equation involving a fractional derivative. Our approach relies basically on the reduction of the considered problem to an equivalent integral equation, then by using fixed point theorems, we prove the existence results. We also discussed the fractional Ambartsumian differential equation, that describes in the classical case the absorption of light by the interstellar matter.
Classification : 34B05, 26A33, 34A30
Format : Online Talk on Zoom
Author(s) : Assia Guezane Laakoud (Badji Mokhtar Annaba University) Rabah Khaldi (Badji Mokhtar Annaba University)

[01393] Generalized Mittag-Leffler Functions and Its Rational Approximations with Real Distinct Poles

Session Time & Room : 1E (Aug.21, 17:40-19:20) @G402

Type : Contributed Talk
Abstract : Mittag-Leffler functions are indispensable in the theory of fractional calculus and many other applications in engineering. However, their computational complexities have made them difficult to deal with numerically. A real distinct pole rational approximation of the two-parameter Mittag-Leffler function is proposed. Under some mild conditions, this approximation is proven and empirically shown to be L-Acceptable. These approximations are especially useful in developing efficient and accurate numerical schemes for partial differential equations of fractional order. Some applications are presented, such as complementary error function and solution of fractional differential equations.
Classification : 33B10, 41A20, 65L05
Author(s) : Olaniyi Samuel Iyiola (Clarkson University)

[01416] Autonomous controllers for a Swarm of UAVs

Session Time & Room : 1E (Aug.21, 17:40-19:20) @F401

Type : Contributed Talk
Abstract :
Self-organization patterns emerge in biological swarms' due to collective interactions from their individuals. This paper presents a set of novel autonomous controllers of the individuals of a swarm of planar unmanned aerial vehicles for the MPC problem. The stabilizing continuous nonlinear controllers of the UAVs gives rise to diverse pattern formation due to the communication that occurs amongst an individual and its neighbors. The controllers' effectiveness is illustrated through computer and numerical simulations.
Classification : 93-XX, 93-10, 93Dxx, 93D05
Author(s) : Sandeep Ameet Kumar (School of Information Technology, Engineering, Mathematics and Physics, The University of the South Pacific)

[01418] Non-linear Particle Swarm Optimization Algorithm for Non-linear Fixed-charge Transportation Problems

Session Time & Room : 3E (Aug.23, 17:40-19:20) @D505

Type : Industrial Contributed Talk
Abstract : The non-linear fixed-charge transportation problems are one of the challenging NP-hard problems. Hence, a new non-linear particle swarm optimization algorithm (NPSO) with new inertia weight and acceleration coefficients have been introduced that not only explores the search space but also maintains the feasibility condition of the transportation problem. The performance of the proposed NPSO is compared with its existing variants. Also, some benchmarks problems from the literature have been solved and the results are compared.
Classification : 90B06, 90C30, 90C90, 90C06
Format : Talk at Waseda University
Author(s) : Shivani Saini (Dr B R Ambedkar National Institute of Technology Jalandhar (INDIA)) Deepika Rani (Dr B R Ambedkar National Institute of Technology Jalandhar (INDIA))

[01420] A stochastic solution to inverse problems in thermo-fluid problems

Session Time & Room : 4E (Aug.24, 17:40-19:20) @D401

Type : Contributed Talk

Abstract : Inverse problems find their applications in various thermo-fluid systems. The present work aims to develop a computational framework using fast Bayesian inference, which leads to forward uncertainty propagation in various thermo-fluid models and solves the corresponding inverse problems. The framework leverages the polynomial chaos expansions (PCEs) to generate a computationally efficient and statistically equivalent surrogate model of the computationally expensive forward model and dimensionality reduction based on Karhunen-Loeve (K-L) expansion.

Classification : 76M21, 80A23, 86A22

Format : Online Talk on Zoom

Author(s) : SUFIA KHATOON (Indian Institute of Technology Delhi)

[01434] Pointwise adaptive finite element method for the elliptic obstacle problem

Session Time & Room : 1C (Aug.21, 13:20-15:00) @D514

Type : Contributed Talk

Abstract : In this talk, I will discuss pointwise a posteriori error analysis of a finite element method for the obstacle problem. The reliability and the efficiency of the proposed a posteriori error estimator will be discussed. In the analysis, sign property of Lagrange multipliers, Green's function estimates and the barrier functions play a crucial role. The construction of the barrier functions is based on appropriate corrections of the conforming part of the solution obtained via an enriching operator. The use of the continuous maximum principle guarantees the validity of the analysis without mesh restrictions but shape regularity. Numerical results will be presented to illustrate the performance of a posteriori error estimator.

Classification : 65N15, 65N30

Format : Talk at Waseda University

Author(s) : Kamana Porwal (Indian Institute of Technology Delhi, New Delhi)

[01435] Automatic generation of terrain maps using sequences of satellite images

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E504

Type : Contributed Talk

Abstract : In this work, we propose an unsupervised methodology for analyzing temporal sequences of satellite images. Images decompose into disjoint tiles, and we embed sequences of tiles into multidimensional time series. The proposed embedding captures valuable information about the terrain and its evolution. It allows the partitioning of the ground into different types of terrain and understanding of the relationship between them. The proposed methodology shows promising results when analyzing a region of Navarre, Spain.

Classification : 62H35

Format : Talk at Waseda University

Author(s) : Aritz Prez (Basque Center for Applied Mathematics) Carlos Echegoyen (Public University of Navarre) Guzmn Santaf (Public University of Navarre) Unai Prez (Public University of Navarre) Mara Dolores Ugarte (Public University of Navarre)

[01452] Some Statistical Properties and Maximum Likelihood Estimation of Parameters of Bivariate Modified Weibull Distribution with its Real-Life Applications

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E504

Type : Contributed Talk

Abstract : Real-life data sets with ties arise quite commonly in medicine, industry, reliability and survival analysis. We attempt to model such types of data sets using bivariate distributions with singular components. For this purpose, we consider mainly two types of approaches, namely the "Minimization approach" and the "Maximization approach." Using the minimization approach the bivariate modified Weibull (BMW) distribution is derived. Due to five parameters, the BMW is a more general and flexible distribution. It reduces to the Marshall-Olkin bivariate exponential (MOBE) and Marshall-Olkin bivariate Weibull (MOBW) distributions under certain parameter restrictions. Some distributional, modal and aging properties of BMW will be discussed. The copula associated with BMW distribution is given. Finally, we will discuss the maximum likelihood estimation of parameters of BMW distribution via the EM algorithm. We will give some

numerical results of a real-life data set with ties.

Classification : 62Nxx, Mainly to developed models to analyze real life bivariate data sets where the ties occur naturally in the data sets. The data may be censored . Such type of models are known as Bivariate distributions with singular component.

Format : Talk at Waseda University

Author(s) : Sanjay Kumar (Ph.D. Student, Department of Mathematics & Statistics, Indian Institute of Technology Kanpur) Debasis Kundu (Professor, Department of Mathematics & Statistics, Indian Institute of Technology Kanpur) Sharmishtha Mitra (Professor, Department of Mathematics & Statistics, Indian Institute of Technology Kanpur)

[01463] Chemical Signalling and Pattern Formation in Predator-Prey Models

Session Time & Room : 4C (Aug.24, 13:20-15:00) @A601

Type : Contributed Talk

Abstract : Random movement of species is well documented to put forward Turing instability in predator-prey models . On the other hand recent studies suggest that directed movement of species known as direct taxis leads to stabilization of steady state and no patterns emerge. However the importance of chemical cues in predator-prey interactions is still a topic of contention among ecologists. Source of chemicals to which prey species respond often originate as cues released by the predators which lead to directed movement of prey individuals opposite to the concentration of chemicals. This movement of prey individuals opposite to the gradient of chemical is known as indirect predator taxis. This talk will introduce an advection-reaction-diffusion mathematical model to understand the impact of chemical induced anti-predation defense in a special class of predator-prey system. The reaction part considers Schoener's model of intraguild-predation which has no periodic solution. We will discuss uniqueness and existence of classical solutions, linear stability analysis results and conditions for the pattern formation. We will show that random diffusion forces constant steady state to be stable and only directed movement of prey individuals has ability to destabilizes the constant steady state and spatio-temporal patterns emerge. We numerically show emergence of spatio-temporal patterning that depicts the tendency to spatio-temporal separation between prey and predators.

Classification : 92B05, Mathematical Biology, Partial Differential Equations

Format : Online Talk on Zoom

Author(s) : Purnedu Mishra (Norwegian University of Life Sciences Norway) Prof. Darius Wrzosek (Norwegian University of Life Sciences)

[01472] The Arithmetic Mean iterative methods for solving brain glioma growth models

Session Time & Room : 1C (Aug.21, 13:20-15:00) @F310

Type : Contributed Talk

Abstract : Brain tumour is the uncontrolled growth of normal brain cells and most malignant form is known as glioma. In this work, the formulation and implementation of the Arithmetic Mean iterative methods for solving glioma growth models are presented. Numerical results and convergence analysis are included to verify the performance of the proposed methods.

Classification : 41A55, 45A05, 45B05, 65D32, 65F10

Format : Talk at Waseda University

Author(s) : Mohana Sundaram Muthuvalu (Universiti Teknologi PETRONAS) Jumat Sulaiman (Universiti Malaysia Sabah) Elayaraja Aruchunan (Universiti Malaya) Majid Ali (Universiti Sains Malaysia) Ramoshweu Solomon Lebelo (Vaal University of Technology)

[01477] Optimization of a submerged piezoelectric device using an ANN Model

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E811

Type : Contributed Talk

Abstract : The design of a submerged piezoelectric wave energy converter (PWEC) device has been analyzed to optimize the power generated by the PWEC device. An artificial neural network (ANN) is adopted to optimize the geometric parameters of the device. First, a numerical model is introduced using the boundary element methodology (BEM). The input database for the modeling of the ANN model is generated using the Latin Hypercube Sampling method, and the output database for the modeling of the ANN model is simulated using the numerical model based on BEM. Four hundred samples are used to model the ANN with data taken in a 70:30 ratio for training and validation of the model. The prediction of the optimal parameter values for the design of the PWEC device is carried out using a database containing 3000 sample points generated randomly using the LHS method. The developed ANN model shows a good agreement between the training accuracy and the validation accuracy. Also, the model forecast provides a range for the geometric parameters of the PWEC device to optimize power generation.

Classification : 68T07, 68T20, 68V99

Format : Talk at Waseda University

Author(s) : Vipin V (Birla Institute of Technology and Science Pilani, Hyderabad Campus) SANTANU KOLEY (Dept.of Mathematics, Birla Institute of Technology and Science - Pilani, Hyderabad Campus)

[01478] Water wave interaction with porous wave barriers placed over stepped-seabed.

Session Time & Room : 1C (Aug.21, 13:20-15:00) @F311

Type : Contributed Talk

Abstract : This study examines the dispersion of water waves by inverted semicircular surface-piercing wave barriers installed on a stepped seabed. The Boundary element method is applied to handle the present Boundary value problem. In addition to this energy identity is derived to estimate the dispersion of wave energy by the pair of perforated wave barriers. In addition, the influence of porosity, geometrical configurations of pair of porous barriers, and stepped seabed on the energy dissipation are investigated. The study reveals that for smaller Keulegan-Carpenter (KC) number, the energy dissipation due to the perforated barriers is higher. However, the reflection coefficient shows the opposite pattern.

Classification : 45B05, 45G15, 45F05

Format : Online Talk on Zoom

Author(s) : SANTANU KUMAR DASH (Birla Institute of Technology and Science-Pilani, Hyderabad campus) SANTANU KOLEY (Birla Institute of Technology and Science - Pilani, Hyderabad Campus)

[01479] Water wave trapping by porous barriers using boundary element method.

Session Time & Room : 1C (Aug.21, 13:20-15:00) @F311

Type : Contributed Talk

Abstract : This study examines the dispersion of water waves by inverted semicircular surface-piercing wave barriers installed on a stepped seabed in presence of a rigid wall in the right far-field boundary. The boundary element method is applied to handle the present boundary value problem. In addition, the energy identity is derived to estimate wave energy dispersion by the pair of perforated wave barriers. The influence of porosity, geometrical configurations of pair of porous barriers, and stepped seabed on the energy dissipation are investigated. The study reveals that for smaller Keulegan-Carpenter (KC) number, the energy dissipation due to the perforated barriers is higher. However, the reflection coefficient shows the opposite pattern.

Classification : 45B05, 45G15, 45F05

Format : Online Talk on Zoom
Author(s) : KAILASH CHAND SWAMI (Birla Institute of Technology & Science-Pilani,Hyderabad Campus) SANTANU KOLEY (Birla Institute of Technology and Science - Pilani, Hyderabad Campus)

[01489] Mathematical modelling of hybrid wave energy converter device

Session Time & Room : 1C (Aug.21, 13:20-15:00) @F311

Type : Contributed Talk
Abstract : The hydrodynamics of a hybrid wave energy converter device is investigated. For the sake of mathematical modeling, the associated boundary value problem is converted into a system of Fredholm integral equations and solved using the boundary element method. To incorporate the higher order plate boundary condition, central difference scheme is used. Primary emphasis is given to analyze the power extraction of the hybrid wave energy converter device for various incident wave parameters associated with the hybrid wave energy converter device.
Classification : 45B05, 76B15, 76B07
Format : Talk at Waseda University
Author(s) : KSHMA TRIVEDI (Birla Institute of Technology and Science-Pilani, Hyderabad campus) SANTANU KOLEY (Birla Institute of Technology and Science-Pilani, Hyderabad campus)

[01490] RANS modelling of OWC device over the sloping seabed

Session Time & Room : 2C (Aug.22, 13:20-15:00) @D401

Type : Contributed Talk
Abstract : The hydrodynamics of the oscillating water column device placed over the sloping seabed under the influence of irregular incident waves is studied. Reynolds-Averaged Navier-Stokes equations (RANS) with a modified k w turbulence model was used and the air-water interface was tracked using a volume-of-fluid (VOF) approach. The results demonstrate that the amplitude of the inward and outward velocities via the orifice, free surface elevations, and flow characteristics are greater for higher significant wave heights.
Classification : 76D05, 76D33, 76F25
Format : Online Talk on Zoom
Author(s) : AMYA RANJAN RAY (Birla Institute of Technology and Science,

Pilani Hyderabad Campus) SANTANU KOLEY (Birla Institute of Technology and Science - Pilani, Hyderabad Campus)

[01509] Hydromagnetic Hybrid Nanofluid Flow Over a Rotating Stretching Disk

Session Time & Room : 2E (Aug.22, 17:40-19:20) @D405

Type : Contributed Talk

Abstract : The research aim in the this article is to study the effect of magnetic field on the unsteady flow and heat transfer of an incompressible nanofluid due to a rotating disc. In addition, the flow is taken to be in a Darcy-Forchheimer porous medium. The governing set of highly non-linear PDEs are converted into set of highly non-linear ODEs using suitable similarity transformations. The system consisting of non-linear ODEs is numerically solved by the Spectral Quasi Linearization Method (SQLM). The solutions for the local skin friction along the radial direction, local skin friction along tangential direction, and the local heat transfer rate at the surface of the disc for different values of the suitable parameters are also obtained. The results of dimensionless velocity and temperature profiles are shown graphically where the values of local skin-friction coefficients and the heat transfer coefficients are presented in tabular form. A statistical analysis in the form of regression analysis is also performed to estimate the skin-friction and heat transfer coefficients.

Classification : 76W05, 76S05

Format : Talk at Waseda University

Author(s) : Raj Nandkeolyar (Department of Mathematics, National Institute of Technology Jamshedpur, Jamshedpur) Premful Kumar (Department of Mathematics, National Institute of Technology Jamshedpur, Jamshedpur)

[01524] Radon measure solutions to compressible Euler equations and applications

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G701

Type : Contributed Talk

Abstract : We proposed a definition of Radon measure solutions to the compressible Euler equations with general constitutive relations. With this definition, we proved the Newton-Busemann law for stationary hypersonic flow passing bodies, constructed delta shock solutions to the Riemann problems of the rectilinear barotropic Euler equations, justified the interpretation of delta shocks as free pistons. This shows the possibility of

treating solid-fluid interaction problems by simpler Cauchy problems with solutions in the class of Radon measures.

Classification : 35R06, 35Q31, 35D99

Format : Talk at Waseda University

Author(s) : Hairong Yuan (East China Normal University) Aifang Qu (Shanghai Normal University)

[01539] Actuator fault reconstruction-based tracking control for periodic piecewise polynomial systems

Session Time & Room : 1C (Aug.21, 13:20-15:00) @G501

Type : Contributed Talk

Abstract : The problem of actuator fault reconstruction and fault-tolerant tracking control for periodic piecewise polynomial systems with time-varying delay is investigated. The observer system is configured with periodic piecewise polynomial character to concurrently reconstruct the actuator faults and states of the system. Based on these configurations, the fault-tolerant tracking control is proposed, which aids in tracking the reference system by compensating the actuator faults. Numerical example is provided to validate the competence of proposed control scheme.

Classification : 93CXX, 37MXX, 37N35, 34H05, 34H15

Author(s) : Aravinth Narayanan (Bharathiar University) Sakthivel Rathinasamy (Bharathiar University)

[01540] Composite Disturbance Rejection and Stabilization for Periodic Control Systems

Session Time & Room : 1C (Aug.21, 13:20-15:00) @F311

Type : Contributed Talk

Abstract : The stabilization and disturbance rejection issues for periodic control systems with actuator faults and external disturbances are investigated through a proportional integral observer approach. An equivalent-input-disturbance approach is employed to estimate the external disturbances. Moreover, proportional integral observer provides more design freedom and enhances the estimation precision of equivalent-input-disturbance. A periodic time-varying control framework is proposed to guarantee robust performance of the system. The potential of the proposed control design is validated via numerical simulations.

Classification : 93CXX, 37MXX, 37N35, 34H05, 34H15

Author(s) : Satheesh Thangavel (Bharathiar University) Sakthivel Rathinasamy (Bharathiar University)

[01542] Bipartite synchronization of complex dynamical networks under hybrid-triggered control

Session Time & Room : 1C (Aug.21, 13:20-15:00) @D514

Type : Contributed Talk

Abstract : The bipartite synchronization problem for multi-weighted complex dynamical networks subject to random coupling delays and external disturbances is investigated. For this, a hybrid-triggered control is incorporated, which in addition, is effective in the reduction of network resource usage guaranteeing the systems performance. And, the external disturbances are attenuated under extended passivity performance. Moreover, the conditions for ensuring the requisite synchronization of undertaken networks are derived. A numerical example is illustrated to validate the results obtained.

Classification : 93CXX, 37MXX, 37N35, 34H05, 34H15

Author(s) : Birundha Devi Nallamuthu (Bharathiar University) Sakthivel Rathinasamy (Bharathiar University)

[01544] Unknown Input Observer-based Multiple Faults Reconstruction for Interval Type-2 Fuzzy-Model

Session Time & Room : 1D (Aug.21, 15:30-17:10) @A208

Type : Contributed Talk

Abstract : The prime intent of this study is to resolve the multiple faults reconstruction and state tracking issues for the interval type-2 fuzzy systems subject to actuator and sensor faults by using an active fault-tolerant tracking control law based on an unknown input observer approach. Moreover, a set of sufficient conditions namely linear matrix inequality is derived to ensure the tracking performance of the addressed system. Eventually, the derived theoretical results are verified through numerical examples.

Classification : 93CXX, 37MXX, 37N35, 34H05, 34H15

Author(s) : Anusuya Sundaram (Bharathiar University) Sakthivel Rathinasamy (Bharathiar University)

[01546] Input-output Finite-time Stabilization for Parabolic PDE Systems with Semi-Markov Switching

Session Time & Room : 1D (Aug.21, 15:30-17:10) @A208

Type : Contributed Talk

Abstract : A robust reliable boundary control problem for a class of parabolic PDE systems with semi-Markov switching subject to actuator faults, randomly occurring uncertainties and nonlinearities is investigated. Particularly, randomness phenomena are characterized by stochastic variables obeying Bernoulli distribution properties. A boundary controller is developed to ensure the robust performance of the considered system. Sufficient conditions for guaranteeing the input-output finite-time stabilization of the closed-loop system are derived. Proposed method is validated through simulation outcomes.

Classification : 93CXX, 37MXX, 37N35, 34H05, 34H15

Author(s) : Abinandhitha Radhakrishnan (Bharathiar University) Sakthivel Rathinasamy (Bharathiar University)

[01548] Quadratically Regularized Bilevel Optimal Transport

Session Time & Room : 2C (Aug.22, 13:20-15:00) @F411

Type : Contributed Talk

Abstract : We study the effect of an L^2 regularization to an optimal control problem that is constrained by the Kantorovich problem of optimal transport. We present a class of possible applications by means of a toy problem. Using a reverse approximation argument, we discuss the approximability of solutions of the unregularized problem by a sequence of solutions of the regularized problems.

Classification : 49Q22, 90C08, 49J45

Format : Talk at Waseda University

Author(s) : Sebastian Hillbrecht (Technische Universitt Dortmund) Christian Meyer (Technische Universitt Dortmund) Paul Manns (Technische Universitt Dortmund)

[01550] Stabilization and State Estimation of Semi-Markovian Cyber-Physical Systems via Time-Triggered Control

Session Time & Room : 1D (Aug.21, 15:30-17:10) @F311

Type : Contributed Talk

Abstract : The issues of input-output finite-time stabilization and state estimation for a class of semi-Markovian switching cyber-physical systems with cyber-attacks are investigated. Primarily, immeasurable states are estimated by designing a mode-dependent observer. Further, based on the observer information, mode-dependent time-triggered controller is developed to ensure that the resultant system is input-output finite-time stable. Finally, the efficacy of proposed result is demonstrated through a numerical example.

Classification : 93CXX, 37MXX, 37N35, 34H05, 34H15

Author(s) : Panneerselvam Vellingiri (Bharathiar university) Sakthivel Rathinasamy (Bharathiar university)

[01551] Observer-based Nonlinear Fault-tolerant Control Design for Fractional-order Parabolic PDE Systems

Session Time & Room : 2C (Aug.22, 13:20-15:00) @G710

Type : Contributed Talk

Abstract : The problem of robust stabilization for fractional-order parabolic PDE systems with nonlinear actuator faults is considered. The main aim of this work is to design an observer-based nonlinear fault-tolerant controller for obtaining the required results. Then, a set of conditions are derived with the aid of Lyapunov-based approach for the stabilization analysis. Further, the theoretical results are verified through the numerical example with graphical results.

Classification : 35R11, 93Dxx, 93Cxx, 37Mxx, 37N35

Format : Online Talk on Zoom

Author(s) : Sweetha Senthilrathnam (Bharathiar university) Sakthivel Rathinasamy (Bharathiar University)

[01564] Extended Observer-based Control for Interval-type-2 Fuzzy Systems Under Event-Triggered Scheme

Session Time & Room : 1D (Aug.21, 15:30-17:10) @F311

Type : Contributed Talk

Abstract : The problems of disturbance rejection and fault tolerant control for interval-type-2-fuzzy systems are investigated by utilization of a generalized extended state observer. To be specific, the system states along with disturbances and actuator faults are simultaneously reconstructed by the implemented observer. Besides, an observer-based event-triggered scheme is implemented to mitigate the communication burden. Furthermore, the asymptotic stability criteria for the constructed system are formulated. Consequently, the theoretical declarations are authenticated by prevailing numerical simulation results.

Classification : 93CXX, 37MXX, 37N35, 34H05, 34H15

Format : Online Talk on Zoom

Author(s) : Shobana Nagarajan (Bharathiar University) Sakthivel Rathinasamy (Bharathiar University)

[01573] A novel robust adaptive algorithm for time fractional diffusion wave equation on non-uniform meshes

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E711

Type : Contributed Talk

Abstract : In this work, a novel high-order adaptive algorithm on non-uniform grid points for the Caputo fractional derivative is derived. Developed algorithm allows one to build adaptive nature where numerical scheme is adjusted according to behavior of α to keep errors very small and converge to solution very fast. Analysis of numerical scheme has been established thoroughly. Moreover, a reduced order technique is implemented by using moving mesh refinement to improve accuracy at several time levels.

Classification : 65N06, 65N12, 65N50, 65N15

Format : Online Talk on Zoom

Author(s) : Rahul Kumar Maurya (Government Tilak P.G. College, Katni, Madhya Pradesh, India) Vineet Kumar Singh (Indian Institute of Technology (BHU) , Varanasi, India)

[01579] Boltzmann equation with generalized collisional invariants

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D402

Type : Contributed Talk
Abstract : I demonstrate the Boltzmann equation with the generalized collision invariants. We investigate the dissipation process and transport characteristics obtained by such Boltzmann equation with the generalized collision invariants. Such results also imply the characteristics of fluids with anomalous diffusion.
Classification : 82Bxx, 93A16
Format : Talk at Waseda University
Author(s) : Ryosuke Yano (Tokio Marine dR. Co., Ltd.)

[01580] Fast Summation for the Barotropic Vorticity Equations

Session Time & Room : 4E (Aug.24, 17:40-19:20) @D401

Type : Contributed Talk
Abstract : The barotropic vorticity equations describe the conservation of absolute vorticity for a fluid on a rotating sphere. When transformed appropriately, one can rewrite these with a Biot-Savart integral, and with a Lagrangian discretization, one can arrive at a discretized system with an update taking the form of a N-body sum. In this talk, I present a fast summation technique that reduces the asymptotic complexity of this sum from $O(N^2)$ to $O(N\log{N})$ with a new spherical tree code, suitable for a wide range of problems in geophysical fluid dynamics.
Classification : 76M28, 76U99, 65M75, 86A08
Format : Talk at Waseda University
Author(s) : Anthony Chen (University of Michigan, Ann Arbor)

[01582] Parameter Estimation in Mathematical Models Using Uncertainty and Sensitivity Analyses

Session Time & Room : 4C (Aug.24, 13:20-15:00) @G301

Type : Contributed Talk

Abstract : The accurate estimation of uncertain parameters in a mathematical model is still considered a laborious task. We propose a systematic methodology based on uncertainty and sensitivity analyses framework applied on a dynamic population balance model representing a crystallization process for the precise estimation of model parameters. For models involving many uncertain parameters, the proposed strategy can be adopted to rank parameters by their decreasing importance and then achieve precise estimation of the more significant parameters.

Classification : 00A71, 81S07, 93B35, Parameter Uncertainty, Uncertainty Quantification, Sensitivity Analysis, Population Balance Models

Format : Online Talk on Zoom

Author(s) : PRIYANKA SEHRAWAT (Indian Institute of Technology Kharagpur) Priyanka Sehrawat (Indian Institute of Technology Kharagpur) Debasis Sarkar (Indian Institute of Technology Kharagpur) Jitendra Kumar (Indian Institute of Technology Ropar)

[01588] Stable numerical schemes and adaptive algorithms for fractional diffusion-wave equation

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E603

Type : Contributed Talk

Abstract : This work develops a stable scheme and adaptive algorithm for time-fractional mathematical models. Developed algorithm allows one to build adaptive nature where numerical scheme is adjusted according to behavior of α to keep errors very small and converge to solution very fast. Analysis of numerical scheme has been established thoroughly. Moreover, a reduced order technique is implemented by using moving mesh refinement to improve accuracy at several time levels.

Classification : 65N06, 65N50, 65N12, 65N15

Author(s) : Vineet Kumar Singh (Indian Institute of Technology (BHU) , Varanasi, India) Rahul Kumar Maurya (Government Tilak P.G. College, Katni, Madhya Pradesh, India)

[01592] Optimal blood distribution using a matheuristic approach

Session Time & Room : 4D (Aug.24, 15:30-17:10) @D408

Type : Contributed Talk

Abstract : The problem of distribution of blood has been extensively studied, but models relating to
different blood types have not been specifically considered in the literature to the best of our
knowledge. This paper describes a new mathematical model for optimising blood distribution in
residential areas. A Lagrangian relaxation-based matheuristic is developed to solve the problem.
Hypothetical data sets were generated to mimic real blood distribution system in an urban
setting. Results obtained using CPLEX solver on the AMPL platform reveal that the model
described in this study is able to achieve quality results within very short times. Specifically, the
number of located blood facilities is minimized for each problem instances as well as covering
much of the demand points on the distribution network. We observe that the proposed system,
when compared to the existing system, provides a better approach to blood distribution and is
adaptable to related areas of supply chain.

Classification : 90C26, 90C27

Author(s) : Olawale Joshua Adeleke (Redeemer's University) Olawale Joshua Adeleke (Redeemer's University) Idowu Ademola Osinuga (Federal University of Agriculture, Abeokuta, Nigeria)

[01599] Theoretical and Experimental Understanding for EMI Shielding and Supercapacitor Applications

Session Time & Room : 1C (Aug.21, 13:20-15:00) @

Type : Contributed Talk

Abstract : The EMI shielding performance and energy storage properties of the -MnO2 SQDs are modulated by incorporating cobalt ions into crystal structure and results are verified through theoretical analysis. All the inherent properties are scrutinised using Reitveld refinement with simulated X-ray and DFT techniques. Besides cDFT/cRPA, PBE generalized GGA+U exchange correlation is used based on FM and different AFM configurations by avoiding SIE. Therefore, this theory can predict the superiority in EMI shielding and supercapacitive performance.

Classification : 06Fxx
Author(s) : Prof. Sukhen Das (Department of Physics, Jadavpur University) Dr. Dheeraj Mondal (Department of Physics, Jadavpur University) Dr. Biplab Kumar Paul (University of Engineering and Management)

[01601] Estimation of the Elementary Chirp Model Parameters

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G701

Type : Contributed Talk
Abstract : We propose some estimation techniques to estimate the elementary chirp model parameters.We derive asymptotic properties of least squares estimators (LSEs) and approximate least squares estimators (ALSEs) for the one-component elementary chirp model. We propose sequential LSEs and sequential ALSEs to estimate the multiple-component elementary chirp model parameters and prove that they have the same theoretical properties as theLSEs. We illustrate the performance of the proposed sequential algorithm on a bat data.
Classification : 62H12, 62F12
Format : Talk at Waseda University
Author(s) : Anjali Mittal (Indian Institute of Technology Kanpur) Rhythm Grover (Indian Institute of Technology Guwahati) Debasis Kundu (Indian Institute of Technology Kanpur) Amit Mitra (Indian Institute of Technology Kanpur)

[01607] AN INVENTORY MODEL WITH PRICE- AND STOCK-DEPENDENT DEMAND

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D505

Type : Contributed Talk
Abstract : In this paper, we develop a multi-item inventory model with price- and stock-dependent demand and backorder. The decision variables in the model are the cycle length and the time when inventory drops to zero. The purpose of the model is minimizing the total inventory cost. Comparisons among alternative replenishment policies such as individual order, joint order or combination between these two policies are also considered. Numerical experiments and sensitivity analysis are also given.
Classification : 90B05, 91B06, 91B02, Inventory models
Format : Talk at Waseda University
Author(s) : Dharma Lesmono (Universitas Katolik Parahyangan) Taufik

Limansyah (Universitas Katolik Parahyangan) Ignasius Sandy (Universitas Katolik Parahyangan)

[01621] A Case Study on Multi-objective Fixed-charge Transportation Problem

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A206

Type : Contributed Talk

Abstract : This paper investigates a case study in the field of transportation and proposes an approach for the Pareto-optimal solution of the multi-objective fixed-charge transportation problem with real life parameters represented as uncertain numbers. The model includes the knowledge and agreement as well as difference in judgements of all the experts involved. Three approaches, viz, goal programming, weighted-sum method and the fuzzy programming technique are extended using AHP, and the obtained results are analyzed and discussed.

Classification : 90C29, 90C70, 90B06, 90-10

Author(s) : Deepika Rani (Dr B R Ambedkar National Institute of Technology Jalandhar (INDIA)) Shivani Saini (National Institute of Technology Jalandhar (INDIA))

[01624] MHD free Convection of Casson fluid flow in an Inclined Square Cavity with Moving upper wall

Session Time & Room : 5B (Aug.25, 10:40-12:20) @D101

Type : Contributed Talk

Abstract : We have studied the natural convection of Casson fluid in a partially heated, inclined porous square cavity in the presence of external inclined magnetic field and viscous dissipation. In addition to these, it is assumed that the upper wall of the cavity is moving. We have used higher order Galerkin finite element method to solve the system of governing equations. Moreover, a comparative study for effects of various physical parameters has been done.

Classification : 76A05, 76D05, 76M10, 76S05, 76W05

Format : Online Talk on Zoom

Author(s) : Ram Dhan Mahla (University of Rajasthan) Sharad Sinha (University of Rajasthan Jaipur)

[01629] Constructive approaches for the controllability of semi-linear heat and wave equations

Session Time & Room : 4D (Aug.24, 15:30-17:10) @G602

Type : Contributed Talk
Abstract : We addresses the controllability of the semi-linear heat equation $\partial_t y- \partial_{xx} y+f(y)=0$, $x\in (0,1)$. Assuming that the function f is C^1 over $\mathbb{R}$ and $\limsup_{\vert r\vert\to \infty} \vert f^\prime(r)\vert/\ln^{3/2}\vert r\vert\leq \beta$ for some $\beta>0$ small enough, we show that a fixed point application related to a linearized equation is contracting yielding a constructive method to approximate boundary controls for the semi-linear equation. Similar ideas are used to address the controllability for semi-linear wave type equations.
Classification : 35K58, 93B05
Format : Talk at Waseda University
Author(s) : Arnaud Munch (Clermont Auvergne University)

[01630] Analysis of blood flow through multiple stenoses in a narrow artery

Session Time & Room : 4C (Aug.24, 13:20-15:00) @A601

Type : Contributed Talk
Abstract : A study of the effects of blood flow parameters in narrow arteries having multiple stenoses is made here, where the blood is considered as a non-Newtonian Kuang-Luo (K-L) fluid model, with no-slip conditions at the arterial wall. In fact, the main properties of K-L fluid model are that the plasma viscosity and yield stress play a very important role. These parameters make this fluid remarkably similar to blood, however, when we change these parameters the flow characteristics change significantly. We have derived a numerical expression for the blood flow characteristics such as resistance to blood flow, blood flow rate, axial velocity, and skin friction. These numerical expressions have been solved by MATLAB 2021 software and discussed graphically. Furthermore, these results have been compared with Newtonian fluid and observation made that resistance to blood flow and skin friction is decreased when blood is changed from non-Newtonian to Newtonian fluid.
Classification : 92B05, 92C30, 76Z05
Format : Talk at Waseda University
Author(s) : Sanjeev Kumar (Dr. Bhimrao Ambedkar University, Agra)

Rashmi Sharma (Dr. Bhimrao Ambedkar University) Amendra Singh (Dr. Bhimrao Ambedkar University)

[01634] Mimetic schemes applied to the convection diffusion equation: A numerical comparison.

Session Time & Room : 2D (Aug.22, 15:30-17:10) @E702

Type : Contributed Talk

Abstract : Mimetic Finite Difference Schemes (DFM) are increasingly present in the numerical resolution of transient problems [1] since they are more precise than traditional Finite Difference (DF) schemes. However, there are methods in DF that use appropriate combinations of schemes in different nodes in order to eliminate the numerical spread of the method, [2]. In these cases, DF methods are more accurate than DFM. In this work, we start from the equation of convection-diffusion of an incompressible fluid
u/t+vu=(Ku), (1)
where u(x, t) represents the unknown of the problem, v(x, t) is the velocity, K is the diffusion tensor, and DFM is defined that eliminates the numerical diffusion presented by traditional DFM schemes. To measure the effectiveness of the mimetic schemes, for different configurations of (1), they are compared with the equivalent schemes in DF with the same order of precision as the DFM; for this purpose, the second-order schemes proposed by [2, 3] are taken. Finally, different comparisons are made to verify the results obtained by the given schemes.

References:

[1] Castillo J. and Grone R.D. A matrix analysis approach to higher-order approximations for divergence and gradients satisfying a global conservation law. SIAM J. Matrix Anal. Appl., 25(1):128 142, 2003.
[2] Mehdi Dehghan. Weighted finite difference techniques for the one-dimensional advection-diffusion equation. Applied Mathematics and Computation, 147(2):307319, 2004.
[3] Mehdi Dehghan. Quasi-implicit and two-level explicit finite-difference procedures for solving the one-dimensional advection equation. Applied Mathematics and Computation, 167(1):4667, 2005.

Classification : 65M06, 65M99

Author(s) : Jorge Ospino (Universidad del Norte) Giovanni Calderon (Universidad Industrial de Santander) Jorge Villamizar (Universidad Industrial de Santander)

[01641] Cut singularity of compressible Stokes flow

Session Time & Room : 3C (Aug.23, 13:20-15:00) @G703

Type : Contributed Talk

Abstract : In this talk we study the cut singularity governed by a compressible Stokes system. The cut is a non-Lipshitz boundary. The divergence of the leading corner singularity vector has different trace values on either sides of cut. In the consequence the pressure solution must have a jump across the streamline emanating from the cut tip. We establish a piecewise regularity of the solution by subtracting the related singular functions.

Classification : 35Q35, 76N10, 76F50

Format : Talk at Waseda University

Author(s) : Tae Yeob Lee (Pohang University of Science and Technology) Jae Ryong Kweon (Pohang University of Science and Technology)

[01644] Optimal epidemic interventions and the trolley problem in heterogeneous populations

Session Time & Room : 3E (Aug.23, 17:40-19:20) @A511

Type : Contributed Talk

Abstract : Interventions to mitigate the spread of infectious diseases, while succeeding in their goal, have economic and social costs associated with them; this limits the duration and intensity of the interventions. We study a class of interventions which reduce the reproduction number and find the optimal strength of the intervention which minimises the number of infections by eliminating the overshoot part of an epidemic, and avoiding a second-wave of infections. We extend the framework to a heterogeneous population and find that the optimal intervention can pose an ethical dilemma for decision and policy makers. This ethical dilemma is shown to be analogous to the trolley problem and we discuss how the problem may be avoided.

Classification : 92-10, 34A34

Format : Online Talk on Zoom

Author(s) : Pratyush Kumar Kollepara (La Trobe University) Rebecca Chisholm (La Trobe University) Istvan Kiss (University of Sussex) Joel Miller (La Trobe University)

[01648] Parameter identifiability for extensions of the Fisher-KPP model

Session Time & Room : 2D (Aug.22, 15:30-17:10) @E503

Type : Contributed Talk

Abstract : The Fisher-KPP model is one of the simplest partial differential equation models exhibiting travelling wave behaviour, and has been widely used to model the growth and spread of populations in biology. When applying the model to experimental data, it is often tempting to generalize the model with additional parameters to obtain a better fit. However, this increase in model complexity also increases the difficulty of estimating the parameter values.

In this study, we use a profile likelihood approach to investigate parameter identifiability in extensions of the Fisher-KPP model on both simulated data, and experimental data from a cell invasion assay. We focus on the effects of the forms of the kinetic terms, model misspecifications, and amount of data. We also quantify the amount of data required to

justify a more complex model, and explore ways to design experiments to yield data more useful for parameter identification.

Classification : 62fxx, 62p10, 92cxx

Format : Online Talk on Zoom

Author(s) : Yue Liu (University of Oxford) Philip K Maini (University of Oxford) Ruth E Baker (University of Oxford)

[01651] Coagulation equations for non-spherical clusters

Session Time & Room : 1D (Aug.21, 15:30-17:10) @F311

Type : Contributed Talk

Abstract : We study the long-time asymptotics of a coagulation model describing the evolution of a system of particles characterized by volume and surface area. The aggregation mechanism takes place in two stages: collision and fusion of particles. A particularity of the system is that, for some fusion mechanisms, the particle distribution describes a system of ramified-like particles. Moreover, we prove that we are able to recover the standard coagulation equation in the case of fast fusion.

Classification : 45K05, 34A34, 35Q92, 35Q70

Format : Talk at Waseda University

Author(s) : Iulia Cristian (University of Bonn) Juan J. L. Velzquez (University of Bonn)

[01662] Shape Preserving aspects of multivariate zipper fractal functions

Session Time & Room : 2E (Aug.22, 17:40-19:20) @G305

Type : Contributed Talk

Abstract : In this article, a novel class of multivariate zipper fractal functions is introduced by perturbing a classical multivariate function through free choices of base functions, scaling functions, and a binary matrix called signature. In particular, the approximation properties of multivariate Bernstein zipper fractal function are investigated along with non-negativity, and coordinate-wise monotonicity features of the germ function.

Classification : 28A80, 41A63, 41A29, 41A05, 41A30

Format : Talk at Waseda University

Author(s) : Deependra Kumar (Indian Institute of Technology Madras) ARYA KUMAR BEDABRATA CHAND (Indian Institute of Technology Madras) Peter Robert Massopust (Technical University of Munich(TUM) Germany)

[01668] Order Reconstruction in Microfluidic Channels

Session Time & Room : 3D (Aug.23, 15:30-17:10) @G402

Type : Contributed Talk

Abstract : We analytically and numerically study Order reconstruction (OR) solutions within the Landau-de Gennes theory for nematic liquid crystals in long shallow channel geometries. OR solutions describe liquid crystal polydomains, i.e., subdomains of distinct director orientation separated by domain walls. Such solutions are of interest due to their potential applications in drug delivery technologies and optical devices for instance. We investigate OR solutions in different physical settings: nematic liquid crystals, passive and active nematodynamics, and ferronematics.

Classification : 34E10, 76A15, 34A99

Format : Online Talk on Zoom

Author(s) : James Dalby (University of Strathclyde)

[01669] Generalising Quasi-Newton Updates to Higher Orders

Session Time & Room : 4C (Aug.24, 13:20-15:00) @A207

Type : Contributed Talk

Abstract : At the heart of all quasi-Newton methods is an update rule that enables us to gradually improve the Hessian approximation using the already available gradient evaluations. Theoretical results show that the global performance of optimization algorithms can be improved with higher-order derivatives. This motivates an investigation of generalizations of quasi-Newton update rules to obtain for example third derivatives (which are tensors) from Hessian evaluations. Our generalization is based on the observation that quasi-Newton updates are least-change updates satisfying the secant equation, with different methods using different norms to measure the size of the change. We present a full characterization for least-change updates in weighted Frobenius norms (satisfying an analogue of the secant equation) for derivatives of arbitrary order. Moreover, we establish convergence of the approximations to the true derivative under standard assumptions and explore the quality of the generated approximations in numerical experiments.

Classification : 90C59, 90C53

Format : Talk at Waseda University

Author(s) : Karl Welzel (University of Oxford) Raphael Hauser (University of Oxford)

[01675] Solution of Linear Systems of Equations using a Gauss-Seidel-based Method

Session Time & Room : 1C (Aug.21, 13:20-15:00) @

Type : Contributed Talk

Abstract : Linear Systems of Equations (LSsEs) often arise from applications in real-life. Because of the importance of such applications, some repository, such as the SuiteSparse Matrix Collection at http://www.cise.ufl.edu/research/sparse/matrices, has been created to document them, and solicit assistance for solving them. The direct and indirect methods commonly applied to solve LSsEs have been complemented by other schemes so as to take care of some peculiarities in the linear systems. An adaptation based on the salient features of the Gauss-Seidel method is herein proposed for the solution of any LSEs. Exploiting one of the features led to the development of a solver for LSsEs, which has been computationally validated as accurate, efficient and

robust.
Classification : 65F10, 65F05, Numerical linear algebra
Format : Online Talk on Zoom
Author(s) : Olabode Matthias Bamigbola (University of Ilorin) Montaz Ali (University of Witwatersand) Adebisi Ibrahim (Oduduwa University, Ile-Ife) Amos Ezeh (University of Ilorin)

[01725] Correlated random displacements computed by the Spectral Lanczos Decomposition Method and Barycentric Lagrange Treecode

Session Time & Room : 4C (Aug.24, 13:20-15:00) @E507

Type : Contributed Talk
Abstract : Brownian Dynamics simulations require correlated random displacements ${\bf g} = \sqrt{D}{\bf z}$ to account for hydrodynamic interactions among solvated biomolecules and polymers, where D is the diffusion matrix based on the Rotne-Prager-Yamakawa tensor and ${\bf z}$ is a normal random vector. The Spectral Lanczos Decomposition Method (SLDM) computes a sequence of approximations to ${\bf g}$, but each iteration requires a matrix-vector product $D{\bf q}_k$, where ${\bf q}_k$ is the kth Lanczos vector. The present work applies the barycentric Lagrange treecode (BLTC) to accelerate the matrix-vector product, and numerical results show the performance of the SLDM-BLTC in serial and parallel calculations.
Classification : 65D99, 65Z05, 65F60, 76M35
Format : Talk at Waseda University
Author(s) : Lei Wang (University of Wisconsin, Milwaukee) Robert Krasny (University of Michigan, Ann Arbor)

[01728] C0 IP Methods for Phase Field Crystal Equations

Session Time & Room : 5C (Aug.25, 13:20-15:00) @E703

Type : Contributed Talk
Abstract : A relatively new class of mathematical models known as phase field crystal models has emerged as a way to simulate physical processes where automic- and microscales are tightly coupled. In this talk, we present numerical schemes for two such models which rely on a C0 interior penalty finite element method spatial discretization. We show that the numerical methods are unconditionally energy stable and unconditionally convergent

and support our conclusions with a few numerical experiments.
Classification : 65M60, 65M12
Format : Talk at Waseda University
Author(s) : Amanda Emily Diegel (Mississippi State University) Natasha Sharma (University of Texas at El Paso)

[01730] A family of robust chaotic S-unimodal maps based on Gaussian function

Session Time & Room : 1C (Aug.21, 13:20-15:00) @

Type : Contributed Talk
Abstract : we propose a new family of one-dimensional smooth maps based on the Gaussian function exhibiting robust chaos in a wide range of parameter space. We prove the existence of robust chaos in the proposed family of maps using the stability criterion and extensive numerical computation of the Lyapunov exponent and sample entropy. We also present other important properties such as the bifurcation phenomenon, invariant measure, ergodicity, entropy and other statistical properties of the proposed robust chaos map.
Classification : 37M05, 37M20, 37M25, 65P40
Author(s) : Vinod Patidar (Sir Padampat Singhania University)

[01734] Towards A Modeling Framework For Pediatric Sickle Cell Pain

Session Time & Room : 4C (Aug.24, 13:20-15:00) @A601

Type : Contributed Talk
Abstract : Sickle cell pain presents in acute episodes in pediatric patients, as opposed to the chronic pain observed in adults. This episodic nature necessitates a distinct approach from those used to model adult pain. Statistical studies have examined interactions between sleep actigraphy measurements and pain levels in pediatric populations, and we propose a dynamic model of pediatric pain that incorporates sleep effects over varying time windows. Our aim is to determine markers of future pain episodes.
Classification : 92-10, 37N25, 65P99, 62P10
Format : Talk at Waseda University
Author(s) : Reginald McGee (College of the Holy Cross) Angela Reynolds (Virginia Commonwealth University) Quindel Jones (Virginia Commonwealth University) Rebecca Segal (Virginia Commonwealth University) Wally Smith (Virginia Commonwealth University) Cecelia Valrie (Virginia Commonwealth University)

[01741] A cannibalistic natural enemy pest model with different harvesting strategies

Session Time & Room : 5C (Aug.25, 13:20-15:00) @A201

Type : Contributed Talk

Abstract : In the present work, we discuss the dynamics of a cannibalistic predator-prey model in the presence of different harvesting schemes for the pest population and the provision of additional food to natural enemies. We present a detailed mathematical analysis and numerical evaluations to discuss the pest-free state, coexistence of species, stability, occurrence of different bifurcations, and the impact of additional food and harvesting schemes on the system's dynamics.

Classification : 92Dxx

Format : Talk at Waseda University

Author(s) : Jai Prakash Prakash Tripathi (Central University of Rajasthan, India)

[01742] A signed distance function preserving scheme for mean curvature flow and related applications

Session Time & Room : 2D (Aug.22, 15:30-17:10) @E702

Type : Contributed Talk

Abstract : Mean curvature flow is an important research topic in geometry, applied mathematics, and the natural sciences. In this talk, we propose a scheme for solving mean curvature flow and some related problems efficiently and accurately on Cartesian grids. Our method uses the sign distance function defined in a narrowband near the moving interface to represent the evolution of the curve. We derive the equivalent evolution equations of distance function in the narrowband. The novelty of the work is to determine the equivalent evolution equation on Cartesian girds without extra conditions or constraints. The proposed method extends the differential operators appropriately so that the solutions on the narrowband are the distance function of the solution to the original mean flow solution. Furthermore, the extended solution carries the correct geometric information, such as distance and curvature, on Cartesian grids. Consequently, it is possible to adapt the existing numerical methods, for instance, finite difference or WENO scheme, that are developed on the Cartesian grids to solve PDEs on curves. The computational domain is a thin narrowband whose widths are a small constant multiple of uniform Cartesian

grid spacing. Some experiments confirm that the proposed method is convergent numerically.
Classification : 65M06
Author(s) : Chia-Chieh Jay Chu (National Tsing Hua UniversityB)

[01748] Large-scale mRNA translation and the intricate effects of competition for the finite pool of ribosomes

Session Time & Room : 3D (Aug.23, 15:30-17:10) @G402

Type : Contributed Talk
Abstract : We develop a mathematical network model based on balance non-linear first order ordinary differential equations to study large-scale simultaneous mRNA translation in the cell. The central feature of the model is that it is a cooperative system and this property guarantees the monotonicity of the flow. We derive that trajectories within each level set of the first integral globally converge to the fixed point. One of our findings is that raising the drop-off rate in an mRNA that is "jammed" by ribosomes can increase the network's overall protein synthesis rate.
Classification : 34E10, 37N25, 92-10, 93D20
Format : Talk at Waseda University
Author(s) : Aditi Jain (IIT Ropar) Michael Margaliot (Tel Aviv University) Arvind Kumar Gupta (IIT Ropar)

[01749] Mean Field Game Partial Differential Inclusions: Analysis and Numerical Approximation

Session Time & Room : 5C (Aug.25, 13:20-15:00) @A201

Type : Contributed Talk
Abstract : We generalize second-order Mean Field Game PDE systems with nondifferentiable Hamiltonians to Mean Field Game Partial Differential Inclusions $($MFG PDIs$)$ by interpreting the p-partial derivative of the Hamiltonian in terms of subdifferentials of convex functions. We present conditions for the existence of unique weak solutions to stationary second-order MFG PDIs where the Hamiltonian is convex, Lipschitz, but possibly nondifferentiable. Moreover, we propose a strongly convergent monotone finite element scheme for the approximation of weak solutions.
Classification : 65N15, 65N30, PDIs in connection with mean field game theory

Format : Talk at Waseda University

Author(s) : Yohance Osborne (University College London) Iain Smears (University College London)

[01754] Spectral-Cutoff for Imaging of Multiple Scattering in Isotropic Point-Like Discrete Random Media

Session Time & Room : 2C (Aug.22, 13:20-15:00) @G601

Type : Contributed Talk

Abstract : To image objects in the discrete random medium composed of isotropic point-like scatterers, the resonances with
multiple scattering in the medium can interfere with imaging and result in poor quality of images.

To solve this problem, we present a spectral-cutoff method, which is derived based on the random matrix theory, to
filter out the undesired responses in the resonance regime to recover the damaged images. Finally, we demonstrate
this method for boosting imaging with numerical simulations.

Classification : 35J05, 35P15, 47B06, 78A46, 94A12

Author(s) : Ray-Hon Sun (Stanford University) Ray-Hon Sun (Stanford University)

[01755] A Study of Imaging in the Existence of Resonance with Multiple Scattering

Session Time & Room : 2E (Aug.22, 17:40-19:20) @G502

Type : Contributed Talk

Abstract : A random medium consisting of many small bodies that can reflect or scatter the incoming waves is called multiple
scattering. Imaging becomes difficult to perform in such random media because of sharp responses arising from
the underlying interactions of multiply scattered waves at resonance frequencies.

In this talk, we present a study by simulating this problem with the Foldy-Lax-Lippmann-Schwinger formalism, which was employed for the multiply scattered waves, in randomly distributed isotropic point-like scatterers.

Classification : 35P05, 47B06, 78A46
Author(s) : Ray-Hon Sun (Stanford University) Ray-Hon Sun (Stanford University)

[01762] Generalized proofs of positivity of the solutions to population models

Session Time & Room : 5C (Aug.25, 13:20-15:00) @D515

Type : Contributed Talk
Abstract : Dynamic models of many processes in the biological and physical sciences are governed by systems of ordinary differential equations called compartmental systems. Since the dependent variables in such models denote population size, the solutions that start from positive initial conditions remain positive for all time. In this study, two generalized proofs of positivity of the solutions to compartmental models are presented. These compartmental models can be used in many applications including epidemiology and population dynamics.
Classification : 92D25, 92-10
Format : Talk at Waseda University
Author(s) : AUNI ASLAH MAT DAUD (Universiti Malaysia Terengganu)

[01789] On uniqueness of multi-bubble blow-up solutions and multi-solitons to L^2-critical NLS

Session Time & Room : 3C (Aug.23, 13:20-15:00) @G709

Type : Contributed Talk
Abstract : This talk is concerned with the long-time behavior of solutions to the focusing L^2-critical nonlinear Schrodinger equations. Firstly, we briefly review the existence and uniqueness of multi-bubble blow-up solutions and multi-solitons in the context of NLS. Then, we introduce the uniqueness for a large energy class of multi-bubble blow-up solutions, which converge to a sum of K pseudo-conformal blow-up solutions particularly with the low rate $(T-t)^{0+}$. Lastly, we also discuss the uniqueness of multi-solitons which converge to a sum of K solitary waves with convergence rate $(1/t)^{2+}$ in the energy space, and with even lower convergence rate $(1/t)^{1/2+}$ in the pseudo-conformal space. The talk is based on the joint work with Prof. Daomin Cao and Prof. Deng Zhang, which has been published in "Archive for Rational Mechanics and Analysis" in 2023.
Classification : 35Q55, 35B44, 35C08
Format : Online Talk on Zoom
Author(s) : Yiming Su (Zhejiang University of Technology)

[01790] Numerical simulation of two-layer shallow-water models: Application to Maximal Exchange at Lombok Strait

Session Time & Room : 3C (Aug.23, 13:20-15:00) @G710

Type : Industrial Contributed Talk

Abstract : We investigate the generation of internal waves in the Lombok Strait due to semi-diurnal tides using the momentum-conserving staggered grid (MCS) scheme. We first simulate the steady interface representing the maximum exchange flows, which has two controls located at Karangasem Narrows (KN) and Nusa Penida Sill (NPS). Next, the transport volume due to semidiurnal tides is calculated. Finally, internal wave activity near the KRI Nanggala 402 shipwreck site is analysed.

Classification : 35Q86, 76M20, 65Mxx, Computational Fluid Dynamics (internal waves, internal hydraulics)

Format : Online Talk on Zoom

Author(s) : Putu Veri Swastika (Udayana University) Sri Redjeki Pudjaprasetya (Bandung Institute of Technology) Nugrahinggil Subasita (Center for Applied Climate Services, Climatological Department, Agency for Meteorology Climatology and Geophysics (BMKG))

[01797] Random dynamics of 2D stochastic Naiver-Stokes equations on the whole space

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G404

Type : Contributed Talk

Abstract : In this talk, we consider the 2D stochastic Navier-Stokes equations (SNSE) driven by a linear multiplicative white noise of It\^o type on the whole space. Firstly, we will discuss the existence of a unique bi-spatial $(\mathbb{L}^2(\mathbb{R}^2),\mathbb{H}^1(\mathbb{R}^2))$-pullback random attractor for non-autonomous SNSE with initial data in $\mathbb{L}^2(\mathbb{R}^2)$. Finally, we will discuss the existence of an invariant measure for 2D autonomous SNSE. Also, the uniqueness of invariant measures for $\boldsymbol{f}=\mathbf{0}$ will be addressed.

Classification : 35B41, 35Q35, 37L55, 37N10, 35R60

Format : Talk at Waseda University

Author(s) : Kush Kinra (Indian Institute of Technology Roorkee, Roorkee) Manil T. Mohan (Indian Institute of Technology Roorkee, Roorkee)

[01804] Spatiotemporal dynamics of a predator-prey system with fear effect

Session Time & Room : 1C (Aug.21, 13:20-15:00) @D514

Type : Contributed Talk

Abstract : We studied a mathematical model with fear effect due to predator population. The model is investigated from the viewpoint of stability and bifurcation analysis. We investigate how behavioral modification in prey population due to fear for predators and mutual interference among predator species can create various spatiotemporal pattern formation in population distribution. Numerical simulation demonstrates that the fear effect in a diffusive predator-prey system with mutual interference may exhibit complicated dynamics.

Classification : 92B05, 92B20, 65L05, 37D05, 03C45

Format : Online Talk on Zoom

Author(s) : Subhas Khajanchi (Presidency University Kolkata)

[01805] A priori error estimates for parabolic interface problems with measure data

Session Time & Room : 3C (Aug.23, 13:20-15:00) @F312

Type : Contributed Talk

Abstract : This talk aims to present a priori error analysis for linear parabolic interface problems with measure data in time in a bounded convex polygonal domain in R^2. Both the spatially discrete and the fully discrete approximations are analyzed. Due to the low regularity of the solution, the convergence analysis of such problems become challenging. A priori error bounds in the $L^2(L^2(\Omega))$-norm for both the spatially discrete and the fully discrete schemes are derived under the minimal regularity assumption the solution together with the L^2-projection operator and the duality argument. Numerical results are reported to support the theoretical analysis.

Classification : 49J20, 49K20, 65N15, 65N30

Format : Talk at Waseda University

Author(s) : Jhuma Sen Gupta (BITS Pilani Hyderabad)

[01806] Well-posedness of a class of SPDE with fully monotone coefficients perturbed by Levy noise

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E502

Type : Contributed Talk

Abstract : In this talk, we consider a class of stochastic partial differential equations with fully locally monotone coefficients in a Gelfand triplet. Under certain generic assumptions of the coefficients, we prove the existence of a probabilistic weak solution as well as the pathwise uniqueness of the solution, which implies the existence of a unique probabilistic strong solution. Finally, we allow both the diffusion and jump noise coefficients to depend on the gradient of the solution.

Classification : 60H15, 35R60, 35Q35

Format : Talk at Waseda University

Author(s) : Ankit Kumar (Indian Institute of Technology, Roorkee, Uttarakhand) Manil T. Mohan (Indian Institute of Technology, Roorkee, Uttarakhand)

[01815] Time-fractional SVIR chicken-pox mathematical model with quarantine compartment

Session Time & Room : 4D (Aug.24, 15:30-17:10) @E711

Type : Contributed Talk

Abstract : This work considers a time-fractional SVIR chicken-pox reaction-diffusion model with nonlinear diffusion operators. The model also contains the quarantine compartment and therefore, it consists of five unknown variables. Further suitable initial and boundary conditions are also given along with the model. The existence of weak solutions proved for the proposed time-fractional model in the bounded domain with appropriate assumptions and a-priori energy estimates. The main results of the work demonstrated using the Faedo-Galerkin method and approximation problem. Finally, numerical simulations are provided to understand the evolution of the chicken-pox virus among the population.

Classification : 92B05, 35K57, 35A01

Author(s) : Shangerganesh Lingeshwaran (National Institute of Technology Goa) Hariharan Soundararajan (National Institute of Technology Goa) Manimaran Jeyaraj (Vellore Insitute of Technology)

[01816] Optimal-control problem for a fractional order chickenpox mathematical model

Session Time & Room : 4D (Aug.24, 15:30-17:10) @E508

Type : Contributed Talk

Abstract : In our modern world, we are still fighting against the 19th-century varicella virus. Researchers made many studies to prevent individuals from chickenpox, but still, it is spreading because of its high transmission rate. To study and overcome this, we introduce a model of SIQVR type having a quarantine compartment. The well-posedness and the stable nature are explored. Further, the optimal-control technique is applied to control the spread of the virus. Finally, numerical simulations are performed.

Classification : 92B05, 49J15, 34D20, 34A08

Format : Online Talk on Zoom

Author(s) : Hariharan Soundararajan (National Institute of Technology Goa)
Shangerganesh Lingeshwaran (National Institute of Technology Goa)

[01817] Time-series medical data classification using echo state network

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E811

Type : Contributed Talk

Abstract : Most time-series medical data classification tasks are carried out using deep recurrent neural networks. However, deep neural networks tend to consume enormous computational power. Echo state network is an efficient model for processing temporal data due to its low training cost. The reservoir maps input signals into a high-dimensional dynamical system and the readout layer extracts patterns from it. Therefore, we developed a new methodology that can classify time-series data using echo state network.

Classification : 68T07, 62R07, 62P10

Format : Talk at Waseda University

Author(s) : Zonglun Li (University College London)

[01822] Domain decomposition for the Random Feature Method

Session Time & Room : 5C (Aug.25, 13:20-15:00) @E705

Type : Contributed Talk

Abstract : The random feature method (RFM) is a framework for solving PDEs sharing the merits of both traditional and machine learning-based algorithms. The direct method for optimization shows a high accuracy but faces acute memory and time-consuming issues with the increase of the scale of the problem. We introduced the domain decomposition into RFM and build a distributed, low-communication, and high-parallelism framework which relieves the pressure of storage and improves solving efficiency significantly in RFM.

Classification : 65N99, 65F20, 65-04, 65Y05

Format : Talk at Waseda University

Author(s) : Yifei Sun (Soochow University) Jingrun Chen (University of Science and Technology of China) Weinan E (Peking University)

[01826] Environmental Feedbacks from the Warburg Effect in Pre-Metastatic Neoplasms

Session Time & Room : 1C (Aug.21, 13:20-15:00) @

Type : Contributed Talk

Abstract : Unusual metabolism is a hallmark of cancer know as the Warburg effect. The methodology of eco-evolutionary games can describe this effect.
We mathematically model the game between two metabolic strategies in the neoplasm: oxidative phosphorylation vs glycolysis. We show that our model results in 5 possible dynamic regimes. We conclude that lower glucose uptake rates for glycolytic cells help maintain less dangerous non-glycolytic tumors and hinder early tumor progression. This conclusion provides new treatment insights.

Classification : 92D25, 92D40, 91A22

Author(s) : Mark Steven Lovett (Dartmouth College) Erol Akay (University of Pennsylvania) Andrew Tilman (USDA: Forestry service) Artem Kaznatcheev (Department of Mathematics and Department of Information and Computing Sciences, Utrecht University.)

[01840] On the inviscid limit of the stochastic Navier-Stokes equation

Session Time & Room : 3C (Aug.23, 13:20-15:00) @G703

Type : Contributed Talk

Abstract : We study the asymptotic behavior of solutions to the two-dimensional stochasitc Navier-Stokes (SNS) equation in the small viscosity limit. The SNS equation is supplemented with no-slip boundary condition, in which a strong boundary layer shall appear in the limit. Several equivalent dissipation conditions are derived to ensure the convergence hold in the energy space. One novelty of this work is that we do not assume any smallness for the noise.

Classification : 35Q35, 60H15, 76D10

Format : Talk at Waseda University

Author(s) : Meng Zhao (Shanghai Jiao Tong University) Ya-Guang Wang (Shanghai Jiao Tong University)

[01844] Operational Matrix Based Numerical Scheme for Fractional Differential Equations

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G802

Type : Contributed Talk

Abstract : Fractional calculus is active in many engineering and physics disciplines due to their non-local properties. This non integer order derivative performs well in systems where the next state depends not only on the current state but also upon all of its previous states.

Modeling such systems and determining their precise solutions are current research topics of interest. Since finding exact solutions for fractional differential equations is more challenging, developing numerical techniques is a trending research topic. In this paper, we propose the spectral collocation method based on the operational matrix of orthogonal basis polynomials to find the approximate solution of fractional differential equations. Different orthogonal and non orthogonal basis polynomials are considered for the approximation, and a comparative study is made. The operational matrix of fractional order derivatives of basis polynomials is derived as a product of matrices. This matrix together with the collocation method, is employed to transform the fractional differential equations into a set of algebraic equations, which is easier to tackle. The perturbation method is applied to show the stability of the discussed method. The solution achieved by this method is more precise than those obtained from the existing methods like the variational iterational, adomian decomposition method, and finite difference method.

Classification : 44Axx, 33C50, 65N35, Fractional Calculus

Author(s) : Ashish Awasthi (National Institute of Technology Calicut) Poojitha S (National Institute of Technology Calicut)

[01846] L3 approximation of the Caputo derivatives and its application to time-fractional wave equation

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E711

Type : Contributed Talk

Abstract : In this talk, we will discuss a new second-order L3 approximation of the Caputo fractional derivative of order 1< < 2. We have applied Lagranges cubic interpolating polynomial to develop this approximation. A second-order difference scheme is also proposed to find the numerical solution of the time-fractional wave equation. The numerical analysis results of the proposed algorithm are provided and a comparative study is also given to show the effectiveness and accuracy of the proposed scheme.

Classification : 65N06

Format : Online Talk on Zoom

Author(s) : NIKHIL SRIVASTAVA (Indian Institute of Technology (BHU) Varanasi, India)

[01847] Non-reflective boundary conditions for the piston problem of gas dynamics

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E508

Type : Contributed Talk

Abstract : We consider the piston problem of gas dynamics, described by the Lagrangian formulation of the Euler equations for an ideal compressible gas. While a highly accurate numerical solution can be obtained in the interior of the domain through state-of-the-art techniques like WENO reconstruction and SSP-RK time-stepping, boundary discretization can lead to unphysical reflections. We investigate and implement several efficient boundary conditions to deal with this problem without significantly increasing the size of the computational domain.

Classification : 65M08, 65M22, 76N30, 35L04, 35L65

Format : Talk at Waseda University

Author(s) : Carlos Muoz (KAUST)

[01848] A Higher Order Schwarz Domain Decomposition Method for Singularly Perturbed Differential Equation

Session Time & Room : 2D (Aug.22, 15:30-17:10) @E702

Type : Contributed Talk

Abstract : We consider a fourth order singularly perturbed differential equation. To solve the problem, the differential equation is transformed into a coupled system of singularly perturbed differential equations. The original domain is divided into three overlapping subdomains. On the regular subdomain, a hybrid scheme is used, while a compact fourth order difference scheme is used on the two boundary layer subdomains on a uniform mesh. We demonstrate that proposed scheme is nearly fourth order uniformly convergent.

Classification : 65M06

Format : Talk at Waseda University

Author(s) : AAKANSHA AAKANSHA (Indian Institutes of Technology (Banaras Hindu University) Varanasi)

[01854] Dynamic Roughness in the Term Structure of Oil Markets Volatility

Session Time & Room : 2E (Aug.22, 17:40-19:20) @A201

Type : Contributed Talk

Abstract : This paper analyses the attributes and the significance of the roughness of oil market volatil-
ity. We employ unspanned stochastic volatility models driven by rough Brownian motions
that yield semi-analytic prices for futures options entailing efficient calibration applications.
We calibrate option prices written on oil futures and provide empirical evidence of the dy-
namic nature of the roughness in oil volatility. The calibrated option-implied Hurst param-
eter varies over time, but rough stochastic volatility models provide a better fit to the term
structure of implied oil volatility compared to classical stochastic volatility. Furthermore,
including the Hurst parameter into the set of implied parameters benefits the stability of

the calibrated parameters and improves pricing performance.
Classification : 91Gxx, 60Lxx, 60Hxx
Format : Talk at Waseda University
Author(s) : Christina Nikitopoulos (UTS) Messias Alfeus (Stellenbosch University) Ludger Overbeck (Justus-Liebig-University Giessen)

[01861] Scattering of an Ostrovsky wave packet in a layered waveguide

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E817

Type : Contributed Talk
Abstract : In this talk I will discuss the scattering of an Ostrovsky wave packet in a two layered waveguide with a delamination sandwiched between imperfect bonding. When the layers have different densities, the strains are described by a system of coupled Boussinesq equations. Asymptotic solutions are constructed, complemented by numerical simulations, and are used to analyse the scattering of the strain waves. These results can provide a tool to control the integrity of layered structures.
Classification : 74J30, 76B15, 35G25, 35G30
Format : Online Talk on Zoom
Author(s) : Jagdeep Tamber (Nottingham Trent University)

[01883] An application to the generalized logistic growth model

Session Time & Room : 5B (Aug.25, 10:40-12:20) @G401

Type : Contributed Talk
Abstract : We study the bifurcation curves for a Dirichlet problem with geometrically concave nonlinearity. We give an application to the generalized logistic growth model. There are totally six qualitatively bifurcation curves.

Classification : 34B18, 74G35
Format : Talk at Waseda University
Author(s) : Kuo-Chih Hung (National Chin-Yi University of Technology) Kuo-Chih Hung (National Chin-Yi University of Technology)

[01888] UAV Tracking and Targeting using YOLO with Enhanced Prior

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D515

Type : Contributed Talk

Abstract : Unmanned Aerial Vehicles defense becomes a hot topic due to the ongoing Ukraine-Russia War and Chinas constant threats to Taiwan. Drones tracking and countermeasures inevitably play a crucial role in future warfare. Here, we propose a feature-enhanced Yolo network to improve the accuracy of detection and tracking for small moving objects. Multi-cores, multi-threads and field programming logic array combined with Kalman filtering are used to speed up our algorithm on edge devices such as cellphones.

Classification : 93C10, 93E11, 68T45

Format : Talk at Waseda University

Author(s) : Pink-Kong Huang (National Yang-Ming Chiao-Tung University) Yu-Shi Chen (National Yang-Ming Chiao-Tung University) Cho-Han Wu (Via Technologies Inc.) Chin-Tien Wu (National Yang-Ming Chiao-Tung University)

[01893] Existence and blow-up solutions of fractional reaction-diffusion system of SPDEs

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G710

Type : Contributed Talk

Abstract : In this talk, we investigate the existence and finite-time blowup solution of a reaction-diffusion system of stochastic partial differential equations (SPDEs) driven by two dimensional fractional Brownian motion. We provide sufficient conditions for the existence of a global solution. Moreover, we provide lower and upper bounds for the finite-time blowup solution of the system of SPDEs and obtain the lower and upper bounds for the probability of non-explosive solutions to our considered system

Classification : 35R60, 60H15, 74H35

Format : Online Talk on Zoom

Author(s) : Sankar Subramani (Periyar University, Salem, Tamilnadu.) Manil T Mohan (Indian Institute Of Technology, Roorkee) Karthikeyan Shanmugasundaram (Periyar University, Salem, Tamilnadu.)

[01906] Adjoint-Based Shape Optimization of Periodic Units for Compact Heat Transfer Devices

Session Time & Room : 2E (Aug.22, 17:40-19:20) @D405

Type : Contributed Talk

Abstract : We present a DOLFIN/FEniCS framework for shape optimization of compact heat transfer devices consisting of periodic units. The framework relies on highly parallelized, efficient finite-element solvers for the three-dimensional periodically developed flow and heat transfer equations and their eigenvalue problems. The adjoint-based shape calculus is implemented by means of automated differentiation and operator overloading. Design constraints are incorporated through an augmented Lagrangian method. The optimized surfaces are compared with designs obtained through density-based topology optimization.

Classification : 80M50, 80M10, 49M41, 80M40, 76S05

Format : Talk at Waseda University

Author(s) : Geert Buckinx (VITO) Stephan Schmidt (Humboldt University Berlin)

[01908] Quantifying Cytoskeletal Dynamics and Remodeling from Live-imaging Microscopy Data

Session Time & Room : 4E (Aug.24, 17:40-19:20) @D514

Type : Contributed Talk

Abstract : The shape of biological cells emerges from dynamic remodeling of the cells internal scaffolding, the cytoskeleton. Hence, correct cytoskeletal regulation is crucial for the control of cell behaviour, such as cell division and migration. A main component of the cytoskeleton is actin. Interlinked actin filaments span the body of the cell and contribute to a cells stiffness. The molecular motor myosin can induce constriction of the cell by moving actin filaments against each other. Capturing and quantifying these interactions between myosin and actin in living cells is an ongoing challenge. For example, live-imaging microscopy can be used to study the dynamic changes of actin and myosin density in deforming cells. These imaging data can be quantified using Optical Flow algorithms, which locally assign velocities of cytoskeletal movement to the data. Extended Optical Flow algorithms also quantify actin recruitment and degradation. However, these measurements on cytoskeletal dynamics may be influenced by noise in the image acquisition, by ad-hoc parameter choices in the algorithm, and by image pre-processing steps. Here, we use in silico data to understand conditions under

which Optical Flow is applicable. We found the condition to guarantee the method has a good performance is that the displacement has to be in a proper proportion as the object size. We test our methods using data on actin densities in larval epithelial cells of Drosophila pupae. The development of our Optical Flow method will be a starting point for identifying differences in cytoskeletal movement and remodeling under experimental perturbations. Our method will be applicable to other datasets in which flow fields are present.

Classification : 92-10, 92-08, 92BXX, 37CXX, 76-10

Format : Online Talk on Zoom

Author(s) : Carey Li (University of St Andrews)

[01913] Mathematical modeling, analysis, and simulation of the Epidemic Dynamics with Stochastic Perturbations: A case study of COVID-19 in Bogot

Session Time & Room : 5B (Aug.25, 10:40-12:20) @A201

Type : Contributed Talk

Abstract : We study the basic reproduction number for the epidemic models with stochastic perturbations in transmission rates and social behavior to analyze the dynamics of the COVID-19 pandemic in Bogot, Colombia. We also consider the effect of vaccination as a control measure. We present the stability conditions and illustrate the simulation results for the proposed model. Finally, we present a computational experiment and validate the model by performing statistical analysis for the actual data.

Classification : 92D30, 92BXX, 60H30

Format : Talk at Waseda University

Author(s) : Andres Rios-Gutierrez (Universidad Nacional de Colombia) Andres Rincon-Prieto (Universidad Nacional de Colombia) VISWANATHAN ARUNACHALAM (Universidad Nacional de Colombia)

[01923] Primal hybrid method for quasi-linear parabolic problems

Session Time & Room : 5C (Aug.25, 13:20-15:00) @E703

Type : Contributed Talk

Abstract : In this article, a second order quasi-linear parabolic initial-boundary value problem is approximated by using primal hybrid finite element method and Lagrange multipliers. Semi-discrete and backward Euler based fully discrete schemes are discussed and optimal order error estimates are established by applying modified elliptic projection. Optimal order error estimates in maximum norm are also derived. Earlier results on maximum-norm superconvergence of the gradient in piecewise linear finite-element approximations of elliptic and parabolic problems are now carried over to quasi-linear case using primal hybrid method. Finally, the results on numerical experiments confirm our theoretical findings.

Classification : 65M60

Author(s) : RAVINA SHOKEEN (The LNM Institute of Information Technology) Ajit Patel (The LNM Institute of Information Technology) Amiya Kumar Pani (BITS Goa)

[01924] Mixed Leader-Follower Dynamics

Session Time & Room : 1E (Aug.21, 17:40-19:20) @F309

Type : Contributed Talk

Abstract : The original Leader-Follower (LF) model partitions all agents whose opinion is a number in $[-1,1]$ to a follower group, a leader group with a positive target opinion in $[0,1]$ and a leader group with a negative target opinion in $[-1,0]$. A leader group agent has a constant degree to its target and mixes it with the average opinion of its group neighbors at each update. A follower has a constant degree to the average opinion of the opinion neighbors of each leader group and mixes it with the average opinion of its group neighbors at each update. In this paper, we consider a variant of the LF model, namely the mixed model, in which the degrees can vary over time, the opinions can be high dimensional, and the number of leader groups can be more than two. We investigate circumstances under which all agents achieve a consensus. In particular, a few leaders can dominate the whole population.

Classification : 37N99, 05C50, 91C20, 93D50, 94C15

Format : Talk at Waseda University

Author(s) : Hsin-Lun Li (National Sun Yat-Sen university) Hsin-Lun Li (National Sun Yat-Sen university)

[01929] Colored noise driven autonomous stochastic resonance

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E504

Type : Contributed Talk

Abstract : A one-dimensional linear autonomous system coupled to a generic stationary nonequilibrium fluctuating bath
can exhibit a resonant response when its damped oscillation period matches some characteristic baths relaxation
time. This condition justifies invoking the stochastic resonance paradigm, even if it can be achieved more easily
by tuning the system to the bath and not vice versa, as is usually the case. The simple nature of the mechanism
numerically investigated here suggests number of exciting applications

Classification : 82C31

Format : Online Talk on Zoom

Author(s) : SHRABANI MONDAL (Jadavpur University) SHRABANI MONDAL (Jadavpur University)

[01946] Optimal Control of Stationary Doubly Diffusive Flows on Lipschitz Domains

Session Time & Room : 2C (Aug.22, 13:20-15:00) @F312

Type : Contributed Talk

Abstract : Doubly diffusive flows involve coupled incompressible flow and double diffusion transport, which models physical problems like bacteria bioconvection, exothermic flows in oceanography and more. We study a distributed optimal control problem governed by doubly diffusive flows under minimal regularity on 2D and 3D bounded Lipschitz domains and establish its well-posedness. First and second-order optimality conditions are derived. Furthermore, a discretization of the control problem based on $H(\mbox{div})$-conforming discontinuous Galerkin finite elements for the state and adjoint variables and piecewise constant finite elements for the control variable is discussed. Optimal apriori error estimates are proven in suitable norms. Numerical experiments are performed using a semi-smooth Newton strategy verifying the theoretical findings.

Classification : 49K20, 65N30, 76S05, 76R50, 49K27

Format : Talk at Waseda University

Author(s) : Jai Tushar (Indian Institute of Technology Roorkee) Arbaz Khan (IIT Roorkee) Manil T. Mohan (IIT Roorkee)

[01958] How can we make tumour predictions under mechanism uncertainty?

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D515

Type : Contributed Talk

Abstract : The need of quantitative tumour growth and progression predictions is pivotal for designing individualized therapies. Medical data correspond to snapshots in time of the patients state and their collection relies on patients clinical presentation. Current standard of care faces the following challenges: (C1) data collection is sparse in time and (C2) we lack the knowledge of the underlying biological mechanisms. To solve them, I will present a methodology that combines mechanistic modelling and machine.

Classification : 92-08

Author(s) : Haralampos Hatzikirou (Khalifa University)

[01964] Competitions between stage-structured species in a patchy environment

Session Time & Room : 2E (Aug.22, 17:40-19:20) @A201

Type : Contributed Talk

Abstract : In this study, an ecological model with two life stages, immature and mature, and incorporating both intra- and inter-competitions between two species is explored to study invasion of species in a two-patch environment. It can be applied to exploring evolution of insects like Drosophila and beetles, which experience larva and adult (immature and mature life stages). The monotone dynamics in such a model provides us a property to explore its local and global dynamics. The model can also admit complex dynamics with multiple positive equilibria and limit point bifurcation when both species persist.

Classification : 92D25, 92D40, 37N25

Format : Talk at Waseda University

Author(s) : Chang-Yuan Cheng (National Pingtung University National Pingtung University)

[01966] Fekete-Szeg Inequality for Universally Prestarlike Functions By a Variational Method

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G401

Type : Contributed Talk

Abstract : The universally prestarlike functions of order 1 in the slit domain = C [1;) have been recently introduced by
S. Ruscheweyh. This notion generalizes the corresponding one for functions in the unit disk (and other circular domains in C). In this paper, we obtain the Fekete-Szeg inequality for such functions by using Variational Method.
We conclude that this paper presents a new class of functions analytic in the slit domain, and closely related to the
class of starlike functions. Besides being an introduction to this field, it provides an interesting connections defined
class with well-known classes. The paper deals with several ideas and techniques used in geometric function theory.

Classification : 30C45

Format : Talk at Waseda University

Author(s) : Lourthu Mary Joseph (Yuvabharathi International School)

[01973] Equilibria for Robust Routing Game of Atomic Players

Session Time & Room : 3E (Aug.23, 17:40-19:20) @D514

Type : Contributed Talk

Abstract : We study a routing game on edge costs given by an interval of the same length, each edge cost can be any value in the interval. Each player only knows the interval length and would select a path that is robust against the worst-case realization of edge costs. Under bottleneck-type objective with minmax-regret criterion, we prove that every robust Nash Equilibrium (NE) is an NE of the corresponding bottleneck routing game with complete information.

Classification : 91A35, 91A80, 91A68, 90C27

Format : Talk at Waseda University

Author(s) : Xudong Hu (Academy of Math and Systems Science, CAS)

[01974] Solving fractional Hantavirus model: A new approach

Session Time & Room : 3D (Aug.23, 15:30-17:10) @G402

Type : Contributed Talk

Abstract : In the present work, fractional order Hantavirus epidemic model introduced by \cite{peixoto2006effect,hantavirus2010modeling} is integrated using new iterative method (NIM) and implicit $\theta-$ method ($\theta=1$). New iterative method has been developed by Daftardar-Gejji and H. Jafari \cite{daftardar2006iterative}. Using new iterative method and $\theta-$ method \cite{yakit2018explicit}, we have developed a new numerical algorithm to solve fractional differential equations (FDEs) in the Hantavirus model. Dynamics of the hanta virus model is studied.
Hantavirus model of fractional order represents mouse population before and after getting influenced by Hantavirus under various conditions and its effect on birth rate and death rate of mice is studied. This model represents a Hantavirus infection in rodents and alien population. It has been observed that solution obtained by new algorithm is accurate and in good agreement when compared with solution obtained by other established algorithms. Further, effects of harvesting efforts $E(t)$ as an optimal control on spread of Hantavirus infection is studied. It has been observed that, population of both susceptible and infected rodents minimizes when we apply optimal control.

Classification : 34AXX, 03-XX, 26AXX

Format : Talk at Waseda University

Author(s) : Yogita Mahesh Mahatekar (COEP Technological University) Amey Deshpande (MIT World peace University)

[01986] Low regularity time integration of NLS via discrete Bourgain spaces

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E604

Type : Contributed Talk

Abstract : We study a filtered Lie splitting scheme for the cubic periodic nonlinear Schrdinger equation on the torus $\mathbb{T}^d$ with $d\geq1$. This scheme overcomes the standard stability restriction $s>\frac d2$ in Sobolev spaces $H^s(\mathbb{T}^d)$ and now allows us to handle initial data in H^s for $s>0$ when $d=1,2$ and $s>\frac d2-1$ when $d\geq3$. Moreover, we establish low regularity error estimates in discrete Bourgain spaces, and prove convergence of order $\tau^{\frac s2}$ in $L^2(\mathbb{T}^d)$, where τ denotes the time step size.

Classification : 65M12, 65M15, 35Q55
Format : Talk at Waseda University
Author(s) : Lun Ji (Universitt Innsbruck) Alexander Ostermann (Universitt Innsbruck) Frdric Rousset (Universit Paris-Saclay) Katharina Schratz (Sorbonne Universit)

[01995] Theoretical and Numerical Study of Regional Boundary Observability for Linear Time-Fractional Systems.

Session Time & Room : 5C (Aug.25, 13:20-15:00) @A207

Type : Contributed Talk
Abstract : The goal of this talk is to examine the regional boundary observability for time-fractional systems involving the Riemann-Liouville fractional derivative. The aim is to reconstruct the initial state of the system under considerations on a desired subregion of the evolution domains' boundary. The reconstruction problem is converted into a solvability problem with the form $AX=b$ using an adaptation of the Hilbert uniqueness method. Some successful numerical examples were simulated and provided at the end.
Classification : 93B07, 93B28, 26A33, 46F12
Format : Online Talk on Zoom
Author(s) : Khalid Zguaid (Higher School of Education and Training of Agadir (ESEFA) , Ibn Zohr University) Fatima Zharae El Alaoui (Moulay Ismail University)

[01997] Robust continuation method for computing solution curves with critical points

Session Time & Room : 4D (Aug.24, 15:30-17:10) @E504

Type : Contributed Talk
Abstract : To better compute the solution curve of challenging problems, numerical continuation methods have proved to be a very efficient tool. However, these methods can still lead to undesired results, particularly near critical points. This paper will therefore present a robust continuation method that will include two key aspects to solve difficult problems: detection of problematic regions during the solution process and additional steps to deal with them. Numerical examples will be presented.
Classification : 65Y20, 65Z05, 74S05

Format : Online Talk on Zoom

Author(s) : Sophie Leger (Universit de Moncton)

[02001] GPU batched sparse solver for XGC fusion plasma collision operator

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G305

Type : Contributed Talk

Abstract : Batched linear solvers solve many small related but independent problems. They are beneficial for GPUs, which require substantial amounts of work to operate efficiently. The XGC gyrokinetic particle-in-cell code for modeling magnetically confined fusion plasma devices employs a LAPACK CPU solver for the collision operator. We describe how Ginkgo's batched solver can be integrated into the collision operator and accelerate the simulation process. We present comparisons for the solve times on A100 GPUs with CPUs.

Classification : 15-04, 35-04, 76-10

Format : Talk at Waseda University

Author(s) : Paul Lin (Lawrence Berkeley National Laboratory) Aditya Kashi (Oak Ridge National Laboratory) Pratik Nayak (Karlsruhe Institute of Technology) Dhruva Kulkarni (Lawrence Berkeley National Laboratory) Aaron Scheinberg (Jubilee Development) Hartwig Anzt (University of Tennessee)

[02003] VEM approximation for the Stokes eigenvalue problem: a priori and a posteriori error analysis

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E705

Type : Contributed Talk

Abstract : We present a priori and a posteriori error analysis to approximate the eigenvalues and eigenfunctions
of the Stokes spectral problem. For the a priori analysis, we take advantage of the compactness of the solution operator to prove convergence of the eigenfunctions and eigenvalues. Additionally we propose a reliable and efficient a posteriori estimator in order to
perform adaptive refinements that allow to recover the optimal order of convergence for non smooth eigenfunctions. We report some numerical tests

Classification : 65Nxx

Format : Talk at Waseda University

Author(s) : Felipe Lepe (Universidad del Bo Bo)

[02006] Dynamics of localization patterns in some nonlocal evolution equations

Session Time & Room : 1C (Aug.21, 13:20-15:00) @G501

Type : Contributed Talk

Abstract : Recently, studies have been proposed to simplify biological pattern formation problems by using nonlocal evolution equations to capture the self-organization caused by complex interactions with many factors. Especially, it has been reported that linear reaction-diffusion networks reduce to some nonlocal evolution equations reproducing patterns. Also, nonlocal effects are derived to reduce the structure of the network. In this talk, we report the influence of nonlocal effects on pattern dynamics for this reduced equation.

Classification : 35B36, 92C15, 35K57

Format : Talk at Waseda University

Author(s) : Hiroshi Ishii (Kyoto University)

[02011] Network models with truncated Poisson-Dirichlet process priors

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E501

Type : Contributed Talk

Abstract : We introduce a Bayesian nonparametric network model based on the truncated Poisson-Dirichlet process prior. In our model, the sociability parameters of the nodes are sorted in descending order. This enables us to focus on the most popular nodes of the network. We will show the simulation algorithm and posterior inference method for this model. Numerical implementations will also be discussed based on simulated observations and real-world datasets.

Classification : 62G05, 62F15, 60G51

Format : Talk at Waseda University

Author(s) : Junyi Zhang (The Hong Kong Polytechnic University) Angelos Dassios (London School of Economics)

[02013] An Accelerated Iteration for Finding Extremal Solutions of Discrete-Time Algebraic Riccati Equations

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G601

Type : Contributed Talk

Abstract : Algebraic Riccati equations (AREs) have been extensively applied in linear optimal control problems and many efficient numerical methods were developed. The stabilizing (or almost stabilizing) solution has attracted the most attention among all Hermitian solutions of the ARE in the past works. Nevertheless, it is an interesting and challenging issue in finding the extremal solutions of AREs which play an important role in the applications. The contribution of this paper is twofold. Firstly, the existence of these extremal solutions is established under the framework of fixed-point iteration. Secondly, an accelerated fixed-point iteration (AFPI) based on the semigroup property is developed for computing four extremal solutions of the discrete-time algebraic Riccati equation. In addition, we prove that the convergence of the AFPI is at least R-suplinear with order $r>1$ under some mild assumptions. Numerical examples are shown to illustrate the feasibility and accuracy of the proposed algorithm.

Classification : 39B12, 39B42, 65H05, 15A24

Author(s) : Chun-Yueh Chiang (Center for General Education, National Formosa University) Hung-Yuan Fan (National Taiwan Normal University)

[02022] Use of jet transport for high order methods

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E505

Type : Contributed Talk

Abstract : The use of multivariate polynomial, called jet, in conjunction with numerical solvers, called transport, has recently become a new baseline to address computations based on high order methods.

Jet transport provides more accurate, efficient, and reliable results through automatizing several crucial parts.

In this talk, I will explain these most recent results and supported by examples in areas in dynamical systems.

Classification : 65Pxx, 37Mxx, 37M21, Numerical integrators for dynamical systems

Format : Online Talk on Zoom

Author(s) : Joan Gimeno (University of Barcelona) Angel Jorba (University

of Barcelona) Marc Jorba (Centre de Recerca Matemtica) Narcs Miguel (PAL Robotics S.L.) Maorong Zou (University of Texas at Austin)

[02024] Quantum asymptotic phase function on the basis of Koopman operator theory

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D404

Type : Contributed Talk
Abstract : The asymptotic phase function is a fundamental quantity for analyzing classical limit-cycle oscillators. In this study, we define the asymptotic phase function for quantum nonlinear oscillators by using the eigenoperator of the Koopman operator associated with the fundamental oscillation frequency. In an example of a quantum van der Pol oscillator with a Kerr effect, we demonstrate that the proposed asymptotic phase appropriately yields isochronous phase values in both semiclassical and strong quantum regimes.
Classification : 81-XX, 34L05, 92B25, Quantum synchronization, nonlinear dynamics, Koopman operator theory
Format : Talk at Waseda University
Author(s) : Yuzuru Kato (Future University Hakodate) Hiroya Nakao (Tokyo Institute of Technology)

[02026] Variants of the penalty method for contact problems - Formulations unifying Nitsche and penalty methods

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G702

Type : Contributed Talk
Abstract : The penalty method is a simple yet effective computational technique of handling unilateral contact problems. In addition to its inconsistent, this method is often criticized of ill-conditioning when the penalty parameter goes to zero.

We propose here new penalty methods overcoming the conditioning issue. We also established that some of our penalty formulations are equivalent of variants of Nitsches method, meaning that the inconsistent of these penalty methods is insignificant.

Classification : 35A35, 65J15, 74M15, 74B05
Format : Online Talk on Zoom
Author(s) : Ibrahima Dione (Professor at Moncton university)

[02027] Understanding Difference Equation System Models using Telescoping Sums Method

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G710

Type : Contributed Talk

Abstract : Difference equations frequently appear as discrete mathematical models of various biological and environmental phenomena. In this paper, the authors study the following systems:
\begin{equation}
x{n+1} = \dfrac{x{n-3}}{\pm 1 \pm y_n x{n-1} y{n-2} x{n-3}},\ \
y{n+1} = \dfrac{y{n-3}}{\pm 1 \pm x_n y{n-1} x{n-2} y{n-3}},
\end{equation}
which were first considered by Elsayed in 2015, and results were proven using mathematical induction.
This time, the authors present the solution forms of each system using telescoping sums technique. The advantages and disadvantages of the two methods are discussed. Boundedness and convergence of solutions shall be presented.

Classification : 39A05, 39A22, 65Q10

Format : Talk at Waseda University

Author(s) : Jerico Bravo Bacani (University of the Philippines Baguio) Julius Fergy Tiongson Rabago (Kanazawa University)

[02032] Stable Minimization of Discrete Conformal Energy for Disk Conformal Parameterization

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E503

Type : Contributed Talk

Abstract : Conformal energy minimization is an efficient approach to computing conformal parameterizations. In this talk, we introduce a stable minimization of discrete conformal energy (SMDCE) algorithm for conformal parameterizations of simply connected open surface. The stability of SMDCE is reflected in the guarantee of the one-to-one and onto properties of the computed parameterization and the insensitivity to the initial value. The numerical experiments indicate the stability and competitiveness with state-of-the-art algorithms in terms of efficiency.

Classification : 52C26, 49Q10, 68U05

Format : Talk at Waseda University

Author(s) : Zhong-Heng Tan (School of Mathematics, Southeast University) Zhenyue Zhang (Nanjing Center for Applied Mathematics)

[02034] Relation between transaction costs and search frictions in optimal maximization

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E505

Type : Contributed Talk

Abstract : We consider an optimal investment problem to maximize expected power-utility of random terminal wealth in a market with two types of illiquidity: transaction costs and search frictions. We suppose an investor trades only at arrival times of Poisson process, and pays proportional transaction costs for purchasing or selling stocks. We characterize a unique optimal trading strategy and provide asymptotic expansions on small transaction costs and small search frictions for boundaries of no-trade region and value function.

Classification : 62P05, 49N90, Financial mathematics, Stochastic analysis

Format : Talk at Waseda University

Author(s) : Tae Ung Gang (KAIST Stochastic Analysis and Application Research Center) Jin Hyuk Choi (UNIST)

[02035] General double-sided orthogonal planes split QFT and wavelet transform on functions and distribution spaces

Session Time & Room : 3C (Aug.23, 13:20-15:00) @F312

Type : Contributed Talk

Abstract : We present, in our talk, an alternative version of the convolution and duality formula, and we give some results on functions and distribution spaces for the general double-sided orthogonal planes split quaternion Fourier transform. We provide the discrete representation of Z2periodic function for continuous quaternion Wavelet transform. Finally, we prove the Plancherel and inversion formulas for the continuous General double-sided orthogonal 2Dplanes split quaternionic Wavelet transform.

Classification : 42C40, 42B10, 14D21

Format : Online Talk on Zoom

Author(s) : Hakim Monaim (Moulay Ismail University)

[02037] Two-stage Bivariate Distribution Estimation based on B-spline approach

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G701

Type : Contributed Talk

Abstract : In this work, we propose a new nonparametric model to estimate distribution functions and densities with bounded support. In addition, we study the asymptotic properties of our estimator such as asymptotic bias, variance and asymptotic normality. The method is illustrated by simulation study and an application to a real data set.

Classification : 62H10, 62H12, 62H05, 65C20, 60E05

Format : Online Talk on Zoom

Author(s) : Nezha Mohaoui (Moulay Ismail University)

[02039] Intelligent Computing Models for Super-large Protein Complex Prediction

Session Time & Room : 4E (Aug.24, 17:40-19:20) @D408

Type : Contributed Talk

Abstract : Improved from our Fast Fourier Transform based prediction methods, recently we have designed new artificial intelligence enhanced computing models to predict the super-large protein complex structures, which can give out results from monomer sequences and show good results and promise advances.

Classification : 92B20, 68T07

Format : Talk at Waseda University

Author(s) : Xinqi Gong (Renmin University of China)

[02040] Simulation of landslide-generated waves using non-hydrostatic numerical model

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E820

Type : Contributed Talk

Abstract : The reduced two-layer non-hydrostatic (NH-2LR) numerical model is developed and used to study landslide-generated waves. The NH-2LR model is validated using analytical solutions and laboratory experiments. Simulations involves landslide motions on a flat bottom as well as over a sloping beach. The effects of dispersion and non-linearity are then investigated; dispersion is important in the early generation and propagation

of landslide-generated waves, whereas non-linearity has a significant influence on maximum run-up.

Classification : 76B15, 76M12, 35L60

Format : Talk at Waseda University

Author(s) : Sri Redjeki Pudjaprasetya (Institut Teknologi Bandung) Dede Tarwidi (Telkom University) Didit Adytia (Telkom University)

[02043] Almost Automorphic Solution of a Leslie-Gower Prey-Predator Model on Time Scales

Session Time & Room : 5C (Aug.25, 13:20-15:00) @G401

Type : Contributed Talk

Abstract : A general non-autonomous Leslie-Gower prey-predator model on time scales with control input terms is examined. The significant property permanence is established along with the existence of almost automorphic solution of the model system. By constructing a suitable Lyapunov functional, presence of a one of a kind all-around attractive positive almost automorphic solution of the system is obtained. Two numerical examples are given to demonstrate the effectiveness of our hypothetical outcomes with simulations.

Classification : 34C27, 34C60, 34C25

Format : Online Talk on Zoom

Author(s) : Soniya NA (Rajiv Gandhi Institute of Petroleum Technology Jais India)

[02049] A Hybrid AMR Low-Rank Tensor Approach for Solving the Boltzmann Equation

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D402

Type : Contributed Talk

Abstract : Computational complexity grows exponentially in a grid-based approach to modeling the Boltzmann equation as dimensionality increases. Scalable low-rank tensor decomposition techniques have been developed to mitigate such issues, but challenges remain when applying real-world boundary conditions in engineering systems with complex geometries. To address these challenges, we propose a novel hybrid algorithm where quad-tree adaptive mesh refinement (AMR) is applied in real space while a low-rank approximation is used in velocity space.

Classification : 76P05, 35Q83, 65M50

Author(s) : Samuel Jun Araki (Jacobs Technology Inc. / Air Force Research Laboratory)

[02053] An efficient preconditioner for the Riemannian trust-region method on the manifold of fixed-rank matrices

Session Time & Room : 5B (Aug.25, 10:40-12:20) @E603

Type : Contributed Talk

Abstract : In 2010, Vandereycken and Vandewalle proposed a preconditioner for the Riemannian trust-region (RTR) method on the manifold of symmetric positive semidefinite matrices of fixed rank. Here, we generalize their work to the manifold of fixed-rank matrices. We use the RTR method with our preconditioner to solve a stiff time-dependent PDE, the Allen--Cahn equation, on the manifold of fixed-rank matrices. Numerical experiments show the efficiency of our preconditioner. This is joint work with Bart Vandereycken.

Classification : 65F55, 65F45, 65F08, 65L04, 65L05

Format : Talk at Waseda University

Author(s) : Marco Sutti (National Center for Theoretical Sciences, Mathematics Division, Taipei, Taiwan)

[02054] Low regularity ill-posedness for elastic waves and ideal compressible MHD in 3D and 2D

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E817

Type : Contributed Talk

Abstract : We construct counterexamples to the local existence of low-regularity solutions to elastic wave equations and to the ideal compressible magnetohydrodynamics (MHD) system in three and two spatial dimensions (3D and 2D). For 3D, inspired by the recent works of Christodoulou, we generalize Lindblads classic results on the scalar wave equation by showing that the Cauchy problems for 3D elastic waves and for 3D MHD system are ill-posed in $H^3(R^3)$ and $H^2(R^3)$, respectively. Both elastic waves and MHD are physical systems with multiple wave-speeds. We further prove that the ill-posedness is caused by instantaneous shock formation, which is characterized by the vanishing of the inverse foliation density. In particular, when the magnetic field is absent in MHD, we also provide a desired low-regularity ill-posedness result for the 3D compressible Euler equations, and it is sharp with respect to the regularity of the fluid velocity. Our proofs for elastic waves and for MHD are based on a coalition of a carefully designed algebraic approach and a geometric approach. To trace the nonlinear interactions of various waves, we algebraically decompose the 3D elastic

waves and the 3D ideal MHD equations into 6×6 and 7×7 non-strictly hyperbolic systems. Via detailed calculations, we reveal their hidden subtle structures. With them we give a complete description of solutions dynamics up to the earliest singular event, when a shock forms. If time permits, we will also present the corresponding results in 2D. This talk is based on joint works with Haoyang Chen and Silu Yin.
Classification : 76N15, 76N30, 35L60, 35L67, 35Q35
Format : Talk at Waseda University
Author(s) : Xinliang An (National University of Singapore) Haoyang Chen (National University of Singapore) Silu Yin (Hangzhou Normal University)

[02055] EMinv software platform for comprehensive analysis of geoscience data

Session Time & Room : 3E (Aug.23, 17:40-19:20) @D407

Type : Contributed Talk
Abstract : We designed and developed a new software platform, consisting of processing and inversion modular for magnetotelluric data and visualization modular for all the geoscience results. New self-improved processing and inversion algorithms were applied in this platform. This platform unified the format of data, results and models and connected data processing, interpretaion and visualization, using our new rule and integrated standard. The platform is a useful tool for both production managers and scientific researchers.
Classification : 86-04, 86-02
Format : Talk at Waseda University
Author(s) : Kun Zhang (Chinese Academy of Geopogical Sciences)

[02063] Modeling Uncertainty and Optimizing Control in Philippines COVID-19 Vaccination

Session Time & Room : 2C (Aug.22, 13:20-15:00) @G304

Type : Contributed Talk
Abstract : We developed a mathematical model considering vaccination in the country. We incorporated stochastic terms to capture uncertainty. Results show the importance of booster shots that increases the vaccine-induced immunity duration. We then consider the problem of distributing a limited vaccine supply over a time period considering that the country is divided into regions. Simulations showed that the strategy solved from our formulation is better at minimizing infections than a discussed alternative strategy.
Classification : 92D30, 37N25, 34F05, 49K15, 37H10

Format : Talk at Waseda University

Author(s) : Randy L. Caga-anan (MSU-Iligan Institute of Technology) Jayrold P. Arcede (Caraga State University) Joey Genevieve T. Martinez (MSU-Iligan Institute of Technology)

[02068] Variable selection aided by correlation networks

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D515

Type : Contributed Talk

Abstract : Variable selection is important because it can provide improved quality of results, faster times of computation and more explainable models. We present recent work in which we use data from over 100 000 cells to find a selection of morphokinetic variables guided by nonlinear correlation networks, able to capture behavioral landscapes of inflammation. Our mathematical modeling, based on logistic and decision tree models, allowed us to identify the most important variables for immune cell prediction.

Classification : 92-08, 92-10, 92B05, 92B15, 92C42

Format : Online Talk on Zoom

Author(s) : David G Aragones (University of Castilla-La Mancha) Gabriel F Calvo (University of Castilla-La Mancha) Georgiana Crainiciuc (Spanish National Cardiovascular Research Center) Miguel Palomino-Segura (Spanish National Cardiovascular Research Center) Jon Sicilia (Spanish National Cardiovascular Research Center) Andres Hidalgo (Yale University)

[02073] Graph convolutional networks for graph signal processing

Session Time & Room : 1C (Aug.21, 13:20-15:00) @F310

Type : Contributed Talk

Abstract : We propose novel graph convolution models for analyzing graph-structured time series data. Graph convolutional networks (GCNs) is a generalization of convolutional neural networks from regular grid data to irregular graph data.

The major building block of a GCN is the filter. Graph filters are designed for graph convolution in spatial and spectral domains. We also propose novel graph wavelet transform methods to be jointly used with graph convolution filters, which can further improve the results.

Classification : 42BXX, Machine learning, graph signal processing

Format : Talk at Waseda University

Author(s) : Jia He (Illinois Institute of Technology) Maggie Cheng (Illinois Institute of Technology)

[02087] Best Approximation in Euclidean Space: A Supply Distribution Efficiency Model

Session Time & Room : 2C (Aug.22, 13:20-15:00) @F411

Type : Contributed Talk
Abstract : In this paper, we developed a mathematical model for supply distribution efficiency using inverse best approximation by considering Euclidean distance in a Euclidean space. Given a sequence $\langle S_i\rangle_{i=1}^k$ of closed convex subsets of a Euclidean space E and a sequence of natural numbers $\langle n_i\rangle_{i=1}^k$, we determined the best location of a convex set S in E such that the Euclidean distance from S to S_i is at most n_i for each $i\in \{1,2,\ldots,k\}$.
Classification : 51K05, 41A45, 41A29
Format : Talk at Waseda University
Author(s) : Rosalio Jr Gaid Artes (Mindanao State University - Tawi-Tawi College of Technology and Oceanography)

[02091] Stock Data has Shape: Managing Stock Portfolio via Topology-informed Machine Learning

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E803

Type : Contributed Talk
Abstract : Given time-series data of a stocks portfolio, we generate sequences of point-cloud embeddings and use topology-based features to train a classifier on a binary classification task: determine whether or not a stock performs well on day-to-day trading. Using the trained classifier, we predict which stocks in our portfolio are projected to earn on a future trading day. We evaluate our topology-informed classifier via standard metrics and projected cumulative earnings based on a tier-structured investment scheme.
Classification : 68Txx, 68Uxx, Machine Learning
Format : Talk at Waseda University
Author(s) : Paul Samuel Ignacio (University of the Philippines Baguio)

[02093] British Call Option On Stocks under Stochastic Interest Rate

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E505

Type : Contributed Talk

Abstract : The closed form expression for the price of the British put and call options have long been established where both interest rate and volatility are assumed to be constant. In reality, these assumptions do not fully reflect the variable nature of the financial markets. In this paper, we derived a closed form expression for the arbitrage-free price of the British call option by assuming stochastic interest rate which follows the Cox-Ingersoll-Ross model and constant volatility.

Classification : 62P05

Format : Talk at Waseda University

Author(s) : Felipe Jr Raypan Sumalpong (Mindanao State University - Iligan Institute of Technology) Kreanne Falcasantos (Mindanao State University - Iligan Institute of Technology)

[02100] Evaluation of Pandemic Severity using Type-2 Fuzzy Systems

Session Time & Room : 1C (Aug.21, 13:20-15:00) @

Type : Contributed Talk

Abstract : A type-2 fuzzy system is used to assess pandemic severity of places. To assess the situation, test positivity, vaccination status, total numbers of infected cases, active cases, recovered cases, deceased cases, population density, etc., are considered. Available imprecise data are converted into type-2 fuzzy numbers and type-2 fuzzy inference system is used. A case study on the recent COVID-19 pandemic situation is performed. The achieved results and comparison reflect usefulness and superiority of the model.

Classification : 03B52, 62A86, 94D05, 90C70, 90B50

Author(s) : Animesh Biswas (University of Kalyani)

[02102] Network Construction Problems

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A206

Type : Contributed Talk

Abstract : Network construction problems seek to find efficient schedules of constructing edges of a new transportation network under limited resources, with the goal of minimizing a scheduling objective which is a non-decreasing function of the times when some important pairs of nodes become connected. The talk will discuss some recent results in this area of combinatorial optimization, focusing on classification and computational complexity.

Classification : 90C27

Format : Talk at Waseda University

Author(s) : Igor Averbakh (University of Toronto)

[02103] Global in Time Weak Solutions to Singular 3D Quasi-Geostrophic Systems

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E606

Type : Contributed Talk

Abstract : Geophysicists have studied 3D Quasi-Geostrophic systems extensively. These systems describe stratified flows in the atmosphere on a large time scale and are widely used for forecasting atmospheric circulation. They couple an inviscid transport equation in $\mathbb{R}_{+}\times\Omega$ with an equation on the boundary satisfied by the trace, where Ω is either $2D$ torus or a bounded convex domain in $\mathbb{R}^2$. In this talk, we show the existence of global in time weak solutions to a family of singular 3D quasi-geostrophic systems with Ekman pumping, where the background density profile degenerates at the boundary. The proof is based on the construction of approximated models which combine the Galerkin method at the boundary and regularization processes in the bulk of the domain. The main difficulty is handling the degeneration of the background density profile at the boundary.

Classification : 35Q35, 76D03

Format : Online Talk on Zoom

Author(s) : Yiran Hu (University of Texas at Austin)

[02106] Numerical solver of ordinary differential equations based on IMT-DE variable transformation

Session Time & Room : 2E (Aug.22, 17:40-19:20) @E505

Type : Contributed Talk
Abstract : We propose a numerical solver of initial value problems of ordinary differential equations based on the IMT-DE variable transformation, a variant of the transformation of the IMT quadrature formula. We solve the Volterra integral equation equivalent to the initial value problem by the Picard iteration, which is numerically executed by the numerical indefinite integration based on the IMT-DE transformation. This study is an example of the applications of the IMT type transformations to various computations.
Classification : 65L05, 65R20, 65D30
Format : Talk at Waseda University
Author(s) : Hidenori Ogata (The University of Electro-Communications)

[02107] Nonlinear stochastic heat equation with variable thermal conductivity

Session Time & Room : 2E (Aug.22, 17:40-19:20) @G502

Type : Contributed Talk
Abstract : We consider a stochastic heat equation with variable thermal conductivity, on infinite domain, with both deterministic and stochastic source and with stochastic initial data. The stochastic source appears in the form of multiplicative generalized stochastic process. In our solving procedure we use regularized derivatives and the theory of generalized uniformly continuous semigroups of operators. We establish and prove the result concerning the existence and uniqueness of solution within certain generalized function space.
Classification : 35D30, 35K05, 47D99
Format : Talk at Waseda University
Author(s) : Danijela Rajter-Ciric (Faculty of Sciences, University of Novi Sad) Milos Japundzic (Novi Sad School of Business - Higher Education Institution for Applied Studies)

[02108] Particle dynamics model for the coarsening process of phase separation

Session Time & Room : 4C (Aug.24, 13:20-15:00) @E507

Type : Contributed Talk
Abstract : The Cahn-Hilliard equation describes phase separation phenomena well.
It has been proven that this solution converges to one of the Hele-Shaw problems in the limit of one coefficient parameter to zero, which is mathematically satisfactory as an order-reduction result.

However, the computation of the Hele-Shaw problem is also problematic. Therefore, we observed the coarsening process of phase separation phenomena and subsequently considered a particle dynamics model that roughly reproduces the process.
Classification : 70-10, 65N06, 65N08
Format : Talk at Waseda University
Author(s) : Daisuke Furihata (Osaka University)

[02111] Geometric visual model for linear derivation of elliptical orbits in 3-dimensional space

Session Time & Room : 2C (Aug.22, 13:20-15:00) @F411

Type : Contributed Talk
Abstract : If visual space is defined as a 3-dimensional complex vector space, linear perspective is expressed as an L1-norm constraint with the scale. The vanishing point represents the boundary of visual space, and the L2-norm constraint indicates that visual space is a sphere. A geometric visual model that satisfies these constraints allows linear derivation of elliptical orbits. The solution is simple because it does not involve an infinite series.
Classification : 51K05
Format : Talk at Waseda University
Author(s) : Hiroyuki Nishimoto (Kochi University)

[02112] Adaptive Virtual Element Methods: convergence and optimality

Session Time & Room : 4D (Aug.24, 15:30-17:10) @E711

Type : Contributed Talk
Abstract : We consider a Virtual Element discretization of elliptic boundary-value problems, using triangular or quadrilateral meshes with hanging nodes of arbitrary, but fixed, maximal index.
We design a two-stage adaptive algorithm, based on a stabilization-free a posteriori error estimator, which alternates data approximation and solution approximation with increasing accuracy.
We prove the convergence of the inner and outer loops, we establish the optimality of the adaptive procedure in suitable approximation classes, and we provide numerical results.

Classification : 65N30, 65N50

Format : Talk at Waseda University

Author(s) : Claudio Canuto (Politecnico di Torino) Lourenco Beirao da Veiga (University of Milan Bicocca) Ricardo H Nochetto (University of Maryland) Giuseppe Vacca (University of Bari) Marco Verani (Politecnico di Milano)

[02116] Generalized Polyak Step Size for First Order Optimization with Momentum

Session Time & Room : 1E (Aug.21, 17:40-19:20) @F309

Type : Contributed Talk

Abstract : This paper presents a general framework to set the learning rate adaptively for first-order optimization methods with momentum, motivated by the derivation of Polyak step size. It is shown that the resulting methods are much less sensitive to the choice of momentum parameter and may avoid the oscillation of the heavy-ball method on ill-conditioned problems. These adaptive step sizes are further extended to the stochastic settings, which are attractive choices for stochastic gradient descent with momentum. Our methods are demonstrated to be more effective for stochastic gradient methods than prior adaptive step size algorithms in large-scale machine learning tasks.

Classification : 90C15, 65K05, 90C06

Format : Online Talk on Zoom

Author(s) : Xiaoyu Wang (Hong Kong University of Science and Technology) Mikael Johansson (KTH Royal Institute of Technology) Tong Zhang (Hong Kong University of Science and Technology)

[02118] The finite volume method for solving the oblique derivative BVP in geodesy

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E504

Type : Contributed Talk

Abstract : We formulate the oblique derivative boundary value problem applied in gravity field and present two approaches to its solution by the finite volume method. In the first approach, the oblique derivative in the boundary condition is decomposed into normal and two tangential components and approximated by the central scheme. In the second approach, the oblique derivative in the boundary condition is treated by the first order upwind scheme. Both approaches are tested by various experiments.

Classification : 65N08

Author(s) : Zuzana Minarechov (Slovak University of Technology) Marek

Mack (Slovak University of Technology) Karol Mikula (Slovak University of Technology) Rbert underlk (Slovak University of Technology)

[02125] TNL: Numerical Library for Modern Parallel Architectures

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E820

Type : Contributed Talk
Abstract : TNL (www.tnl-project.org) is a collection of building blocks that facilitate the development of efficient numerical solvers and HPC algorithms. It is implemented in C++ using modern programming paradigms in order to provide a flexible and user-friendly interface similar to, for example, the C++ Standard Template Library. TNL provides native support for modern hardware architectures such as multicore CPUs, GPUs, and distributed systems, which can be managed via a unified interface. In our presentation, we will demonstrate the main features of the library together with efficiency of the implemented algorithms and data structures.
Classification : 68W99, 68U01, 65N99, High-performance computing
Format : Talk at Waseda University
Author(s) : Tom Oberhuber (Czech Technical University in Prague) Jakub Klinkovsk (Czech Technical University in Prague) Radek Fuk (Czech Technical University in Prague)

[02138] Convergence Analysis of Leapfrog for Geodesics

Session Time & Room : 2E (Aug.22, 17:40-19:20) @E505

Type : Contributed Talk
Abstract : The leapfrog algorithm was proposed in Noakes98 to find geodesics joining two given points x_0 and x_1 on a path-connected complete Riemannian manifold. The basic idea is to choose some junctions between x_0 and x_1 that can be joined by geodesics locally and then adjust these junctions. In this talk, we find the relationship between the leapfrog's convergence rate $\tau_{i,n}$ of i-th junction with the maximal root λ_n of a polynomial.
Classification : 65L10, 65D15, 49J45, 53C22
Format : Online Talk on Zoom
Author(s) : Erchuan Zhang (University of Western Australia) Lyle Noakes (University of Western Australia)

[02139] Normalizing Flows Based Mutual Information Estimation

Session Time & Room : 4E (Aug.24, 17:40-19:20) @A502

Type : Contributed Talk

Abstract : Mutual Information is a measure of mutual dependence on random quantities without specific modelling assumptions. However, estimating mutual information numerically from high-dimensional data remains a difficult problem. We propose a principled mutual information estimator based on a generalization of normalizing flows. The proposed method uses an autoregressive structure in estimating mutual information with estimating marginal and joint entropy simultaneously. Empirical results demonstrate that our proposed estimator exhibits improved bias-variance trade-offs on standard benchmark tasks.

Classification : 94a17, 62b10, 68t07, 68t09

Format : Talk at Waseda University

Author(s) : Haoran Ni (University of Warwick) Martin Lotz (University of Warwick)

[02142] Self-similar hierarchy of vortices in turbulence

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E817

Type : Contributed Talk

Abstract : By direct numerical simulations, we show that there exists the hierarchy of vortex axes in turbulence, which is self-similar in a wide range of scales, i.e., in the inertial range and a lower part of the dissipation range. This result means that the volume fraction occupied by the tubular vortices at each scale is independent of the scale.

Classification : 76F65, 65Z05

Format : Talk at Waseda University

Author(s) : Tomonori Tsuruhashi (The University of Tokyo) Susumu Goto (Osaka University) Sunao Oka (Osaka University) Tsuyoshi Yoneda (Hitotsubashi University)

[02148] A comparative study on scattering of water waves by barriers of various kinds.

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E820

Type : Contributed Talk

Abstract : The present study outlines the mathematical and computational details needed to compute the solutions on the scattering of surface water waves by a finite dock, thin rectangular elastic plate and circular elastic plate in finite depth water. The boundary value problem is handled for solutions analytically using a matched eigenfunction expansion . Various physical quantities associated with the scattering problems are studied for various values of wave and structural parameters. A selection of results are given to illustrate the variations of scattering coefficients and to compare with existing solutions.

Classification : 76B15

Format : Online Talk on Zoom

Author(s) : SOFIA SINGLA (IIITUNA, UNA)

[02158] Spatially coordinated collective phosphorylation filters spatiotemporal noises for precise circadian timekeeping

Session Time & Room : 4E (Aug.24, 17:40-19:20) @D514

Type : Contributed Talk

Abstract :

The mammalian circadian clock is based on a self-sustaining transcriptional-translational negative feedback loop. This machinery is expected to suffer from the heterogeneous arrival time distribution of clock protein from the noisy intracellular environment at the nucleus; however, mammals exhibit robust daily rhythms of physiological and behavioral processes, including sleep and hormone secretion. We explore under which condition the circadian clock compensates for the heterogeneity by a modeling approach.

Classification : 92BXX, 92Cxx

Format : Talk at Waseda University

Author(s) : Seokjoo Chae Dae Wook Kim (University of Michigan) Seunggyu Lee (Korea University) Jae Kyoung Kim (KAIST)

[02160] Using quantum mechanics for calculation of different infinite sums

Session Time & Room : 2E (Aug.22, 17:40-19:20) @D405

Type : Contributed Talk

Abstract :
Certain class of infinite sums can be calculated analytically starting from a specific quantum mechanical problem. For simplicity we illustrate the method by exploring the problem of a particle in a box. Twofold calculation of the mean value of energy for the polynomial wave function inside the well yields even argument p of Riemann zeta and related functions. This method can be applied to a wide class of exactly solvable quantum mechanical problems.

Classification : 81P10, 35J10, 35L05, 37N20

Format : Talk at Waseda University

Author(s) : Milica Pavkov Hrvojevic (Facuty of Sciences University of Novi Sad) Petar Mali (Faculty of Sciences University of Novi Sad) Milica Rutonjski (Faculty of Sciences University of Novi Sad) Slobodan Radosevic (Faculty of Sciences University of Novi Sad)

[02164] Uncertainty-Aware Null Space Networks for Data-Consistent Image Reconstruction

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E811

Type : Contributed Talk

Abstract : State-of-the-art reconstruction methods in inverse problems have been developed by incorporating latest advances in deep learning. Before learning approaches can be used in safety-critical areas like medical imaging, a model must not only provide a reconstruction, but also an estimate of its reliability. This study presents a cascaded architecture of null space networks and combines it with recent progress of uncertainty quantification in computer vision. This way, two key properties are met: data-consistency and uncertainty-awareness.

Classification : 68T07, 68T37, 92C50, 92C55

Format : Talk at Waseda University

Author(s) : Christoph Angermann (VASCage Research Centre on Vascular Ageing and Stroke) Simon Goeppel (Universitt Innsbruck) Markus Haltmeier (Universitt Innsbruck)

[02174] A mathematical model to predict how obesity raises the risk of diabetes

Session Time & Room : 4D (Aug.24, 15:30-17:10) @E711

Type : Contributed Talk

Abstract : Nowadays, obesity is a serious global issue. Obesity increases the risk of developing significant health issues like diabetes, cancer, and heart attacks. This work tries to depict the link between pancreatic damage, blood insulin levels, and blood glucose in a mathematical model. The model also illustrates how the increased obesity index raises diabetes risk. Additionally, we incorporated a delay term in the model to depict insulin production lag brought on by dysfunctional beta-cells due to obesity. We analytically analyzed both delay and non-delay models. Moreover, numerical simulations are demonstrated to support the theoretically-based analysis.

Classification : 92B05, 34H05, 34D05

Author(s) : Parimita Roy (Thapar Institute of Engineering and Technology)
Ani Jain (Thapar Institute of Engineering and Technology)

[02175] Learning Interaction laws in particle- and agent-based systems

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E705

Type : Contributed Talk

Abstract : We consider the following inference problem for a system of interacting particles or agents: given only observed trajectories of the agents in the system, can we learn what the laws of interactions are? We would like to do this without assuming any particular form for the interaction laws, i.e. they might be any function of pairwise distances, or other variables. We discuss when this problem is well-posed, construct estimators for the interaction kernels with provably good statistically and computational properties, and discuss extensions to second-order systems, more general interaction kernels, and stochastic systems. We measure empirically the performance of our techniques on various examples, including families of systems with parametric interaction kernels, and settings where the interaction kernels depend on unknown variables. We also conduct numerical experiments to study the emergent behavior of these systems. This is joint work with F. Lu, J. Feng, P. Martin, J.Miller, S. Tang and M. Zhong.

Classification : 70F17, 62M20, 34A55

Format : Talk at Waseda University

Author(s) : Mauro Maggioni (Johns Hopkins University)

[02184] Oscillatory Translational Instability of Localized Spot Patterns in the Schnakenberg Reaction-Diffusion System in Defected 3D Domains

Session Time & Room : 1C (Aug.21, 13:20-15:00) @G501

Type : Contributed Talk

Abstract : For a two-component reaction-diffusion system in a bounded $3D$ domain, we investigate oscillatory instabilities of N-spot equilibrium. An N-spot equilibrium consists of localized spots in which the activator concentration is exponentially small everywhere except localized regions. In the stability analysis, we consider the translation mode and obtain the eigenvalue λ is $\mathcal{O}(\varepsilon^2)$, which is the same order as the spot dynamics, while $\tau $ is $\mathcal{O}(\varepsilon^{-3})$. As a result, the system which contains the behavior of λ and $\tau \lambda$ falls into the $\mathcal{O}(\varepsilon^2)$ correction. We later find that stability of these solutions is governed by a $3N \times 3N$ nonlinear matrix eigenvalue problem. Entries of the $3N \times 3N$ matrix involves terms calculated from certain Greens function that contains information about the domains geometry. In the nonlinear matrix eigenvalue system, the most unstable eigenvalue decides the oscillation frequency at onset while the corresponding eigenvector determines the mode of spot oscillations. Further, we demonstrate the impact of various types of localized heterogeneity on this instability. An example of localized domain defects that we consider is to analyze the effect of perturbing the system by removing a small ball in the domain, which therefore allows a leakage of the chemical species out of the domain. Perturbation techniques is employed to compute Greens function of near-spherical and near-cubic domains to gain analytic insight into how domain geometry select the dominant mode of oscillation. We show full solutions of the 3-D Schnakenberg PDE to confirm our asymptotic results.

Classification : 35B36, 35B35, 35B25

Format : Talk at Waseda University

Author(s) : Siwen Deng (Macquarie University) Justin Tzou (Macquarie University)

[02185] Vibration of anti-symmetric angle-ply layered conical shell frusta using splines

Session Time & Room : 1C (Aug.21, 13:20-15:00) @

Type : Industrial Contributed Talk

Abstract : Vibration of anti-symmetric angle-ply layered conical shell is studied including shear deformation using spline function approximation. The equilibrium equations are formulated in terms of displacement and rotational functions. These functions are approximated using Bickley-type splines to obtain the generalised eigenvalue problem. Parametric studies are made to analyse the effects of circumferential node number, length ratio and cone angle on the frequency parameter for number of layers and materials with ply orientations under different boundary conditions.

Classification : 74K25, 74-10, 74E30, 74G15, 74B05, Composite Shell structure

Author(s) : Viswanathan Kodakkal Kannan (Samarkand State University)

[02188] Rare events of weak noise-driven dynamical systems

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E501

Type : Contributed Talk

Abstract : Real-world dynamical systems can be susceptible to events with a low probability of occurrence but severe repercussions. The aim is to asymptotically quantify the likelihood of these events in dynamical systems represented by stochastic differential equations (SDEs).

First, we will go through the mathematical framework for investigating such situations. Then, we will demonstrate a numerical obstacle when using a rare events method due to diverging the tilting factor, aka Radon-Nikodym derivative. A solution will be proposed and shown using multiple scenarios.

Classification : 60F10, 65C20, 49M05, 49M29, 65C05

Author(s) : Mnerh Alqahtani (University of Hafr Al Batin) Tobias Grafke (University of Warwick)

[02189] Improved viscous flow between expanding or contracting permeable walls

Session Time & Room : 2D (Aug.22, 15:30-17:10) @D404

Type : Contributed Talk

Abstract : Solutions to transport models of fluid in contracting/expanding porous vessels remain unknown, and the problem has been restricted to the slow expansion/contraction of the walls. I partially address these gaps by generating explicit solutions and improving approximations without the slowness dilation rate. Indeed, the homogeneous differential equation is completely solved and this exact solution may be leveraged to form more precise approximations to the flow via perturbation techniques when the Reynolds number is small.

Classification : 76S05, 34B15

Format : Online Talk on Zoom

Author(s) : Christopher C. Tisdell (University of New South Wales (UNSW))

[02191] Analysis Seismic Data in Sumatra Using Robust Sparse K-Means Clustering

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E501

Type : Contributed Talk

Abstract : K-means algorithm is considered to be the most important unsupervised machine learning method in clustering. It works intimately on complete and clear data but cannot handle outliers. Therefore, robust statistical algorithms are required to deal with it. This paper presents robust sparse k-means algorithm to show clustering of seismic data in Sumatra. Clustering results are displayed graphically for two, three and four clusters to see the zones formed based on the grouping results.

Classification : 62-11, 62-08

Format : Talk at Waseda University

Author(s) : Ulfasari Rafflesia (Univestitas Gadjah Mada, Yogyakarta) Dedi Rosadi (Univestitas Gadjah Mada, Yogyakarta) Devni Prima Sari (Universitas Negeri Padang)

[02197] Mean-field diffusive coupling to promote dispersal, synchronisation and stability of infectious diseases

Session Time & Room : 2E (Aug.22, 17:40-19:20) @G402

Type : Contributed Talk

Abstract : The scope of mediated infectious diseases is strongly impacted by mobility of humans and mediating agents. The movement of hosts and mediators determines how spatially contagious infectious diseases are spread. Therefore, the metapopulation dynamics of mediated infectious disease model is examined in a patchy scenario where the hosts' and mediators' populations are divided into subpopulations. The network of humans and mediators are utilized to depict the patchy environment. The network patches are connected by mean field diffusive coupling. The patches of related networks synchronize and achieve bistable states as a result of dispersal.

Classification : 34N05

Format : Online Talk on Zoom

Author(s) : Tina Verma (Thapar Instiute of Engineering & Technology)

[02200] Structured Distances to Nearest Singular Matrix Pencil

Session Time & Room : 1E (Aug.21, 17:40-19:20) @G304

Type : Contributed Talk

Abstract : We consider the structured distance to singularity for a given regular matrix pencil $A+sE$, where $(A,E)\in \mathbb S \subseteq (\mathbb{C}^{n,n})^2$. This includes Hermitian, skew-Hermitian, $*$-even, $*$-odd, $*$-palindromic, T-palindromic, and dissipative Hamiltonian pencils. We derive explicit computable formulas for the distance to the nearest structured pencil $(A-\Delta_A)+s(E-\Delta_E)$ such that $A-\Delta_A$ and $E-\Delta_E$ have a common null vector. We then obtain a family of computable lower bounds for the unstructured and structured distances to singularity.

Classification : 15A18, 15A22, 65K05

Format : Talk at Waseda University

Author(s) : Anshul Prajapati (Indian Institute of Technology Delhi) Punit Sharma (Indian Institute of Technology Delhi)

[02201] Total Variation and Undecimated Wavelet Approach to Chest Radiograph Image Enhancement

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E820

Type : Contributed Talk

Abstract : ABSTRACT
Medical images are often corrupted by white noise, blurring and contrast defects. Consequently, important medical information may be degraded or completely masked. In this talk, I will discuss recent advances in the implementation of a total variation method and an undecimated wavelet image enhancing algorithm, as well as morphological techniques such as closing, thinning and pruning combined with wavelets methods, to improve the image quality and to extract target features from chest radiographs.

Classification : 68U10, 44A20, 46N10, Chest radiograph image enhancement, mathematical morphology, wavelet decomposition

Author(s) : Anthony Y Aidoo (Eastern Connecticut State University) Gloria Agyeiwaa Botchway (University of Ghana) Matilda Acheampong Wilson (University of Ghana)

[02215] Solving Fokker-Planck Equation in High Dimensions via Milestoning

Session Time & Room : 2D (Aug.22, 15:30-17:10) @E506

Type : Contributed Talk

Abstract : We propose a novel method for solving Fokker-Planck-type equations via the Feynman-Kac formula, closely related to rare events sampling. A family of trajectories is maintained between each pair of milestones while new samples are drawn based on an importance-sampling principle. We also show a probabilistic estimate of the sampling error which explains why, so-called, milestoning can significantly speed up molecular dynamics simulations.

Classification : 65C35, 65C30, 60H35

Format : Talk at Waseda University

Author(s) : Ziheng Chen (University of Texas at Austin) Bjorn Engquist (University of Texas at Austin)

[02218] Self-gravitational force calculation of infinitesimally thin gaseous disks based on adaptive mesh refinement accelerated by sparse fast Fourier transform

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E703

Type : Contributed Talk

Abstract : The central region of galaxies can be infinitesimally thin gaseous disks due to the angular moment conservation. Dynamic of gaseous disks is significant for probing the gas flows inward/outward to the origin of galaxies. Moreover, self-gravitational force calculation should be concerned during the evolution of galaxies. We can use the sparse fast Fourier transform (sFFT) to preserve the nearly linear complexity $O(N\log N)$ for numerical calculation based on adaptive mesh refinement (AMR) in this presentation.

Classification : 65M80, 42A16, 42A38

Format : Talk at Waseda University

Author(s) : Chien-Chang Yen (Fu Jen Catholic University)

[02220] Analytical approximation of phase dynamics for oscillators without polar symmetry

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G709

Type : Contributed Talk

Abstract : Predicting and controlling oscillatory systems, despite its relevance, is still an unachieved goal. A simplification method to ease this task is phase reduction, a dimensional reduction scheme that capture the dynamics of each oscillator in just one variable -the phase-. Despite phase reduction importance, analytical results are only available for systems with polar symmetry. In this talk we show how to perform analytical phase reduction on non-symmetric oscillators.

Classification : 37Mxx, 37Nxx

Format : Talk at Waseda University

Author(s) : Ivan Leon (Tokyo Tech Institute of Technology) Hiroya Nakao (Tokyo Tech Institute of Technology)

[02222] Unfolding operator in Heisenberg group and its applications

Session Time & Room : 3D (Aug.23, 15:30-17:10) @A511

Type : Contributed Talk

Abstract : After the development of multi-scale convergence in the 1990s, the periodic unfolding approach is one of the most effective methods for studying multi-scale problems like homogenization in the Euclidean setup.
This talk will discuss the periodic unfolding operator in the Heisenberg group. Analogous to the Euclidean unfolding operator, we prove all the required properties. We apply the unfolding operator to homogenize an optimal control problem subject to a state equation having high contrast diffusive coefficients.

Classification : 35Rxx

Format : Talk at Waseda University

Author(s) : Abu Sufian (TIFR- Centre for Applicable Mathematics) Akambadath Keerthiyil Nandakumaran (Indian Institute of Science, Bangalore, India)

[02224] Numerical simulation of convective flow models in porous media using deep learning technique

Session Time & Room : 2D (Aug.22, 15:30-17:10) @D404

Type : Contributed Talk

Abstract : The outstanding computational ability of artificial neural networks (ANN) makes the deep learning (DL) branch more robust for solving various simple and complex convective models $\left(2D ~and~3D\right)$ in porous media. Moreover, it is an unsupervised learning approach in the DL that uses randomly sampled spatial and boundary collocation points as training data for ANN. A loss function according to the governing and boundary conditions is formulated and enforced to minimize at the sampled collocation points through the backpropagation algorithm using suitable optimization techniques. Eventually, a fine-tuned ANN is achieved after a sufficiently large number of training processes, and the tunned ANN is used to replicate the solution quickly.

Classification : 76S05, 68T07

Author(s) : Sumant Kumar (Defence Institute of Advanced Technology, Pune) Rathish Kumar Venkatesulu Bayya (Indian Institute of Technology

Kanpur) Somanchi V.S.S.N.V.G. Krishna Murthy (Defence Institute of Advanced Technology, Pune)

[02225] On Fractional Lah-Bell Polynomials and Numbers

Session Time & Room : 3C (Aug.23, 13:20-15:00) @F312

Type : Contributed Talk

Abstract : In this talk, we will present a fractional generalization of the Lah-Bell polynomials and the Lah numbers associated to the fractional Poisson probability distribution. We derive the exponential generating functions in terms of the Mittag-Leffler function along with some convolution identities. These identities are the natural extension of several well-known identities available in literature. Finally, applications to compound Poisson process, Mittag-Leffler function, and the Laguerre polynomials are also presented.

Classification : 60E05, 05A19, 26A33, 11C08, 05A17

Format : Online Talk on Zoom

Author(s) : Ritik Soni (Central University of Punjab) Ashok Kumar Pathak (Central University of Punjab)

[02227] A discrete-time competition model of Ricker type with reproductive delay

Session Time & Room : 4D (Aug.24, 15:30-17:10) @E508

Type : Contributed Talk

Abstract : We study a discrete-time competition model of Ricker type with reproductive delay. The model is examined under the assumption that species 1 and 2 have the same vital rates except that a fraction of species 1 individuals delays the initiation of reproduction. This assumption ensures that species 2 can always increase whenever species 1 can increase. This study shows that, even under this situation, species 1 can eliminate species 2 if the population is fluctuating.

Classification : 92B05, 37N25, 39A60, 92D40, 92D25

Format : Online Talk on Zoom

Author(s) : Ryusuke Kon (University of Miyazaki)

[02229] Efficient numerical methods for time-fractional Black-Scholes equation arising in finance

Session Time & Room : 2D (Aug.22, 15:30-17:10) @E702

Type : Contributed Talk

Abstract : Two numerical schemes to solve time-fractional Black-Scholes PDE governing European options. are proposed. First, fractional derivative is discretized by L1-scheme and spatial derivatives by cubic spline method on uniform mesh. Secondly, we discretize temporal variable by L1-scheme on non-uniform mesh and spatial derivatives by NIPG method on uniform mesh. Stability, convergence and numerical results are carried out. Three European options are priced as application and impact of time-fractional derivative order on option price is shown.

Classification : 65M06, 65M12, 65M15

Format : Online Talk on Zoom

Author(s) : Jaspreet Kaur Anand (Indian Institute of Technology Guwahati, Guwahati, Assam) Natesan Srinivasan (Indian Institute of Technology Guwahati, Guwahati, Assam)

[02235] Numerical simulation of dislocation multiple cross-slip

Session Time & Room : 4D (Aug.24, 15:30-17:10) @G602

Type : Contributed Talk

Abstract : Our contribution deals with the phenomenon in material science called multiple cross-slip of dislocations in slip planes. The numerical model is based on a mean curvature flow equation with additional forcing terms included. The curve motion in 3D space is treated using our tilting method, i.e., mapping of a 3D situation onto a single plane where the curve motion is computed. The physical forces acting on a dislocation curve are evaluated in the 3D setting.

Classification : 35K57, 35K65, 65N40, 65M08, 53C80

Format : Talk at Waseda University

Author(s) : Petr Pau (Czech Technical University in Prague) Miroslav Kol (Czech Technical University in Prague) Michal Bene (Czech Technical University in Prague)

[02236] An hp-version discontinuous Galerkin method for the generalized Burgers-Huxley Equations with weakly singular kernel

Session Time & Room : 5C (Aug.25, 13:20-15:00) @A201

Type : Contributed Talk

Abstract : We study the numerical approximation for the generalized Burgers-Huxley equations with a weakly singular kernel. Firstly, we derive an a priori error estimate for the hp-version of discontinuous Galerkin (DG) time stepping method. For the start-up singularities near t = 0, using geometrically refined time-steps and linearly increasing approximation orders, we get the exponential rates of convergence. For the fully discretized system we combine the DG time-stepping method and DG finite element discretization in space. Finally, the computational results are presented to validate our theoretical results.

Classification : 65N15, 65N30

Format : Talk at Waseda University

Author(s) : Sumit Mahajan (Indian Institute of Technology, Roorkee) Arbaz Khan (IIT Roorkee)

[02238] A Generalized Multi-Parameterized Proximal Point Algorithm

Session Time & Room : 4D (Aug.24, 15:30-17:10) @D408

Type : Contributed Talk

Abstract : Proximal point algorithm (PPA) is an important class of methods for solving convex problems. In this article, a generalized multi-parameterized proximal point algorithm (GM-PPA) is developed to solve linearly constrained convex optimization problems. Compared with existing PPAs, the proposed method is much more general as well as flexible. Many existing PPAs reduce to our algorithm when some newly introduced parameters are fixed. Furthermore, by appropriately setting the algorithm parameters, our GM-PPA is potentially able to reduce the computation time and iteration number whereas the convergence result can still be guaranteed. Numerical experiments on synthetic problem are conducted to demonstrate the efficiency of our algorithm.

Classification : 90C25, 90C30

Format : Talk at Waseda University

Author(s) : Yuan Shen (Nanjing University of Finance & Economics)

[02242] Metaheuristic based numerical solution and statistical optimization of heat transfer through rotating heat pipe

Session Time & Room : 5B (Aug.25, 10:40-12:20) @D101

Type : Contributed Talk

Abstract : This study presents the numerical solution for heat transfer through a rotating heat pipe filled with hybrid nanofluid Graphene oxide-molybdenum disulphide (GO-MoS2). The developed mathematical model is solved by hybridization of Particle Swarm Optimization along with finite difference method. Sensitivity of different parameters on heat transfer is analysed by fitting the full quadric regression model using response surface method. The identified parameters for heat transfer enhancement are nanoparticle concentration, inlet fluid mass and temperature difference.

Classification : 76A20, 80M20, 65L06, 62P35, 90C31

Format : Talk at Waseda University

Author(s) : Ziya Uddin (BML Munjal University, Gurugram) Hamdy Hassan (Egypt-Japan University of Science and technology) Souad Harmand (UPHF) Wubshet Ibrahim (Ambo University)

[02248] Remedies for entropy growth from iterative methods in CFD

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E604

Type : Contributed Talk

Abstract : We explore the influence of iterative methods on entropy-conserving and dissipative discretizations of nonlinear conservation laws with implicit time discretizations. Newton's method can cause entropy dissipative schemes to become anti-dissipative, even with smaller iteration errors than time integration errors. We suggest various remedies and find a relaxation technique to be the most effective. Numerical experiments with dispersive wave equations demonstrate that entropy conservation produces more accurate results than non-conservative schemes, even with larger tolerances.

Classification : 65M12, 65N22, 65H10, 65F10

Format : Talk at Waseda University

Author(s) : Viktor Linders (Lund University) Philipp Birken (Lund University)

[02249] An Adaptive Time Stepping Scheme for Rate-Independent Systems

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E503

Type : Contributed Talk

Abstract : We investigate a local incremental stationary scheme for the numerical solution of rate-independent systems. The main novelty of our approach in comparison to existing methods is an adaptive choice of the step size for the update of the curve parameter. It is proven that the piecewise affine approximations generated by the algorithm converge (weakly) to a so-called parametrized balanced viscosity solution. Numerical experiments illustrate the theoretical findings and show a significant increase of the step size during sticking and in viscous jumps.

Classification : 65J08, 65K15, 65M12, 65M50

Format : Talk at Waseda University

Author(s) : Merlin Andreia (TU Dortmund University) Christian Meyer (TU Dortmund University)

[02254] Optimized first order alternating algorithms for fast and accurate low rank tensor decomposition

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G304

Type : Contributed Talk

Abstract : CP tensor decomposition has been proven to be a powerful tool for extracting information from large high order tensor, being widely applied in many areas such as chemistry, biology and medical science. However, efficiently computing the CP tensor still remains a challenge. In this study, we propose some optimized first order alternating least square algorithms for low rank tensor decomposition. We validate and illustrate the proposed algorithms by using simulated and real multi-way data.

Classification : 15A72, 15A69, 65Z05

Format : Talk at Waseda University

Author(s) : HUIWEN YU (Aarhus University) Ove Christiansen (Aarhus University)

[02266] Constructing ternary quasigroups possessing properties of parastrophic orthogonality

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G601

Type : Contributed Talk

Abstract : A set of ℓ orthogonal n-ary operations or hypercubes of order m is equivalent to an $(\ell,m^n,\ell-n+1)$ maximum distance separable or MDS code. Consequently, the problem of constructing MDS codes can be reduced to constructing orthogonal operations. We research constructing a ternary medial quasigroup possessing parastrophic orthogonality property. A necessary and sufficient condition that the quasigroup is self-orthogonal, strongly self-orthogonal or totally parastrophically orthogonal is that each polynomial of a certain set is invertible-valued.

Classification : 05B15, 20N05

Format : Online Talk on Zoom

Author(s) : Fedir Sokhatsky (Vasyl Stus Donetsk National University) Iryna Fryz (Vasyl Stus Donetsk National University)

[02267] A Massively Parallel Performance Portable Free Space Spectral Poisson Solver for Beam and Plasma Physics Problems

Session Time & Room : 4D (Aug.24, 15:30-17:10) @E504

Type : Contributed Talk

Abstract : Recently, a new fast algorithm for computing volume potentials has been proposed by Vico, Greengard, and Ferrando, which provides a spectral accuracy free-space Poisson equation solver, useful for plasma and beam physics. We write a parallel performance portable implementation in the IPPL library, using the Exascale Computing Project's heFFTe and Kokkos libraries, and MPI for parallelization. A comparison with the traditional Hockney-Eastwood algorithm manifests the memory benefits of using the new algorithm, especially on GPUs.

Classification : 65Y05, 78A30, 35Q61, 65K05, 65N80

Format : Talk at Waseda University

Author(s) : Sonali Mayani (Paul Scherrer Institute) Antoine Cerfon (NYU) Matthias Frey (University of St. Andrews) Veronica Montanaro (Paul Scherrer Institute) Sriramkrishnan Muralikrishnan (Jlich Supercomputing Centre) Andreas Adelmann (Paul Scherrer Institute)

[02269] Mathematical model for prioritize patient in operating room block scheduling

Session Time & Room : 3E (Aug.23, 17:40-19:20) @D505

Type : Contributed Talk

Abstract : We concentrate on the scheduling problem in surgical operating room that involves limited equipment and surgical specialities. Our objective is develop a feasible schedule that consider resources utilization, prioritized patients in health risk condition and availability of the surgical specialities teams. Our approach is the assignation of operating room by block using week horizon with different relative weight. A mathematical model is proposed to optimum the operating room scheduling performance.

Classification : 90B35

Format : Online Talk on Zoom

Author(s) : Syarifah Zyurina Nordin (Malaysia Japan International Institute of Technology (MJIIT) , Universiti Teknologi Malaysia)

[02271] Enumerate All Routes on a Doughnut

Session Time & Room : 2C (Aug.22, 13:20-15:00) @G304

Type : Contributed Talk

Abstract : We consider a following doughnut routing problem. Given a matching \$M=(U \cap V,E)\$ as a bipartite graph, two concentric circles, the cyclic ordering of the vertices in \$U\$ and \$V\$, we wish to draw \$M\$ with the minimum number of edge crossings so that the vertices in \$U (\$resp. \$V)\$ are on the smaller \$(\$resp. larger\$)\$ circle with the given cyclic ordering.
We propose an enumerate algorithm for all optimal solutions of the problem.

Classification : 05C38

Format : Talk at Waseda University

Author(s) : Yasuko Matsui (Tokai University) Shin-ichi Nakano (Gunma University)

[02276] Detection Topic of Bjorka Using LSTM with LDA

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E811

Type : Contributed Talk
Abstract : This paper presents topic modeling for Hacker Bjorka using LSTM with LDA. The Research purpose is to analyze the public opinion of Bjorka and the topics related to him in the online community. The findings reveal that the majority of the public perception of Bjorka is positive, with accuracy of 80,26% and perplexity of -8,28. This study provides a valuable contribution to the field of computational text analysis and its applications in the online community.
Classification : 68T07
Author(s) : Muhammad Muhajir (Universitas Gadjah Mada) Dedi Rosadi (Universitas Gadjah Mada)

[02286] Partially Observable Stochastic Control with Memory Limitation and Mean-Field Approach

Session Time & Room : 1E (Aug.21, 17:40-19:20) @F401

Type : Contributed Talk
Abstract : In this presentation, we describe the difficulties with partially observable stochastic control, POSC, and then propose memory-limited POSC, ML-POSC, to solve them. POSC does not consider memory limitation, which hampers the applications to actual controllers. Furthermore, POSC needs to solve a functional differential equation, which is intractable even numerically. In contrast, ML-POSC explicitly formulates limited memories of controllers. Additionally, ML-POSC reduces a functional differential equation to a partial differential equation by the mean-field control technique.
Classification : 49N30, 49N80, 49K45, 93E20
Format : Talk at Waseda University
Author(s) : Takehiro Tottori (The University of Tokyo) Tetsuya J. Kobayashi (The University of Tokyo)

[02289] HIV Community Transmission: A Multi-strain Modelling Approach

Session Time & Room : 1E (Aug.21, 17:40-19:20) @G402

Type : Contributed Talk
Abstract : In this study, we proposed a two-strain model comprising drug-sensitive and drug-resistant strains for the dynamics of Human Immunodeficiency Virus (HIV) spread in a community. A treatment compartment is included in the modelling framework by considering drug

adherence. We introduced various time delays for different phase transitions of the disease to track down the effect of its chronicity. A comprehensive stability and bifurcation analysis reveal the importance of treatment availability and drug adherence.

Classification : 34D05, 34D20, 92D25, 92D30

Format : Online Talk on Zoom

Author(s) : Ashish Poonia (Indian Institute of Technology Guwahati) Siddhartha Pratim Chakrabarty (Indian Institute of Technology Guwahati)

[02290] Bilevel programming problems

Session Time & Room : 4C (Aug.24, 13:20-15:00) @A207

Type : Contributed Talk

Abstract : Most real-world optimization problems have a hierarchical structure. In mathematical optimization, hierarchical optimization problems are often known as multilevel programming problems. A particular case of multilevel problems with just two decision-makers is called a bilevel programming problem. In the formal framework of bilevel programming problems, two decision-makers are involved, a leader and a follower, at two different levels, each striving to minimize their objective functions while constrained by several interconnected constraints.

Classification : 90C46, 49J52, 90C99

Author(s) : Shivani Saini (Thapar Institute of Engineering and Technology, Patiala, Punjab)

[02298] New semidefinite relaxations for a class of complex quadratic programming problems

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A201

Type : Contributed Talk

Abstract : In this talk, we propose some new semidefinite relaxations for a class of nonconvex complex quadratic programming problems, widely appear in signal processing and power system. By deriving new valid constraints to the matrix variables in the lifted space, we derive some enhanced semidefinite relaxations of complex quadratic programming problems. Then, we compare the proposed semidefinite relaxations with existing ones, and show that the newly proposed semidefinite relaxations could be strictly tighter than the previous ones. Numerical results indicate that the proposed semidefinite relaxations not only provide tighter relaxation bounds but also improve some existing approximation algorithms by finding better sub-optimal solutions.

Classification : 90C20, 90C22, 90C35
Format : Talk at Waseda University
Author(s) : Zhibin Deng (University of Chinese Academy of Sciences) Yinzhe Xu (North China Electric Power University) Cheng Lu (North China Electric Power University) Yafeng Liu (Chinese Academy of Sciences)

[02300] Stability of Euler implicit/explicit-SAV schemes for the Navier-Stokes equations

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E703

Type : Contributed Talk
Abstract : In this talk, the H^2 stability of two types of the first order Euler implicit/explicit-SAV schemes for the Navier-Stokes equations with finite element discretization is studied with smooth or non-smooth initial data. In the literature, the first order Euler implicit/explicit scheme for the Navier-Stokes for the initial data u_0 in H^{α} with $\alpha =1,2$ and the Euler semi-implicit/explicit scheme for the initial data u_0 in H^0 have been proven to have H^2- almost unconditional stability. In this talk, with the help of scalar auxiliary variable approach, the H^2 unconditional stability of two types of the first order Euler implicit/explicit-SAV schemes for the Navier-Stokes equations for the initial data u_0 in H^{α} with $\alpha =0, 1,2$ are established, which improve the classical one. Numerical experiments are presented to support the stability results. This is joint work with Teng-Yuan Chang.
Classification : 65Mxx, 86-08, 76Bxx
Format : Talk at Waseda University
Author(s) : Ming-Cheng Shiue (National Yang Ming Chiao Tung University) TENG-YUAN Chang (National Yang Ming Chiao Tung University)

[02301] Weak Maximum Principle for Nonlocal Boundary Value Problems

Session Time & Room : 3E (Aug.23, 17:40-19:20) @F311

Type : Contributed Talk
Abstract : Throughout the last years, increased attention has been devoted to the investigation of nonlocal models in which points separated by a non-vanishing distance interact with each other. In this talk, we present a weak maximum principle for nonlocal boundary value problems and point out a possible application.
Classification : 47G20, Analysis of Nonlocal Models

Format : Talk at Waseda University
Author(s) : Julia Huschens (Trier University)

[02303] Coupling Of Nonlocal Neumann Problems

Session Time & Room : 3E (Aug.23, 17:40-19:20) @F311

Type : Contributed Talk
Abstract : In nonlocal models points separated by a non-vanishing distance interact with each other. Therefore, domains separated by a non-vanishing distance can be coupled in these models. In this talk, we consider the nonlocal diffusion operator $\mathcal{L}u(x):=\int_{\mathbb{R}^{d}}u(x)-u(y)\gamma(y,x))\,\mathrm{d}y$ and the nonlocal Neumann operator $\mathcal{N} u(y):=\int_{\Omega}(u(y)-u(x))\gamma(x,y)\,\mathrm{d}x$. With these operators we introduce a coupled Neumann problem and we, moreover, consider parabolic nonlocal Neumann equations.

Classification : 47G20, Analysis of nonlocal models
Format : Talk at Waseda University
Author(s) : Michael Vu (University Trier)

[02305] Simulating First Passage Times for Ito Diffusions

Session Time & Room : 2D (Aug.22, 15:30-17:10) @E506

Type : Contributed Talk
Abstract : We are interested in the mechanism of olfactory receptor neuron responses in moths. A neuron's processing of information is represented by spike trains, collections of spikes, short and precisely shaped electrical impulses. Mathematically, these can be modeled as the first passage times of solutions to certain stochastic differential equations, describing the membrane voltage, to a threshold. Classical numerical methods like the Euler-Maruyama method and the Milstein scheme approximate hitting times as a by-product and are not very good if we perform them on a large interval of time. For that reason, we study an algorithm that simulates the exact discretized grid of a class of stochastic differential equations. It uses an acceptance-rejection scheme for the simulation of that grid at random time intervals; later, the whole path can be completed independently of the target process by interpolation of the Brownian or Bessel bridge. This method is very effective in the sense that it neither simulates the whole path nor focuses on a fixed time interval. We further examine the different numerical methods with the help of an example.

Classification : 65C30, 60H99, 92-10, First Passage Times, Exact Simulations, Applications in Neuroscience

Format : Talk at Waseda University

Author(s) : Evelyn Buckwar (Johannes Kepler University) Devika Khurana (Johannes Kepler University)

[02311] Lipschitz Stability of Recovering the Conductivity from Internal Current Densities

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G809

Type : Contributed Talk

Abstract : Hybrid imaging techniques have been developed recently to produce clearer images than those produced by electrical impedance tomography. We focus on the inverse problem arising in the quantitative step of many hybrid imaging methods, formulated as recovering the isotropic conductivity of an object given internal current densities generated by applying different boundary conditions to the electrostatic equation. We provide a local Lipschitz stability for the general inverse problem in both full and partial data cases.

Classification : 35R30, 65N21, 92C55

Format : Talk at Waseda University

Author(s) : Lingyun Qiu (Yau Mathematical Sciences Center, Tsinghua University; Yanqi Lake Beijing Institute of Mathematical Sciences and Applications) Siqin Zheng (Yau Mathematical Sciences Center, Tsinghua University)

[02312] Fractional controllability problem of semilinear hyperbolic systems

Session Time & Room : 5D (Aug.25, 15:30-17:10) @F402

Type : Contributed Talk

Abstract : In this communication, we talk about the fractional controllability problem of internally controlled semilinear hyperbolic systems. in the first method, we show the controllability of the linear system using Hilbert uniqueness method HUM, and the fractional controllability problem is solved applying Schauders fixed point theorem. Secondly, the analytics study is then attempted by employing generalized inverse methods and changed also into a fixed point problem. Hence, we give an approximate approach to find a control that brings the Riemann-Liouville fractional attained position (resp. speed) to the required position yd1 (resp. speed yd2). Finally, computing simulations are used to confirm the obtained results.

Classification : 57-XX, 26-XX, 53-XX
Format : Online Talk on Zoom
Author(s) : Mustapha Benoudi (Moulay Ismail University)

[02315] On Adaptive Kalman Filtration

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E504

Type : Contributed Talk
Abstract : We consider a linear partially observed system. The coefficients of this system depend on some finite - dimensional unknown parameter. We study
the problems of the construction of adaptive
Kalman filtration equations. The adaptive filter is constructed
in two steps. First we propose a preliminary estimator using
observations on a relatively small interval of observations. Then this
estimator is used for construction of One-step MLE-process. Finally the last
estimator allows us to construct an adaptive recurrent filter.

Classification : 62M05, 62M20, 62F12, 62G20
Format : Talk at Waseda University
Author(s) : Yury Kutoyants (Le Mans University)

[02316] Spatio-temporal modeling with SPDE based GMRF

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E504

Type : Contributed Talk
Abstract : Gaussian random fields (GRFs) are a type of geostatistical model used in spatial inference problems. In many such contexts data are available at a given spatial scale, whereas predictions are required at another scale that represents a different spatial configuration.
The GRF model of interest and the accompanying Bayesian inferential procedure use the INLA-SPDE approach. In this talk I will describe the GRF model, the inference procedure and discuss challenges in this situation.
Classification : 62M30, 62P12, 60G60, 60H15, 62F15, Infer spatio-temporal precipitation patter in Austria
Format : Talk at Waseda University
Author(s) : Corinna Perchtold (Johannes Kepler University, Linz) Evelyn Buckwar (Johannes Kepler University) Johan Lindstrm (Lund University)

[02319] Parameter estimation of the Richards model in multi-wave epidemic cases

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E504

Type : Industrial Contributed Talk

Abstract : The Richards model with changepoint detection can model multi-wave infectious disease transmission. Next, choose the best parameter estimation method from non-linear least squares and genetic algorithm to accurately predict COVID-19 cases in Indonesia and Japan. Genetic algorithm predictions outperform non-linear least squares. A genetic algorithm only needs a range for the initial value, while non-linear least squares need an exact value. The government and health facilities can use prediction results to prevent infectious disease epidemics.

Classification : 62P10, 92B15, 92B05

Format : Talk at Waseda University

Author(s) : Faihatuz Zuhairoh (Universitas Gadjah Mada) Dedi Rosadi (Universitas Gadjah Mada) Adhitya Ronnie Effendie (Universitas Gadjah Mada)

[02321] Anisotropic perimeter approximation for topology optimization

Session Time & Room : 4E (Aug.24, 17:40-19:20) @F403

Type : Contributed Talk

Abstract : Perimetric type functionals are known to be difficult to handle directly within topology optimization algorithms because of their high sensitivity to topology changes. I will present a Gamma-convergence approximation of an anisotropic variant of the perimeter which is built upon the solution of an elliptic boundary value problem. I will discuss the advantages of such a construction over local approximations, and show applications to the optimal design of supports in additive manufacturing.

Classification : 49Q10, 49Q20, 49Q05

Format : Talk at Waseda University

Author(s) : Samuel Amstutz (Ecole polytechnique) Beniamin Bogosel (Ecole polytechnique)

[02322] Low discrepancy point sets inspired by Sudoku hypercubes

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G601

Type : Contributed Talk
Abstract : Monte Carlo methods are effective to avoid the "Curse of Dimensionality," while not perfect since their convergences are late.
To overcome the weakness, quasi-Monte Carlo methods have been developed.
Some of the methods use low discrepancy point sets called (T, M, S)-nets.
In this talk, I present a new construction procedure of (T, M, S)-nets from orthogonal arrays as an application of the extension of Sudoku to higher dimensions named Sudoku hypercubes.
Classification : 05B15, 65C05
Format : Talk at Waseda University
Author(s) : Shigetaka Taga (University of Tsukuba)

[02325] A Hybrid Method for Solving Linear KKT Systems

Session Time & Room : 4D (Aug.24, 15:30-17:10) @E508

Type : Contributed Talk
Abstract : We propose an iterative method for solving linear systems arising from optimization problems with a separable objective function and dense constraints and suitable preconditioner for quick convergence. The method is implemented in Julia using Krylov.jl for the iterative solution, CUDA.jl to enable GPU capabilities, and a custom kernel for construction of the preconditioner. The method attains faster solution times than direct methods common in solvers such as Mosek and Gurobi in theory and in practice.
Classification : 65F10, 15A29, 90C05, 65K05, 90C25
Format : Talk at Waseda University
Author(s) : Shaked Regev (Gridmatic) Shaked Regev (Gridmatic)

[02326] Multi-level Wavelet Convolutional Neural Networks for Classifying Lung Cancer

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E811

Type : Contributed Talk

Abstract : Lung cancer classification becomes significant as it can increase the survival rate. Our previous study to classify lung cancer using Recurrent Neural Networks (RNN) and Wavelet RNN intensify accuracy by 2.7%. It may increase with the computational complexity. Thus, in this research, we focus classifying lung cancer using deep learning Neural Networks that has been successfully applied in practice. A model called Multi-level Wavelet Convolutional Neural Networks. This study provides more discussion on Neural Networks and lung cancer classification.

Classification : 68T07

Format : Online Talk on Zoom

Author(s) : Devi Nurtiyasari (Gadjah Mada University) Dedi Rosadi (Gadjah Mada University) Abdurakhman Abdurakhman (Gadjah Mada University)

[02329] Improve Error Prediction Using Regularization Model for Movie Recommendation System

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E811

Type : Contributed Talk

Abstract : Currently, most applications (such as Netflix, Spotify, and the others) provide engaging facilities to improve the users experience. These applications highly depend on the effectiveness of their recommendation systems. The goal for this paper was to improve error prediction (RMSE and MAE) using Regularization model compared with state-of-art models. The proposed technique obtains a better result than a state-of-art model with an improvement of 0.48% and 1.43% on error prediction using ML-1M dataset, respectively.

Classification : 68T07, 68T09, Machine Learning

Format : Online Talk on Zoom

Author(s) : Malim Muhammad (Universitas Gadjah Mada) Dedi Rosadi (Universitas Gadjah Mada) Danardono Danardono (Universitas Gadjah Mada)

[02330] Representation Learning for Continuous Single-cell Biology with Graph Neural Networks

Session Time & Room : 4E (Aug.24, 17:40-19:20) @D505

Type : Contributed Talk

Abstract : Single-cell RNA sequencing provides high-resolution transcriptomics to study cellular dynamic processes, yet its high-dimensionality, sparsity, and noises undermine the performance of downstream analysis. We propose a deep learning framework based on Variational Graph AutoEncoder to learn a low-dimensional representation that preserves global information and local continuity. By applying pseudotemporal ordering to the extracted features, we show that the model accurately preserves the dynamic cell trajectories of real and synthetic scRNA-seq datasets.

Classification : 92B20, 68T05, Machine Learning, Bioinformatics

Format : Talk at Waseda University

Author(s) : Chengkai Yang (The University of Tokyo)

[02332] Risk Parity Portfolio in the COVID-19 Era: Indonesia Empirical Evidence

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A510

Type : Contributed Talk

Abstract : A Risk Parity Portfolio allocates capital thus each asset contributes the same amount of risk to the entire portfolio. In this paper, we conduct an empirical study of Risk Parity Portfolio with Gaussian Multivariate Mixture-Based Clustering based on financial ratio data. The daily closing price data of LQ45 index stocks listed on the Indonesia Stock Exchange
were employed. The performance of the Risk Parity Portfolio outperformed the Tangency Portfolio in the COVID-19 era.

Classification : 91G10, 91G80

Format : Online Talk on Zoom

Author(s) : Rosita Kusumawati (Mathematics Department, Mathematics and Natural Sciences Faculty, Universitas Gadjah Mada) Dedi Rosadi (Mathematics Department, Mathematics and Natural Sciences Faculty, Universitas Gadjah Mada) Abdurakhman Abdurakhman (Mathematics Department, Mathematics and Natural Sciences Faculty, Universitas Gadjah Mada)

[02334] A generalized integral equation formulation for pricing American options under regime-switching model

Session Time & Room : 4E (Aug.24, 17:40-19:20) @D505

Type : Contributed Talk

Abstract : In this paper, we present a generalized integral equation formulation for American put options under regime-switching model, with a goal of improving computational efficiency in mind, particularly when the number of regimes, n is large. Given that the integral equation approach is characterized with its excellent trade off between maximizing analytical tractability and minimizing numerical discretization, our achieved high efficiency is based on a newly proved theorem, which facilitates the decoupling of an originally simultaneously involved n-PDEs so that they can be solved recursively at the numerical solution stage. While some numerical examples are provided to demonstrate the implementation of the new approach and its efficiency, it is anticipated that the very same theorem can be used to reduce the computational burden if other numerical approaches are adopted.

Classification : 91G20, 91-10

Format : Talk at Waseda University

Author(s) : Yawen Zheng (University of Wollongong) Song-Ping Zhu (University of Wollongong)

[02336] Within-Groups Generalized M-Estimators in One-Way Unbalanced Panel Data Model

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E504

Type : Industrial Contributed Talk

Abstract : Within-Groups Generalized M-Estimators (WGM) is a method for determining robust estimators of outliers for panel data models. This study will conduct a simulation to compare WGM in one-way unbalanced panel data model with fixed-effects approach using different multivariate locations and scale estimators, namely S-multivariate, Minimum Volume Ellipsoid (MVE), and Minimum Covariance Determinant (MCD). Then apply it to economic growth data in Kalimantan. Based on the simulation results and applications, it is known that the WGM with the S-multivariate estimator gives a better MSE value.

Classification : 62J99

Format : Talk at Waseda University

Author(s) : Desi Yuniarti (Department of Mathematics, Faculty of Mathematics and Natural Science, Universitas Gadjah Mada, Yogyakarta) Dedi Rosadi (Department of Mathematics, Faculty of Mathematics and Natural Science, Universitas Gadjah Mada, Yogyakarta) Abdurakhman Abdurakhman (Department of Mathematics, Faculty of Mathematics and Natural Science, Universitas Gadjah Mada, Yogyakarta)

[02337] Numerical analysis for the cancer invasion system with nonlocal diffusion

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E604

Type : Contributed Talk

Abstract : Cancer modelling is challenging in grounds of capturing the physics behind it and performing numerical simulations. In this work, we analyze the cancer invasion model with nonlocal diffusion. First, the Galerkin finite element scheme is implemented to the given system of equations for spatial discretization. Then, backward Euler scheme is applied for temporal discretization. Further, a priori error bounds and convergence estimates for the fully-discrete problem are derived. Numerical tests provided validate the theoretical studies.

Classification : 65M15, 65M60, 92B05

Format : Talk at Waseda University

Author(s) : Kausika Chellamuthu (Bharathiar University, Coimbatore 641046, Tamil Nadu.)
Manimaran Jeyaraj (Vellore Institute of Technology)Manimaran Jeyaraj (Vellore Institute of Technology, Chennai Campus, Chennai - 600127.)

[02343] Construction and analysis of splitting methods for Chemical Langevin Equations

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E502

Type : Contributed Talk

Abstract : Consider modeling the stochastic dynamics underlying different chemical systems, which is usually described by the
Gillespie Stochastic Simulation Algorithm (SSA), i.e. the Markov process arising from taking into account every
single chemical reaction event. While exact and easy to implement, this algorithm is computationally expensive for
chemical reactions involving a large number of molecular species. As an approximation, Chemical Langevin Equations

(CLEs) can work for large number of species or/and reactions. In this talk, we construct an explicit splitting method
applied to the system of CLEs for a simple example of a reversible bimolecular reaction. The drift term of this
stochastic differential equation system satisfies a local one-sided Lipschitz condition and the diffusion term involves
square root terms. We then present the main ideas of a mean-square convergence proof, as well as numerical
illustrations. The results are joint work with Youssra Souli, Johannes Kepler University, Linz.

Classification : 60H10, 65C30, 60H35

Format : Talk at Waseda University

Author(s) : Evelyn Buckwar (Johannes Kepler University) Youssra Souli (Johannes Kepler University)

[02345] Performance of the Treynor Ratio in Compilation of Fuzzy Portfolios

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A510

Type : Industrial Contributed Talk

Abstract : In investing, investors have several characteristics, namely risk averse, risk seeker, and risk indifferent. Differences in these characteristics lead to the preparation of an optimal portfolio in decision-making. This study analyzes the application of the Treynor ratio as an instrument to measure portfolio performance. Portfolio preparation uses a fuzzy approach. The process of optimizing the model by applying multiobjective. The results of this study are the portfolio Treynor index ratio formed against the characteristics for the three characteristics of investors. This is used for investor recommendations in determining investment decisions.

Classification : 91G10, 91G80

Format : Online Talk on Zoom

Author(s) : Padrul Jana (Universitas Gadjah Mada) Dedi Rosadi (Universitas Gadjah Mada) Epha Diana Supandi (Universitas Islam Negeri Sunan Kalijaga)

[02347] Reduction of High Wave Load on a Sea Wall by an Elastic Plate and a Porous Structure

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E820

Type : Contributed Talk
Abstract : The present study investigates the wave impact on a sea wall in the presence of an elastic plate and a finite-width porous structure within the linearized water wave theory framework. By employing eigenfunction expansion, a system of an algebraic equation is obtained and solved. The force, reflection and dissipation coefficients are plotted through graphs to investigate the effect of different system parameters.
Classification : 76B15
Format : Talk at Waseda University
Author(s) : GAGAN SAHOO (IIT ROPAR) SUBASH CHANDRA MARTHA (IIT Ropar) SOFIA SINGLA (IIIT UNA, UNA)

[02348] Multi-day Value-at-Risk estimation by GARCH and Extreme Value Theory

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E505

Type : Contributed Talk
Abstract : The conventional VaR models have been unable to predict huge losses by market prices because these underestimate the probability of extreme price fluctuations. To overcome this problem, McNeil and Frey introduced a two-step approach combining the GARCH model and EVT. In this study, we investigate the estimation of multi-day VaR based on a bootstrapping simulation approach with GARCH-EVT, as well as perform back-testing in order to evaluate its ability to provide appropriate multi-day VaR estimation.
Classification : 62P05
Format : Talk at Waseda University
Author(s) : Ichiro Nishi (Tokio Marine Holdings, Inc.)

[02351] THE WELL-POSEDNESS AND DISCONTINUOUS GALERKIN APPROXIMATION FOR THE NON-NEWTONIAN STOKESDARCYFORCHHEIMER COUPLING SYSTEM

Session Time & Room : 5B (Aug.25, 10:40-12:20) @D101

Type : Contributed Talk

Abstract : We establish the well-posedness theorem and study discontinuous Galerkin $($DG$)$ approximation for the non-Newtonian Stokes--Darcy--Forchheimer system modeling the free fluid coupled with the porous medium flow with shear/velocity-dependent viscosities. The unique existence is proved by using the theory of nonlinear monotone operator. In particular, we prove a coupled inf-sup condition to show the existence of pressure in $L^2(\Omega_1) \times L^\frac{3}{2}(\Omega_2)$. We also explore the convergence of the Picard iteration for the continuous problem. Moreover, we apply the DG method with $\mathbb{P}_k/\mathbb{P}_{k-1}$ element for numerical discretization and obtain the well-posedness, stability, and error estimate. For the discrete problem, we also investigate the convergence of the Picard iteration. The theoretical results are confirmed by the numerical examples.

Classification : 76Axx, 76Sxx, 76Dxx, 65Nxx

Format : Talk at Waseda University

Author(s) : Jingyan Hu (University of Electronic Science and Technology of China) Guanyu Zhou (University of Electronic Science and Technology of China)

[02352] Analysis of a model of Dengue fever transmission

Session Time & Room : 1E (Aug.21, 17:40-19:20) @G402

Type : Contributed Talk

Abstract : In our study, we consider a model formulation of a dengue fever transmission including delay terms. The next-generation matrix techniques have been used for deriving the basic reproduction number for the spread of infectious disease. Nondimensionalisation has been carried out and equilibrium points have been obtained. Then stability analysis of the delay model has been investigated. Numerical simulations have been shown for the specific parameters and the effect of the time delays has been observed.

Classification : 34D20, 37G15, 92D25, 92-10, 34K20

Format : Talk at Waseda University

Author(s) : Burcu Grbz (Johannes Gutenberg-University Mainz) Aytl Gke (Ordu University) Segun Isaac Oke (Ohio University, USA) Michael O. Adeniyi (Lagos State University of Science and Technology) Mayowa M. Ojo (Thermo Fisher Scientific)

[02353] Finite volume coupled with finite element scheme for the chemotaxis-fluid model

Session Time & Room : 4D (Aug.24, 15:30-17:10) @D401

Type : Contributed Talk

Abstract : We propose a linear decoupled positivity-preserving scheme for the chemotaxis-fluid system modeling the mutual interaction of the swimming aerobic bacteria with the surrounding fluid flow. The scheme consists of the finite element method (FEM) for the fluid equations on a regular triangulation and an upwind finite volume method (FVM) for the chemotaxis system on two types of dual mesh. The discrete cellular density and chemical concentration can be regarded as the piecewise constant functions on the dual mesh $($or equivalently, the piecewise linear functions on the triangulation in the mass-lumping sense$)$, which are obtained by the upwind finite volume approximation satisfying the positivity-preserving and mass conservation laws.

The numerical velocity is computed by the finite element method in the triangulation and is utilized to define the upwind-type numerical flux in the dual mesh. We examine the M-property of the matrices from the discrete system and prove the well-posedness and the positivity-preserving property. By using the L^p-estimate of the discrete Laplace operators, semigroup analysis, and induction method, we establish the optimal error estimates for chemical concentration, cellular density and velocity field in $(l^\infty(W^{1,p}), l^\infty(L^p),l^\infty(W^{1,p}))$-norms. Several numerical examples are presented to confirm the theoretical results.

Classification : 76Dxx, 65Mxx, 76Mxx

Format : Talk at Waseda University

Author(s) : Ping Zeng (University of Electronic Science and Technology of China) Guanyu Zhou (University of Electronic Science and Technology of China)

[02356] Reconstruction of Multipolar Acoustic Sources using Sparse Measurements

Session Time & Room : 1D (Aug.21, 15:30-17:10) @A208

Type : Contributed Talk

Abstract : In this talk, we will discuss an algorithm for reconstructing multipolar acoustic sources using sparse far-field multifrequency measurements of the scattered field. A hybrid Fourier algorithm exploiting the low rank of the structured Hankel matrix associated with the scattered

field is designed. The sparse data is first linked to the Fourier coefficients of the source, then enriched using an annihilation-filter-based Hankel matrix completion approach (ALOHA), and finally inverted for sources using the inverse Fourier transform.

Classification : 45Qxx, 65Txx, Machine Learning

Format : Talk at Waseda University

Author(s) : Abdul Wahab (Nazarbayev University) Abdul Wahab (Nazarbayev University)

[02358] Minimal time for boundary controllability of linear hyperbolic balance laws

Session Time & Room : 5C (Aug.25, 13:20-15:00) @A207

Type : Contributed Talk

Abstract : The purpose of this talk is to present our recent results on minimal control time for null and exact boundary controllability of 1-D linear hyperbolic balance laws with arbitrary internal and boundary coupling. We will show explicit and easy-to-compute formulas to completely characterize such critical quantities, which can be strictly smaller than the classical uniform lower bound. The difference between these two kinds of controllability will also be discussed.

Classification : 93B05, 35L04, Control of Partial Differential Equations; Boundary Controllability; Hyperbolic system involving balance laws (with source term (i.e. internal coupling)) and Conservation laws (without source term); Optimal control time

Format : Talk at Waseda University

Author(s) : Long Hu (Shandong University) Guillaume Olive (Jagiellonian University)

[02359] A Weighted Max-Min Model for Stochastic Fuzzy Multi-Objective Supplier Selection in a Supply Chain

Session Time & Room : 2C (Aug.22, 13:20-15:00) @G301

Type : Contributed Talk

Abstract : This research is focused on the study of Nonsymmetrical Stochastic Fuzzy Multi-Objective Supplier Selection Linear Programming (SFMOSSLP) with objective and constraint functions containing fuzzy parameters and random variables. This study aimed to develop an algorithm to transform the SFMOSSLP into a Deterministic Single-Objective Linear

Programming (DSOLP) using the weighted max-min method so it can be easy to solve using the simplex method. In the end, we showcase the algorithm's performance and discuss its
practicality.

Classification : 03B52, 03E72, 90C05, 90C15, 60G07

Author(s) : Grandianus Seda Mada (Universitas Gadjah Mada) Nugraha K. F. Dethan (Universitas Timor) Julius Aloysius Nenoharan (Universitas Timor)

[02361] A unified framework for convergence analysis of stochastic gradient algorithms with momentum: a linear two-step approach

Session Time & Room : 2D (Aug.22, 15:30-17:10) @E506

Type : Contributed Talk

Abstract : From the viewpoint of weak approximation, the stochastic gradient algorithm and stochastic differential equation are closely related. In this talk, we develop a systematic framework for the convergence of stochastic gradient descent with momentum by exploring the stationary distribution of a linear two-step method applied to stochastic differential equations. Then we prove the convergence of two stochastic linear two-step methods, which are associated with the stochastic heavy ball method and Nesterov's accelerated gradient method.

Classification : 65C30, 60H35

Format : Talk at Waseda University

Author(s) : Qian Guo (Shanghai Normal University) Fangfang Ma (Shanghai Normal University)

[02365] Fuzzy C-Medoids Clustering on the Foreign Currency Exchange Rate Against the Indonesian Rupiah

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E504

Type : Industrial Contributed Talk

Abstract : The exchange rate is always fluctuating, indicates the presence of heteroscedasticity. Forecasting currency exchange rate movements is necessary in order to make a correct decision. In this study, clustering was carried out using a fuzzy c-medoids algorithm with distances based on the estimated parameters of the GARCH model. The case study used is data on foreign exchange rates against the Indonesian Rupiah (IDR) for the monthly

period of January 2018October 2022.
Classification : 62M10
Format : Online Talk on Zoom
Author(s) : Vemmie Nastiti Lestari (Universitas Gadjah Mada) Abdurakhman Abdurakhman (Universitas Gadjah Mada) Dedi Rosadi (Universitas Gadjah Mada)

[02367] Applying the 2 Steps SLP method to the UC-ACOPF problem

Session Time & Room : 4E (Aug.24, 17:40-19:20) @D408

Type : Contributed Talk
Abstract : The Unit Commitment (UC) problem is a widely used tool for the daily management of power transmission networks in modern economies. While the classical UC is a mixed-integer linear problem, when the AC Power Flow (ACPF) equations are included as constraints it becomes a mixed-integer nonlinear problem (MINLP). The 2-Step SLP method has been successfully applied to solving MINLP problems for gas networks, and here we will analyze its performance for power networks.
Classification : 90Cxx
Format : Talk at Waseda University
Author(s) : Dolores Gmez (Universidade de Santiago de Compostela) Alfredo Ros-Albores (Universidade de Santiago de Compostela) Pilar Salgado (Universidade de Santiago de Compostela)

[02369] Unique continuation results for generalized ray transforms

Session Time & Room : 3C (Aug.23, 13:20-15:00) @F311

Type : Contributed Talk
Abstract : We discuss unique continuation results for certain generalized ray transforms. We prove that if the generalized ray transform of a function vanishes along all lines passing through an open set in Euclidean space, and the function vanishes in that same open set, then the function vanishes identically. We give an example to show that the second assumption cannot be removed. We also consider generalized transforms on higher order objects such as vector fields, symmetric 2-tensor fields etc., and under the same hypotheses, show that a certain component vanishes. Since such ray transforms have a non-trivial kernel, this is the optimal result that one can expect.
Classification : 46F12, 35J40, 45Q05

Format : Talk at Waseda University

Author(s) : Divyansh Agrawal (TIFR Centre for Applicable Mathematics (CAM)) Venkateswaran P. Krishnan (TIFR Centre for Applicable Mathematics (CAM)) Suman Kumar Sahoo (University of Jyvaskyla)

[02372] Stokes flow past circular cylinders in slip-patterned microchannel using BEM

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D101

Type : Contributed Talk

Abstract : We present Stokes flow past staggered circular cylinders in microchannel with an alternating slip and no-slip on the channel walls. We utilize Boundary Element Method (BEM) to numerically solve Stokes equation. In order to gain a deep insight of flow mechanics, we investigate the streamlines, velocity profiles, and pressure drops with varying slip-length, radius of the cylinder, and spacing between the cylinder. The findings of this study might be helpful for mixing enhancement in microchannel.

Classification : 76M15, 35Q30, 76B15, 65N38, 76M10

Author(s) : Chandra Shekhar Nishad (Pandit Deendayal Energy University Gandhinagar)

[02374] Embarrassingly-parallel optimization algorithms for high-dimensional optimal control

Session Time & Room : 2E (Aug.22, 17:40-19:20) @F401

Type : Contributed Talk

Abstract : Developing efficient algorithms for Hamilton--Jacobi partial differential equations (HJ PDEs) is crucial for solving high-dimensional optimal control problems in real time but notoriously tricky due to the so-called curse of dimensionality. In this talk, we present novel grid-free and embarrassingly-parallel optimization algorithms for solving a broad class of HJ PDEs relevant to high-dimensional state-dependent optimal control problems. We illustrate their performance and efficiency on large-scale multi-agent path planning problems.

Classification : 49L12, 65K10, 90C30, 49M29, 49M37

Format : Talk at Waseda University

Author(s) : Gabriel Provencher Langlois (New York University) Jerome Darbon (Brown University)

[02377] Accurate approximation of layer potentials evaluated near surfaces of spherical topology

Session Time & Room : 4C (Aug.24, 13:20-15:00) @E704

Type : Contributed Talk

Abstract : Layer potentials, integrals representing the solution of a PDE when solved using boundary integral methods, are notoriously difficult to accurately evaluate close to the boundary of the domain due to a rapidly varying integrand. The presented quadrature method resolves this key challenge by factoring the integrand into a smooth and a simpler nearly singular part, then efficiently expanding the smooth part in a new basis and treating the remaining nearly singular integrals analytically.

Classification : 65D32, 65D30, 65R20, 65N99

Format : Talk at Waseda University

Author(s) : David Krantz (KTH Royal Institute of Technology) Anna-Karin Tornberg (KTH Royal Institute of Technology)

[02378] Hough transform generalization for detecting fuzzy lines and fuzzy circles

Session Time & Room : 1C (Aug.21, 13:20-15:00) @

Type : Contributed Talk

Abstract : In this paper, we investigate a technique, namely fuzzy Hough transform, to detect fuzzy geometrical entities like fuzzy lines and fuzzy circles. This technique identifies fuzzy lines and fuzzy circles by a voting procedure. This voting procedure is carried out in parameter space in the fuzzy set-theoretic framework. Sequentially, a concept of similarity measure between two fuzzy shapes is delineated. Moreover, we apply the proposed technique in a few authentic images to detect fuzzy lines and fuzzy circles. Also, the idea of similarity measure between two fuzzy shapes is implemented in two sample images of fuzzy shapes.

Classification : 03E72, 97G40

Author(s) : Diksha Gupta (Ajeenkya D Y Patil Unversity, Pune)

[02379] Quasigroups with inverse properties and information protection

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G305

Type : Contributed Talk

Abstract : In connection with the computerization of almost all spheres of life, the need for information protection, and therefore for the development of new encryption methods, has grown rapidly. To quickly decipher the information, it is appropriate to use invertible functions having the property of some invertibility of elements, i.e. quasigroups with inverse properties. We investigate varieties of these quasigroups and propose methods for their constructions and applications.

Classification : 20N05, 08B15, 14L30

Format : Online Talk on Zoom

Author(s) : Alla Lutsenko (Vasyl` Stus Donetsk National University)

[02380] PDE methods for joint reconstruction-segmentation of images

Session Time & Room : 4E (Aug.24, 17:40-19:20) @A502

Type : Contributed Talk

Abstract : In practical image segmentation tasks, the image must first be reconstructed from indirect/damaged/noisy observations. Traditionally, reconstruction-segmentation would be performed in sequence: first reconstruct, then segment. Joint reconstruction-segmentation performs reconstruction and segmentation simultaneously, using each to guide the other.

Past joint reconstruction-segmentation has employed relatively simple segmentation algorithms, e.g. ChanVese. This talk will describe how joint reconstruction-segmentation can be performed using Bhattacharyya-flow-based segmentation (Michailovich et al., 2007) and graph-PDE-based segmentation (Merkurjev et al., 2013).

Classification : 94A08, 35Q93, 35R02

Format : Talk at Waseda University

Author(s) : Jeremy Michael Budd (California Institute of Technology) Franca Hoffmann (California Institute of Technology) Allen Tannenbaum (Stony Brook University) Yves van Gennip (Technische Universiteit Delft) Carola-Bibiane Schnlieb (University of Cambridge) Jonas Latz (Heriot-Watt University)

[02381] Dynamic parking pricing for smart urban transportation system

Session Time & Room : 3E (Aug.23, 17:40-19:20) @D502

Type : Contributed Talk

Abstract : Traffic jam is one of the critical challenges of an urban city. Researchers have reported that search for a parking space significantly contributes to this problem. By having a dynamic pricing depending on the demand, this challenge can partially be addressed by filtering customers to move to other non-demanding parking spaces or look for cost reasonable options. Furthermore, parking places will compete to maximize their profit. Hence, a game theoretic or hierarchical decision making model can best describe the scenario. Bounded by the allowed maximum parking pricing, perhaps set by the city administration, and the minimum price to stay in business, this paper models a dynamic parking pricing as a price-wise continuous multilevel decision making problem.

Classification : 90-XX, 90B06, 00A69

Author(s) : Surafel L Tilahun (Addis Ababa Science and Technology University)

[02384] An Energy Stable Semi-implicit Scheme for the Euler System under Diffusive Scaling

Session Time & Room : 3D (Aug.23, 15:30-17:10) @G601

Type : Contributed Talk

Abstract : An asymptotic preserving (AP) and energy stable scheme for the barotropic Euler system under a diffusive scaling is designed and analysed. A semi-implicit upwind finite volume on a staggered grid which dissipates the mechanical energy is introduced. The proposed scheme preserves the positivity of density and is consistent with weak solutions. The results of extensive case studies are presented to substantiate the robustness and efficacy of the proposed scheme as well as the theoretical claims.

Classification : 35L45, 35L65, 35L67, 35L60

Format : Talk at Waseda University

Author(s) : Arun Koottungal Revi (Indian Institute of Science Education and Research Thiruvananthapuram) Mainak Kar (Indian Institute of Science Education and Research Thiruvananthapuram)

[02389] Exploring the excess of cloud condensation nuclei and rain suppression using a minimal 3D Boussinesq model with bulk cloud microphysics

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D408

Type : Contributed Talk

Abstract : For many decades the hypothesis that an increase in air pollution could affect the rain formation processes has been discussed with theoretical, experimental, and numerical arguments. Several studies have shown that higher pollutant concentrations can inhibit, decrease or increase precipitation. Differences between results arise partly from the complexity of the problem, which requires the consideration of processes at multiple scales. This study aims to provide a very simple numerical model that satisfactorily represents the atmospheric dynamics and cloud microphysics to explore the effect of pollution on rain formation. We adapted and extended a previously existing three-dimensional minimal model consisting of five equations describing the atmospheric dynamics and implemented a simple bulk parametrization that represents the role of cloud condensation nuclei (CCN) 's role in cloud formation processes. To explore the effect of different CCN concentrations and distributions, we used two CCN profiles, one with a single accumulation layer and one with two layers, modifying their concentrations. Our results showed that polluted scenarios resulted in rain inhibition when a single CCN layer was initially present and rain increment when two layers were present. In low-polluted environments, both CCN initial profiles generated similar precipitation and showed similar dynamic patterns. In this talk, we will highlight the importance of the vertical distribution of CCN, not only concentration, on the formation of rain, its inhibition, or suppression. This is joint work with Olmo Guerrero Medina.

Classification : 86A08, 35Q86

Format : Talk at Waseda University

Author(s) : Gerardo Hernandez-Duenas (National Autonomous University of Mexico, Institute of Mathematicas) Olmo Guerrero-Medina (University of California Davis)

[02390] Discontinuous Galerkin method for time-fractional delay differential equation

Session Time & Room : 3D (Aug.23, 15:30-17:10) @G402

Type : Contributed Talk

Abstract : In this article, we analyze the discontinuous Galerkin method for time-fractional partial differential equation with delay term $u(\theta(t))$, where $\theta(t)=t-\tau(t)< t$. The well-posedness of the fully discrete scheme for a fractional delay system is investigated. Also, we show the optimal order of convergence in the energy norm. Some numerical results are provided to support theoretical results.

Classification : 26A33, 35D30, 65M60, 34K37

Format : Talk at Waseda University

Author(s) : Raksha Devi (Department of Mathematics, Indian Institute of Technology, Roorkee) Dwijendra N. Pandey (Department of Mathematics, Indian Institute of Technology, Roorkee)

[02391] Null controllability of semilinear differential inclusion with nonlocal condition

Session Time & Room : 3C (Aug.23, 13:20-15:00) @G402

Type : Contributed Talk

Abstract : We discuss the null controllability of semilinear differential inclusion with the nonlocal condition using $L^p(

[0, a], U)$ control, where U may be a separable Hilbert space or uniformly convex Banach space. Undoubtedly, exact controllability is much more beneficial than null controllability. But, null controllability plays its role in a system where exact controllability does not hold. Differential inclusion can properly define partial differential equations involving jump discontinuous functions.

Classification : 34G10
Format : Talk at Waseda University
Author(s) : BHOLANATH KUMBHAKAR (DEPARTMENT OF MATHEMATICS, INDIAN INSTITUTE OF TECHNOLOGY ROORKEE) DWIJENDRA NARAIN PANDEY (DEPARTMENT OF MATHEMATICS, INDIAN INSTITUTE OF TECHNOLOGY ROORKEE)

[02393] Effect of adding reactions on the chemical reaction network sensitivity

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G802

Type : Contributed Talk
Abstract : Biological functions arise from the complex dynamics of reaction networks comprising numerous reactions and chemicals. However, network information is often inaccurate and diverse across species. Previously, we developed the "Structural Sensitivity Analysis", which enables the responses of reaction systems to parameter perturbations to be determined solely from network topology. In this study, we investigate how small alterations to network structure affect system behavior. The results can be classified into five distinct cases based on topology.
Classification : 37N25
Author(s) : Atsuki Hishida Atsuki Hishida (Kyoto University) Atsushi Mochizuki (Kyoto University)

[02394] Gaussian distributions on Riemannian symmetric spaces of non-positive curvature

Session Time & Room : 5D (Aug.25, 15:30-17:10) @F402

Type : Contributed Talk

Abstract : Learning from data that live in Riemannian manifolds has become central to many applications, ranging from radar signal processing to neuroscience. In this talk, we present a generalisation of Gaussian distributions to Riemannian symmetric spaces of non-positive curvature, which include hyperbolic spaces, as well as spaces of real, complex and quaternion positive definite matrices, and spaces of structured Toeplitz or block-Toeplitz positive definite matrices and discuss applications to geometric statistics on such spaces.

Classification : 53C22, 53B20, 53B50, 53C80, 53C35, Geometric statistics, probability on manifolds

Format : Talk at Waseda University

Author(s) : Cyrus Mostajeran (Nanyang Technological University) Salem Said (Universit Grenoble-Alpes)

[02398] Mixed-precision Paterson--Stockmeyer method for evaluating matrix polynomials

Session Time & Room : 2D (Aug.22, 15:30-17:10) @E503

Type : Contributed Talk

Abstract : The Paterson--Stockmeyer method is an evaluation scheme for matrix polynomials with scalar coefficients that arise in many state-of-the-art algorithms based on polynomial or rational approximants, for example, those for computing transcendental matrix functions. We derive a mixed-precision version of the Paterson--Stockmeyer method that can be faster and use less memory than its fixed-precision counterpart while delivering the same level of accuracy.

Classification : 65G50, 65F45, 65F60

Format : Talk at Waseda University

Author(s) : Nicholas J. Higham (The University of Manchester) Xiaobo Liu (The University of Manchester)

[02400] A generalized structural bifurcation analysis of chemical reaction networks

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G401

Type : Contributed Talk

Abstract : Chemical reactions link metabolites and form complex networks in living cells. We have previously developed structural bifurcation analysis, by which bifurcation properties of reaction systems are determined solely from network topologies. In this work, we establish a precise formalization connecting our analysis to conventional methods based on Jacobian matrices. The formalization increases applicability of the analysis, e.g. determining multistationarity, without assuming the full-rankedness of stoichiometric matrices or eliminations of equations/chemicals.

Classification : 34Hxx, 92Bxx, 34D10

Format : Talk at Waseda University

Author(s) : Yong-Jin Huang (Division of Biological Sciences, Graduate School of Science, Kyoto University) Takashi Okada (Division of Biological Sciences, Graduate School of Science, Kyoto University) Atsushi Mochizuki (Institute for Life and Medical Sciences, Kyoto University)

[02401] A low-degree normalized B-spline-like representation for Hermite osculatory interpolation problems

Session Time & Room : 1C (Aug.21, 13:20-15:00) @F310

Type : Contributed Talk

Abstract : This talk deals with Hermite's osculatory interpolating splines. For a partition of a real interval
endowed with a refinement consisting in dividing each subinterval into two small subintervals, we
consider a space of smooth splines with super-smoothness at the vertices of the initial partition, and
of the lowest possible degree. A normalized B-spline-like representation for the considered spline
space is provided. In addition, several quasi-interpolation operators based on blossoming and
control polynomials have also been developed. Some numerical tests are presented and compared
with some recent works to illustrate the performance of the proposed approach.

Classification : 41A15
Author(s) : Mohamed BOUSHABI (Abdelmalek Essaadi University, LaSAD, ENS, 93030 Tetouan, Morocco) Salah Eddargani (University of Rome Tor Vergata Rome) Mara Jos Ibez (University of Granada) Abdellah Lamnii (Abdelmalek Essaadi University, LaSAD, ENS, 93030 Tetouan, Morocco)

[02405] STABILITY OF NON-ISOTHERMAL POISEUILLE FLOW IN FLUID OVERLYING POROUS DOMAIN

Session Time & Room : 5C (Aug.25, 13:20-15:00) @D101

Type : Contributed Talk
Abstract : The linear stability analysis of thermal convection of Poiseuille flow in an anisotropic and inhomogeneous porous domain underlying fluid domain is investigated. The impact of depth ratio, anisotropy, inhomogeneity, Darcy number, Reynolds number and Prandtl number is inspected. An increase((decrease)) in anisotropy((inhomogeneity)) parameter follows unimodal((porous)) to bimodal((fluid and porous)) characteristic of neutral curves. Energy budget analysis is carried out to classify type of instability. Secondary flow patterns are analysed to validate the least stable mode.
Classification : 76E17, 76E06, 76T99, 80A19, 76S05
Format : Talk at Waseda University
Author(s) : Anjali Anjali (Department of Mathematics, Indian Institute of Technology Roorkee) Premananda Bera (Department of Mathematics, Indian Institute of Technology Roorkee) Arshan Khan (Department of Mathematics, Indian Institute of Technology Roorkee)

[02407] Scattering of water waves by two horizontal porous plates over a pair of trenches

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E820

Type : Contributed Talk
Abstract : The scattering of water waves by two non-uniform horizontal porous plates in the presence of a pair of trenches is modeled using Darcys law for flow past a porous plate. The eigenfunction expansions in conjunction with the matching conditions gives rise to an overdetermined system of linear equations, which is solved to obtain the numerical values of physical quantities such as reflection, transmission, dissipation coefficients and force. Different graphs are plotted to visualize the effect of different system parameters. This study highlights two horizontal porous plates over uneven

bottom topography will play a vital role in constructing an effective breakwater reducing high wave impact.

Classification : 76B15
Format : Talk at Waseda University
Author(s) : Sunita Choudhary (Indian Institute Technology, Ropar) S. C. Martha (Indian Institute Technology, Ropar)

[02409] Effect of Permeability on Couette Flow in Fluid-Porous System

Session Time & Room : 5C (Aug.25, 13:20-15:00) @D101

Type : Contributed Talk
Abstract : A horizontal fluid layer overlying a porous layer is considered in which the plane Couette flow is induced due to uniform movement of upper plate and convection arises due to maintenance of temperature difference between the upper and lower plate. Fluid considered is Newtonian and incompressible which satisfies Boussinesq approximation. The porous layer is modelled by Darcy's law. The classical linear stability analysis is implemented to study the impact of media permeability for heavy oils.
Classification : 76E06, 76E17, 76T99, 76F10, 76S05
Format : Talk at Waseda University
Author(s) : Nandita Barman (Department of Mathematics) Premananda Bera (Department of Mathematics)

[02412] Randomized algorithms of AND-OR tree calculation regarding query complexity

Session Time & Room : 4C (Aug.24, 13:20-15:00) @G301

Type : Contributed Talk
Abstract : We discuss the randomized algorithm of AND-OR tree calculation. It is known that for any nontrivial balanced AND-OR tree, there is a unique randomized input (eigen-distribution) which achieves the distributional complexity. In contrast, the dual problem has the opposite result; the optimal randomized algorithm is not unique. We extend the study on randomized algorithms to unbalanced cases and see that uniqueness still fails in most of the cases.
Classification : 03D15, 68Q17, 68W20
Format : Talk at Waseda University
Author(s) : Fuki Ito (Tokyo Metropolitan University) Fuki Ito (Tokyo Metropolitan University)

[02414] Quadratic Lie algebras algorithms applied over oscillator algebras

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G305

Type : Contributed Talk

Abstract : Quadratic Lie algebras appear in Mathematics and Physics. Main examples are oscillator and generalized oscillator which are related to space-time models and determine some Lie groups with Lorentz metrics or Lorentzian cones. This variety of algebras with bilinear invariant forms can be built using double extensions from a metric vector space via derivations. In this talk we will see an overview of how all these concepts can be algorithmically obtained. Available in our Github repository.

Classification : 17B05, 15A63, 17B40, 17B81

Format : Talk at Waseda University

Author(s) : Jorge Roldn-Lpez (Universidad de La Rioja) Pilar Benito (Universidad de La Rioja)

[02415] Propagation of epistemic uncertainty though a multi-layerd geometrically exact beam

Session Time & Room : 4E (Aug.24, 17:40-19:20) @D408

Type : Contributed Talk

Abstract : Uncertainty is ever-present in engineering. In this work, we demonstrate the effect of parameter uncertainty on a carbon spring prosthetic foot. The prosthesis is built with multiple layers of carbon fibre laminate. This layered structure is accounted for via homogenisation of the material parameters in the geometrically exact beam model of the prosthesis. Homogenising the material parameters introduces additional uncertainty. The resulting uncertain deformation envelopes and stored energy envelopes are examined.

Classification : 90C70, 70E55, 74-XX

Format : Talk at Waseda University

Author(s) : Eduard Sebastian Scheiterer (Institute of Applied Dynamics - Friedrich-Alexander Universitt Erlangen-Nrnberg) Sigrid Leyendecker (Institute of Applied Dynamics - Friedrich-Alexander Universitt Erlangen-Nrnberg)

[02417] State equation for oscillator chains

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E504

Type : Contributed Talk

Abstract : We present a linear state equation between kinetic temperature and mass density that has been widely verified in boundary-driven one-dimensional nonequilibrium systems. We show that this relation holds even more universally and in particular when standard relations between purely mechanical and thermodynamic quantities do not apply. We investigate special situations in which phase transitions occur and the relation fails, as common in statistical mechanics. We also provide a theoretical explanation of how this happens.

Classification : 82C05, 70-10

Format : Talk at Waseda University

Author(s) : Vincenzo Di Florio (Politecnico di Torino) Lamberto Rondoni (Politecnico di Torino) Claudio Giberti (University of Modena and Reggio Emilia) Hong Zhao (Xiamen University)

[02418] A two-stage method for an industrial NP-hard bin packing problem

Session Time & Room : 3E (Aug.23, 17:40-19:20) @D505

Type : Industrial Contributed Talk

Abstract : Our industrial problem consists of building batch annealings from a sample of steel coils. We have to consider all the rules/constraints related to the characteristics of coils and constraints related to technology. The objective is to ensure the annealing of coils at the minimum cost.

This problem is a simultaneous NP-hard bin packing type. A two-stage method is developed in this paper to address this problem: stage one refers to a smart enumeration of all possible and feasible bins. Then, the second stage will consist of finding the optimal solution for an ILP.

Classification : 90B30, 90C10

Format : Talk at Waseda University

Author(s) : Abdelghani Bouras (Industrial Engineering Department, College of Engineering, Al lFaisalUniversity)

[02420] Nonparametric Bivariate Density Estimation for Missing Censored Lifetimes

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E504

Type : Contributed Talk

Abstract : Estimation of the joint density of two censored lifetimes is a classical problem in survival analysis, but only recently the theory and methodology of efficient nonparametric estimation have been developed. A familiar complication in survival analysis is that in real data censored lifetimes and indicators of censoring may be missing. For the model of missing completely at random, an efficient bivariate density estimator is proposed, and a practical example is presented.

Classification : 62N02, 62G05, 62G07, Missing data, survival analysis and censoring, nonparametric estimation

Format : Online Talk on Zoom

Author(s) : Lirit Fuksman (The University of Texas at Dallas)

[02424] Nonlinear fractional elliptic systems : Theory and Numerics

Session Time & Room : 5B (Aug.25, 10:40-12:20) @G502

Type : Contributed Talk

Abstract : In this talk, we focus on a class of elliptic systems with gradient source terms, governed by the fractional Laplacian $(-\Delta)^s$ of order $0

Classification : 35J66, 35K57, 65N30, 35-00, 65-00

Format : Online Talk on Zoom

Author(s) : Maha Daoud (Hassan II University of Casablanca)

[02429] Differential geometry with extreme eigenvalues in the positive semidefinite cone

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G305

Type : Contributed Talk

Abstract : Geometric data in convex cones appear in a wide range of applications. Of particular interest is the space of symmetric positive definite (SPD) matrices and a variety of associated geometries that have been successfully exploited in medical imaging, neuroscience, and machine learning. In this talk, I will explore the Hilbert and Thompson geometries associated with SPD matrices and show that they offer a natural route to

statistics based on extreme eigenvalues with promising computational properties.

Classification : 15B48, 53C22, 53B20, 53B50, 53C80

Format : Talk at Waseda University

Author(s) : Nathal Da Costa (Nanyang Technological University) Cyrus Mostajeran (Nanyang Technological University) Rodolphe Sepulchre (University of Cambridge) Graham van Goffrier (University College London)

[02430] Hessian geometric derivation of macroscopic thermodynamic uncertainty relations (TUR)

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D404

Type : Contributed Talk

Abstract : The recently developed Hessian geometry of force and flux spaces in chemical reaction networks provides a geometric derivation of TUR. The relations are obtained from a comparison of two Riemannian metric tensors - one characterizes the pseudo entropy production and the other the current fluctuations. This geometry yields a characterization of the error term as the norm of a linear subspace component of the flux vector and thus characterizes the fluxes where TUR become equalities.

Classification : 82Cxx, 53Zxx, 80Axx

Format : Talk at Waseda University

Author(s) : Dimitri Loutchko (The University of Tokyo) Tetsuya J Kobayashi (The University of Tokyo)

[02432] Dispersion relation reconstruction for 2D Photonic Crystals based on polynomial interpolation

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E820

Type : Contributed Talk

Abstract : A natural way to compute photonic dispersion relation is to restrict the parameters to the edges of the irreducible Brillouin zone (IBZ), which has been formalized as a dangerous simplification. We propose a novel method based on polynomial interpolation to approximate band functions in the whole IBZ. The importance of IBZ interiors, the need to reduce computational cost and our analysis of the regularity of band functions illustrate the necessity and feasibility of our method.

Classification : 78M22, 26B30, 32A10, 65M60, 41A10

Format : Talk at Waseda University

Author(s) : Yueqi Wang (University of Hong Kong) Guanglian Li (University of Hong Kong)

[02433] Response Surface Methodology-Based Model Updating Using FRF Curvature

Session Time & Room : 2E (Aug.22, 17:40-19:20) @D405

Type : Contributed Talk

Abstract : We propose a Response Surface Methodology (RSM) based model updating approach using Frequency Response Function (FRF) curvature as the response for optimization. The optimization algorithm is based on a multi-objective function that is solved using MATLAB. The updated model is then used for identifying structural damage. The proposed approach is validated through numerical simulations on a simply supported beam and an experimental study on a free-free aluminum beam. The results demonstrate that the RSM-based model updating approach can accurately identify the location and severity of damage in structures.

Classification : 82M20, 90C29

Format : Online Talk on Zoom

Author(s) : Nur Raihana Sukri (Malaysia-Japan International Institute of Technology, Universiti Teknologi Malaysia) Syarifah Zyurina Nordin (Malaysia Japan International Institute of Technology (MJIIT) , Universiti Teknologi Malaysia) Nurulakmar Abu Husain (Malaysia Japan International Institute of Technology, Universiti Teknologi Malaysia)

[02434] Multiobjective Mesh Optimization Algorithms for Quadrilateral Meshes

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E709

Type : Contributed Talk

Abstract : Accurate numerical PDE solutions require good quality computational meshes on the corresponding geometric domains. Both explicitly and implicitly tangled meshes are problematic for finite element simulations as are meshes with low quality elements. In this talk, we will present our multiobjective optimization methods for mesh untangling and quality improvement of quadrilateral meshes. The objective functions are developed by combining separate objective functions using ``no articulation of preferences. Encouraging results from numerical experiments will be presented.

Classification : 65N50, 65N30, 65K10

Format : Talk at Waseda University

Author(s) : Moein Moradi (University of Kansas) Suzanne Michelle Shontz (University of Kansas)

[02436] Subordinated Stochastic Processes and Applications

Session Time & Room : 2E (Aug.22, 17:40-19:20) @F412

Type : Contributed Talk

Abstract : A Subordinated stochastic process is obtained by time changing a parent process X_t with a positive
non-deceasing stochastic process T_t. The process T_t is called the directing process or the random clock.
Subordinated processes demonstrate interesting probabilistic properties and have applications in finance,
economics, statistical physics, anomalous diffusion and fractional calculus. Also scaling limits of continuous time
random walk depending on the conditions on mean waiting times and second moments conditions on jumps
converges weakly to different subordinated stochastic process. The aim of this talk is to discuss the concept of subordinated processes and their connections to different fields.

Classification : 60G10, 60G18, 60G20, 62M10, 60G51

Format : Talk at Waseda University

Author(s) : Arun Kumar (Department of Mathematics, Indian Institute of Technology Ropar, Rupnagar, Punjab, India 140001)

[02442] Geopolitical and Demographic Possible Factor affecting COVID-19 Spread level with OPLSDA approach

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E504

Type : Industrial Contributed Talk

Abstract : COVID-19 continuing challenges to health and socio-economic crisis. Geopolitical and demographic may possible affecting COVID-19 spread and this research focus on COVID-19 spread level classification. The method used is Orthogonal Projections to Latent Structures Discriminant Analysis (OPLS-DA), OPLS-DA projects predictor that have the best correlation with responses so that they can separate predictor variables from variables that are not correlated. OPLS-DA effectively identifies sources of variability between classes to produce good classification results with an accuracy rate 84.44%. The results also explain how predictor variables can affect the level of spread of COVID-19.

Classification : 62H30, 68U01, Classification and Discriminant Analysis for Outlier and High-dimensional data
Format : Online Talk on Zoom
Author(s) : Noviana Pratiwi (Gadjah Mada University) Dedi Rosadi (Gadjah Mada University) Abdurakhman Abdurakhman (Gadjah Mada University)

[02443] Enhanced charge-based algorithm and its application in reliability-redundancy allocation problems

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A201

Type : Contributed Talk
Abstract : Reliability-redundancy allocation problems (RRAP) require selecting components with diverse choices and redundancy levels that maximize profit within constraints. The nonlinearity and non-smoothness in RRAP have defeated many traditional mathematical approaches. Therefore, in this paper, a new version of the charge-based artificial electric field algorithm (AEFA) is proposed, incorporating a novel Coulomb's constant and bounds. This restructuring improves the adaptability of AEFA on RRAPs. The suggested algorithm outperforms other existing algorithms on seven RRAPs.
Classification : 90C15, 90B25, 90C29, 90C06, 90C26
Author(s) : Dikshit Chauhan (Dr B R Ambedkar National Institute of Technology Jalandhar) Anupam Yadav (Dr B R Ambedkar National Institute of Technology Jalandhar)

[02444] Pricing American XVA with stochastic default intensity

Session Time & Room : 2D (Aug.22, 15:30-17:10) @E709

Type : Contributed Talk
Abstract : We derive a PDE model for American derivatives' pricing including the valuation adjustment (XVA),
assuming mean-reverting default risk for the counterparty, and constant default risk for the self-party.
There are two nonlinear source terms, one from the American constraint and one from the XVA, handled by a double-penalty iteration.

We also derive asymptotic approximations to the XVA price and to the free boundary.
We present numerical experiments to study the accuracy and effectiveness of the 2D PDE and asymptotic approximations.
Classification : 65Mxx, 65Nxx, 91Gxx
Format : Talk at Waseda University
Author(s) : Christina Christara (University of Toronto) Yuwei Chen (University of Toronto)

[02449] Recent Advances in Fast Finite Difference Schemes for PDE Problems

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G306

Type : Contributed Talk
Abstract : In this talk, a fast finite difference scheme is discussed to a hidden-memory variable-order time-fractional diffusion equation. To reduce the computational cost and memory, a modified exponential-sum-approximation method is utilized to discretize the hidden-memory variable-order fractional derivative. We then develop different techniques from the analysis of L1 methods to prove the convergence for the corresponding fast fully discrete scheme. Numerical experiments are presented to substantiate the theoretical results.
Classification : 34A08, 26A33, 65D15, 65D40
Format : Talk at Waseda University
Author(s) : Lu-Yao Sun (University of Macau)

[02452] Fifth-order WENO Schemes with Z-type Nonlinear Weights for Hyperbolic Conservation Laws

Session Time & Room : 2E (Aug.22, 17:40-19:20) @E702

Type : Contributed Talk
Abstract : In this talk, we propose the variant Z-type nonlinear weights in the fifth-order weighted essentially non-oscillatory (WENO) finite difference scheme for hyperbolic conservation laws. We take new smoothness indicators and follow the form of Z-type nonlinear weights introduced by Borges et al., leading to fifth order accuracy in smooth regions and sharper approximations around discontinuities. Finally, numerical examples are presented to demonstrate the advantages of the proposed WENO schemes in shock-capturing.

Classification : 65M06

Author(s) : Jiaxi Gu (Pohang University of Science and Technology) Xinjuan Chen (Jimei University) Jae-Hun Jung (Pohang University of Science and Technology)

[02453] Allee effects, Evolutionary game, and Ideal free strategies in Partial Migration Population

Session Time & Room : 2D (Aug.22, 15:30-17:10) @E503

Type : Contributed Talk

Abstract : Allee effect is a density-dependent phenomenon in which population growth or individual components of fitness increase as population density increases. Understanding the density-dependent effect is vital to elucidate how populations evolve and to investigate evolutionary stability. Partial migration, where a proportion of a population migrates while other individuals remain resident, is widespread across most migratory lineages. However, the mechanism is still poorly understood in most taxa, especially those experiencing positive density-dependent effects. In this talk we discuss the evolutionary stability of partial migration population with the only migrant population experiencing Allee effects. Using the Evolutionary Game Theoretic (EGT) approach, we show the existence and uniqueness of a evolutionary stable strategy (ESS). We also show that the ESS is the only Ideal Free distribution (IFD) that arises in the context of a partially migrating population.

Classification : 39A60, 92D25, 91A22

Format : Talk at Waseda University

Author(s) : Yogesh Trivedi (Bits-Pilani, K.K Birla Goa Campus) Ram Singh (Bits-Pilani, K.K Birla Goa Campus) Anushaya Mohapatra (Bits-Pilani, K.K Birla Goa Campus)

[02454] Cellular gradient flow structure connects single-cell-level rules and population-level dynamics

Session Time & Room : 1C (Aug.21, 13:20-15:00) @D515

Type : Contributed Talk

Abstract : In multicellular systems, single-cell behaviors should be coordinated consistently with the overall population dynamics and biological functions. We show that the generalized gradient flow modeling of the cellular population dynamics naturally connects them and reproduces well-

known properties of cells. We also demonstrate the gradient flow structure in a standard model of the T-cell immune response. This theoretical framework works as a basis for understanding multicellular dynamics and functions.
Classification : 92C37, 92D25, 49S05
Format : Talk at Waseda University
Author(s) : Shuhei A Horiguchi (The University of Tokyo) Tetsuya J Kobayashi (The University of Tokyo)

[02457] Optimizing Bunkering Management Strategy to Support Green Shipping Using Artificial Bee Colony Algorithm (ABC)

Session Time & Room : 3E (Aug.23, 17:40-19:20) @D505

Type : Contributed Talk
Abstract : Sea transportation has been considered as more eco-friendly transportation compared to other transportation. However, maritime logistic has produced a lot of carbon emissions. Therefore, this research is performed for optimizing the development of bunkering management strategies. It will focus on choosing a fuel with an affordable price and producing fewer carbon emissions. The problem can be formulated as the MINLP to minimize the total cost and can be solved by ABC algorithm as an optimization method.
Classification : 90Bxx, 90Cxx, 90-08
Format : Online Talk on Zoom
Author(s) : Nurul Fajr Romadhona (Sepuluh Nopember Institute of Technology) Sena Safarina (Sepuluh Nopember Institute of Technology) Oktaviani Turbaningsih (University of Tasmania)

[02459] Functional ODE observers for DAE control systems

Session Time & Room : 2E (Aug.22, 17:40-19:20) @D515

Type : Contributed Talk
Abstract : Many control systems have essential features, which can only be expressed if system dynamics is described by simultaneous differential and algebraic equations (DAEs). For example, the classical state space models, governed only by ordinary differential equations (ODEs), cannot adequately treat impulses that occur in electrical circuits. This talk is devoted to the problem of designing functional observers for linear DAEs. A new and milder sufficient condition for functional observers is proved.
Classification : 93B53, 93B07, 93A10, 93C99, 93D05

Format : Talk at Waseda University
Author(s) : Nutan Kumar Tomar (Indian Institute of Technology Patna) Juhi Jaiswal (Indian Institute of Technology Madras) Pabitra Kumar Tunga (Indian Institute of Technology Patna)

[02467] Existence of unique blow-up solutions to fully fractional thermostat models

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G401

Type : Contributed Talk
Abstract : A thermostat is a device that detects the temperature of a physical system and takes the requisite actions to maintain the system's temperature at a predetermined set point. This paper deals with a fully fractional thermostat model involving Riemann-Liouville fractional derivatives. By choosing an appropriate weighted Banach space of continuous functions, we employ the Banach contraction principle to establish the existence and uniqueness result. An example is presented to validate our theoretical finding.
Classification : 26A33, 34A08, 34K10, 34K37, 65L10, Fractional differential equations, Riemann-Liouville fractional derivative, Thermostat model, Banach contraction principle, Product rectangle rule, Numerical simulation.
Format : Online Talk on Zoom
Author(s) : KIRAN KUMAR SAHA (Indian Institute of Technology Roorkee) NAGARAJAN SUKAVANAM (Indian Institute of Technology Roorkee)

[02468] Intuitionistic fuzzy proximal twin svm with fuzzy hyperplane

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D501

Type : Contributed Talk
Abstract : Twin support vector machine (TWSVM) is a contemporary machine learning technique for classification and regression problems. However, TWSVM is sensitive to noises as it ignores the positioning of the input data samples and hence fails to distinguish between support vector and noises. To overcome this issue, we propose a novel Intuitionistic fuzzy proximal twin svm with fuzzy hyperplane (IFTPSVM-FH). Instead of addressing two quadratic programming problems like in TWSVM, two non-parallel classifiers are obtained by solving two systems of linear equations which makes the model more efficient. The two major features of the proposed approach are that it gives an intuitionistic fuzzy number based on the relevance to each data vector and that the parameters for the hyperplane,

such as the components of the normal vector and the bias term, are fuzzified variables. With the use of fuzzy variables, the proposed fuzzy hyperplane effectively captures the ambiguous character of real-world categorization tasks by representing vagueness in the training data. The proposed approach uses local neighbourhood information among the data points and also uses both membership and non-membership weights to reduce the effect of noise and outliers. By incorporating nonlinear kernel functions into the feature space, the method can be used to detect complex patterns or non-linearity in the dataset. We have applied our method on real-world classification tasks and concluded that it performs incredibly well in comparison to other approaches. In order to demonstrate the practical application of the proposed model, we use it for the predict the trends of the stock market.

Classification : 90-08, 90C30, 90C25

Format : Online Talk on Zoom

Author(s) : Yash Arora (IIT Roorkee) Shiv Kumar Gupta (IIT Roorkee)

[02472] Geometry and mechanics of shape-programmable systems

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E803

Type : Contributed Talk

Abstract : Modern responsive materials such as liquid crystal elastomers (LCEs) can be pre-programmed to undergo spatially inhomogeneous deformations in response to external stimuli such as heat and light. Shape-programming of LCEs has been the subject of intense research in recent years, resulting in the discovery of patterning designs and techniques that allow flat 2D sheets to assume target geometries upon activation. In this talk, we present recent mathematical, computational and experimental advances in shape-programming of LCEs.

Classification : 74-04, 74-10, 74S05, 74M05, 74G65

Format : Talk at Waseda University

Author(s) : Daniel Duffy (University of Cambridge) Cyrus Mostajeran (Nanyang Technological University) John Simeon Biggins (University of Cambridge) Timothy J White (University of Colorado Boulder) Mark Warner (University of Cambridge)

[02473] Applications of Bures-Wasserstein geometry of HPD matrices to signal detection

Session Time & Room : 2C (Aug.22, 13:20-15:00) @F411

Type : Contributed Talk

Abstract : Autocovariance matrices can describe characteristic of time series data. If the data follow the stationary process, the corresponding autocovariance matrix is Hermitian positive definite (HPD). In this talk, we introduce Riemannian geometry of the HPD matrix spaces equipped with the BuresWasserstein (BW) metric and propose a detection method by utilizing the geodesic distance to define BW mean and median of HPD matrices. Robustness of the proposed mean and median will also be analyzed.

Classification : 53B20, 60G35, 32M15

Format : Talk at Waseda University

Author(s) : Yusuke Ono (Keio University) Linyu Peng (Keio University)

[02477] Effect of contact angle hysteresis in a novel microfluidic system

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D402

Type : Contributed Talk

Abstract : We present a reduced ODE model, derived from a continuum framework, for fluid flow and solute transport in a novel microfluidic system with applications for drug discovery. While the flow is gravity-driven, our analysis highlights the importance of capillary effects, exploring how contact angle hysteresis and meniscus shape modify the flow. We show how our model can be used to identify optimal parameter regimes for advective solute transport, which informs device operation and design.

Classification : 76-10, 76D45, 92-10

Format : Talk at Waseda University

Author(s) : Barnum Swannell (University of Oxford) Sarah Waters (University of Oxford) James Oliver (University of Oxford) Daniela Ortiz Franyuti (Roche Innovation Center) Olivier Frey (InSphero) Michal Rudnik (InSphero)

[02480] Conservative Timesteppers for Fluid Mechanics via Finite Elements in Time

Session Time & Room : 5C (Aug.25, 13:20-15:00) @E703

Type : Contributed Talk

Abstract : Finite-element-in-timeFETformulations can be carefully constructed to preserve key structures in time-dependent PDEs, such as energy and helicity dissipation, material conservation, and Hamiltonians. Furthermore, with appropriate trial and test spaces, FET formulations can be solved one timestep at a time, like classical timesteppers.

We propose a general auxiliary space concept that connects these ideas, using FET to derive timesteppers up to arbitrary order in time that preserve these structures. We discuss potential future applications of this idea.

Classification : 65M60, 76D05, 65P10, 76W05, 65M22

Format : Talk at Waseda University

Author(s) : Boris Duncan Andrews (University of Oxford) Patrick Emmet Farrell (University of Oxford) Wayne Arter (United Kingdom Atomic Energy Authority)

[02483] Existence and uniqueness of traveling wave solutions for competition-diffusion systems

Session Time & Room : 5C (Aug.25, 13:20-15:00) @G502

Type : Contributed Talk

Abstract : In this talk, we will consider the existence and uniqueness of traveling wave solutions for a class of competition-diffusion models. We find a necessary and sufficient condition for the existence of non-decreasing traveling wave solutions connecting trivial and positive equilibria. Moreover, with the help of the asymptotic behaviors of such solutions at positive infinity, we also prove that traveling wave solutions are unique up to translations.

Classification : 35K40, 35K57, 35B35

Format : Talk at Waseda University

Author(s) : Jian-Jhong Lin (National Taipei University of Technology)

[02487] Asset Forecasting Using Geometric Brownian Motion and Variance Gamma Models

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E505

Type : Contributed Talk

Abstract : The basic assumption in the Black-Scholes-Merton model is log returns assets normally distributed. In reality, asset price movements are so fluctuating that the data is not normally distributed. This paper proposes a way to forecast using the variance gamma (VG) model. The VG model has three parameters to control volatility, skewness, and kurtosis. We compare results with the geometric Brownian motion (GBM) model. The accuracy of the model used the mean absolute percentage error (MAPE).

Classification : 62P20

Format : Online Talk on Zoom

Author(s) : Abdul Hoyyi (Gadjah Mada University) Abdurakhman Abdurakhman (Gadjah Mada University) Dedi Rosadi (Gadjah Mada University)

[02489] L^p-estimates for Maxwell's equations in heterogeneous materials

Session Time & Room : 3C (Aug.23, 13:20-15:00) @G601

Type : Contributed Talk

Abstract : Estimates for the time-harmonic Maxwell's equations in heterogeneous materials are concerned.

The materials contain two constituents. One high-conductivity constituent of small size is embedded in each period so that it is disconnected. The other of low-conductivity constituent contains the rest of the material. The contrast ratios of the conductivity and the magnetic permeability in one constituent to the other can be very high. Here L^p-estimates for the electromagnetic fields uniform in contrast ratios are presented.

Classification : 35J70, 35J25, 35J75

Format : Talk at Waseda University

Author(s) : Li-Ming Yeh (National Yang Ming Chiao Tung University) Dongwoo Sheen (Seoul National University)

[02500] Constructing crypto-algorithms using vector-valued functions

Session Time & Room : 2E (Aug.22, 17:40-19:20) @G304

Type : Contributed Talk
Abstract : Binary compositions of vector-valued functions defined on an arbitrary set, including finite sets, are introduced. Some properties of the compositions are investigated. In particular, it is proved that each of them is associative. Using the obtained results, crypto-algorithms with a public key have been obtained.
Classification : 11T71, 94A60, 05B15, 20N05, 20N15
Author(s) : Fedir Sokhatsky (Vasyl' Stus Donetsk National University)

[02503] Modelling mosquito dynamics and novel malaria vector control interventions

Session Time & Room : 5C (Aug.25, 13:20-15:00) @A201

Type : Contributed Talk
Abstract : We present mathematical and statistical models of mosquito behaviour and feeding cycle dynamics. We analytically derive estimates of vectorial capacity for malaria (the potential of the mosquito population to transmit malaria). We parameterise these models to data from semi-field and field studies and evaluate the impact of current and novel vector control interventions in reducing vectorial capacity. We connect these models to malaria transmission models in humans to investigate the impact of these interventions in reducing clinical malaria transmission.
Classification : 92D30, 92D45, 92D50, 92C60, Malaria modelling, mosquito behaviour
Author(s) : Nakul Chitnis (Swiss Tropical and Public Health Institute)

[02505] Modelling capture and storage of gases in porous media

Session Time & Room : 2D (Aug.22, 15:30-17:10) @D404

Type : Contributed Talk
Abstract : An accurate description of reactive mass transport in porous media is of paramount importance in a multitude of environmental applications. In this talk, we will present mathematical models of gas transport in porous media for applications in contaminant removal and

hydrogen storage. The models will be simplified via dimensional analysis and solved analytically in some limiting cases. Numerical solutions of the full models will also be presented. All solutions will be compared with experimental data.

Classification : 76S05, 80A19, 35B40, 76M50

Format : Talk at Waseda University

Author(s) : Francesc Font (Universitat Politcnica de Catalunya, CIF: Q0818003F, C. Jordi Girona, 31, 08034 Barcelona, Barcelona) Tim G. Myers (Centre de Recerca Matemtica) Maria Aguareles (Universitat de Girona) Esther Barrabs (Universitat de Girona)

[02506] Hydrodynamic hovering of swimming bacteria

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D404

Type : Contributed Talk

Abstract : The 'hovering' of flagellated bacteria near a rigid surface, i.e. stable swimming at a finite separation, has been studied experimentally and computationally but remains poorly understood physically. We use boundary element simulations to confirm existing results and to reveal that an elongated, as opposed to spherical, cell body is essential for hovering. We then derive and asymptotically solve a simplified model for the swimming cell and its near-field wall interactions, thereby elucidating the dominant physics.

Classification : 76Z10, 92C17, 76M45

Format : Talk at Waseda University

Author(s) : Pyae Hein Htet (University of Cambridge) Debasish Das (University of Strathclyde) Eric Lauga (University of Cambridge)

[02511] Autocratic Decision-Making based on Neutrosophic Sets for Machine Selection in the Industrial Factories

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A201

Type : Industrial Contributed Talk

Abstract : Neutrosophic Sets address ambiguity by considering the levels of truth, falsity, and indeterminacy. This research proposes an autocratic strategy for dealing with Multi-Attribute Decision-Making problems in the neutrosophic environment. The method is adopted to handle machine selection problems to stimulate both production level and income creation, in which executives utilize neutrosophic values to estimate the determination

levels of the characteristics. Analytical examinations demonstrate that the offered approach is more efficient than the other existing methods.

Classification : 90B50, 65Kxx

Format : Talk at Waseda University

Author(s) : Amirhossein Nafei (National Taipei University of technology, Taipei , Taiwan) Seyed Hadi Nasseri Ojaki (Department of mathematics, University of Mazandaran, Babolsar, Iran)

[02512] Incentive design for electric vehicles charging station management

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D501

Type : Contributed Talk

Abstract : We propose a new bilevel optimization model to determine optimal pricing of Electric Vehicle (EV) changing stations. The goal is to define incentives to decrease the energy grid peaks while integrating the behaviour of the EV users
through preference lists. The bilevel optimization model is reformulated as a single level one based on a rank pricing approach. The model is solved through a cutting plane approach. Numerical results are discussed

Classification : 90-10, 90c11

Format : Talk at Waseda University

Author(s) : Luce Brotcorne (INRIA) Luce Brotcorne (INRIA) Miguel Anjos (University of Edinburgh) Gal Guillot (INRIA)

[02513] Models for the Interdiction Problem for the Minimum Spanning Tree

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D502

Type : Contributed Talk

Abstract : The Minimum Spanning Tree Interdiction (MSTI) problem is a two-player game between a network operator aiming to determine a Minimum Spanning Tree (MST) and an interdictor which, constrained by a budget, changes the network topology to increase the weight of a MST. Mathematical formulations for a generalization of the MSTI problem are devised, and valid inequalities are proposed. Dominance relations between the models are studied, and computational experiments are presented to evaluate their efficiencies.

Classification : 90-10, 90C10, 90C46, Bilevel programming

Format : Talk at Waseda University

Author(s) : Luis Salazar-Zendeja (INRIA) Diego Cattaruzza (Centrale Lille) Martine Labb (Universit Libre de Bruxelles) Frdric Semet (Centrale Lille)

[02516] Stability and dynamics of multi-layer shear flow with liquid-liquid slip

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D403

Type : Contributed Talk
Abstract : Although the presence of slippage at polymer-polymer interfaces has been widely reported in experiments and MD simulations, its effect on the stability of superposed fluid layers undergoing shear has not been adequately addressed. Therefore, we formulate a mathematical model and under the assumption of one layer being asymptotically thin we derive a novel weakly non-linear evolution equation for the interface to study the linear stability and system dynamics. A slip-induced Turing-type instability is found.
Classification : 76E17, 76E30, 76E05, 76D05
Author(s) : Anna Katsiavria (Imperial College London) Demetrios Papageorgiou (Imperial College London)

[02517] Flocking Dynamics of Agents with Nonidentical Intrinsic Accelerations

Session Time & Room : 5C (Aug.25, 13:20-15:00) @A201

Type : Contributed Talk
Abstract : Collective dynamics has attracted much attention over the past decades. It depicts a group of agents represents the identical dynamics under the interaction. There have been several papers proposed to study these. In this talk, we set up a flocking model where agents in a flock can have different intrinsic accelerations. We give some theoretical results to ensure the occurrence of flocking dynamics and some numerical simulations are provided to support these.
Classification : 92D50, 92D25, 34D05, 93D20
Format : Talk at Waseda University
Author(s) : Yu-Hao Liang (National University of Kaohsiung)

[02519] Intensity modulated radiotherapy planning through a fuzzy approach

Session Time & Room : 4C (Aug.24, 13:20-15:00) @A207

Type : Contributed Talk

Abstract : In radiotherapy treatment, is it possible to vary the radiation intensity, achieving a dose distribution with superior compliance. An individualized treatment plan comprises information on how the dose is distributed within a patient. The dose distribution problem translates into optimizing the total radiation dose applied to the patient. Fuzzy optimization is used to deal with inaccurate prescription. Interior point methods are applied to determine optimal solutions with less dose distribution in critical organs.

Classification : 90C51, 90C05, 90C70

Format : Talk at Waseda University

Author(s) : Aurelio Oliveira (University of Campinas) Nicole Cassimiro (University of Campinas)

[02520] A direct method for solving a structured Sylvester equation

Session Time & Room : 2D (Aug.22, 15:30-17:10) @E505

Type : Contributed Talk

Abstract : In this talk, we will present a pseudospectral method for 2D advection operators. After discretizing the 2D advection operator by the Legendre-Gauss-Lobatto pseudospectral methods, we obtain a Sylvester equation. The Sylvester equation is equivalent to a block tridiagonal liner system of equations. We propose a URV approach to solve the linear system.

Classification : 65F05, 65N35

Format : Talk at Waseda University

Author(s) : Yung-Ta Li (Fu Jen Catholic University)

[02521] Asymptotic tracking of a point cloud moving on Riemannian manifolds

Session Time & Room : 1E (Aug.21, 17:40-19:20) @G402

Type : Contributed Talk

Abstract : We present two Cucker-Smale type models for the asymptotic tracking of a point cloud moving on complete, connected, and smooth Riemannian manifolds. For each model, we provide a sufficient framework in terms of a moving target point cloud, system parameters, and initial data. In the proposed framework, we show asymptotic flocking, collision avoidance, and asymptotic tracking to a given point cloud. The main result is a joint work with Hyunjin Ahn, Seung-Yeal Ha and Jaeyoung Yoon.

Classification : 34D05, 34H05, 70F10, 70G60, 92D25

Format : Talk at Waseda University

Author(s) : Hyunjin Ahn (Myongji University) Junhyeok Byeon (Seoul National University) Seung-Yeal Ha (Seoul National University) Jaeyoung Yoon (Seoul National University)

[02528] Propagation of Rayleigh-like surface waves in multilayered nonlocal elastic media

Session Time & Room : 5C (Aug.25, 13:20-15:00) @E817

Type : Contributed Talk

Abstract : Haskell matrix method is employed to derive the dispersion relation of Rayleigh-like surface waves propagating through a multilayered nonlocal elastic solid half-space. This dispersion relation is reduced for a 2-layered model to discuss the characteristics of phase speed of Rayleigh-like wave. For specific model, the effect of nonlocality on Rayleigh-like waves for 2- and 3-layered models has been depicted graphically. The particle motion remains elliptical, and influenced by the presence of nonlocality for 2-layered model.

Classification : 74J15

Format : Talk at Waseda University

Author(s) : Aarti Khurana (Panjab University Chandigarh)

[02529] Application of machine learning to predict dynamics of epidemiological models that incorporate human behavior

Session Time & Room : 4E (Aug.24, 17:40-19:20) @D514

Type : Contributed Talk

Abstract : In this work, we present modeling, analysis and simulation of a mathematical epidemiological model which incorporates human social, behavioral, and economic interactions. We discuss an approach based in

Physics-Informed Neural Network, which is capable of predicting the dynamics of a disease described by modified compartmental models that include parameters, and variables associated with the governing differential equations. Finally, human behavior is modeled stochastically and it is included in the compartmental models.

Classification : 92Bxx, 92-04, 92-05

Format : Talk at Waseda University

Author(s) : Alonso Gabriel Ogueda Oliva (George Mason University) Padmanabhan Seshaiyer (George Mason University)

[02532] Stochastic pseudo-symplectic explicit Runge-Kutta methods for Hamiltonian Systems

Session Time & Room : 2D (Aug.22, 15:30-17:10) @E506

Type : Contributed Talk

Abstract : We propose a systematic approach, based on colored trees and B-series, to construct explicit Runge-Kutta pseudo-symplectic schemes for stochastic Hamiltonian systems in the sense of Stratonovich. Numerical experiments are presented to verify our theoretical analysis and illustrate the long-term accuracy of these methods. Overall, these schemes offer a good compromise between computational time and accuracy, because they are more accurate than the explicit It-Taylor approximation methods and less computationally expensive than the implicit symplectic schemes.

Classification : 65C30, 60H35

Format : Talk at Waseda University

Author(s) : cristina adela anton (MacEwan University)

[02534] Solving a Tree Genetic Diversity Via Homogeneous Self Dual Embedding

Session Time & Room : 3C (Aug.23, 13:20-15:00) @F311

Type : Industrial Contributed Talk

Abstract : This research discusses another way to solve Second-Order Cone Programming of a tree genetic diversity. We propose a method based on a splitting augmented Lagrangian method (SALM) and an implementation of a homogenous self-dual (HSD) concept to a sub-problem that belongs to convex programming. Furthermore, we utilize operator splitting to review the existence of HSD. An optimal solution for tree genetic diversity can be obtained by using the modified SALM.

Classification : 46N10, 47N10, 90C26, 35Q49, 97M40

Format : Online Talk on Zoom

Author(s) : Alvian Alif Hidayatullah (Sepuluh Nopember Institute of Technology) Sena Safarina (Sepuluh Nopember Institute of Technology) Subchan Subchan (Sepuluh Nopember Institute of Technology)

[02538] Probabilistic proofs for some important combinatorial identities

Session Time & Room : 2C (Aug.22, 13:20-15:00) @G301

Type : Contributed Talk

Abstract : Combinatorial identities involving binomial coefficients are very useful in various areas of applied mathematics, especially in discrete mathematics. Using a probabilistic approach, we present simple proofs for some important combinatorial identities involving moments of the gamma, normal, and chi-squared random variates. Some generalizations and interpretations are also given.

Classification : 05A19, 05A10, 33B15, 60C05, 62E15

Format : Online Talk on Zoom

Author(s) : Ashok Kumar Pathak (Central University of Punjab, Bathinda)

[02540] Dynamics of Fractional Order Crime Transmission Model with Fear Effect and Gang-war

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G401

Type : Contributed Talk

Abstract : Various studies present mathematical models of ordinary and fractional differential equations to reduce delinquent behavior and encourage prosocial growth. However, these models do not include the fear effect of the judiciary and of other gangs on one criminal gang, which is necessary to depict the behavioral changes of criminals. Hence, this talk will discuss a fractional-order of crime transmission model with the fear effect of the judiciary on offenders with competition effect in different gangs.

Classification : 26A33, 00A71, 34A08

Format : Talk at Waseda University

Author(s) : Trilok Mathur (Birla Institute of Technology and Science, Pilani) Shivi Agarwal (Birla Institute of Technology and Science, Pilani) Komal Bansal (Birla Institute of Technology and Science, Pilani)

[02547] Split S-ROCK methods for stiff It\^{o} stochastic differential equations

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E502

Type : Contributed Talk

Abstract : We propose explicit stochastic Runge--Kutta methods for stiff It\^{o} stochastic differential equations. The family of the methods is constructed on the basis of the Runge--Kutta--Chebyshev methods, and we utilize a Strang splitting-type approach. The derived methods achieve weak order 2, and have high computational accuracy for relatively large time-step size, as well as good stability properties. In numerical experiments, we confirm that our methods are superior to existing methods in computational accuracy.

Classification : 60H10, 65L05, 65L06

Format : Talk at Waseda University

Author(s) : Yoshio Komori (Kyushu Institute of Technology) David Cohen (Chalmers University of Technology) Kevin Burrage (Queensland University of Technology)

[02548] Rayleigh-like waves in coated elastic half-space containing voids

Session Time & Room : 5C (Aug.25, 13:20-15:00) @E817

Type : Contributed Talk

Abstract : Secular equation for Rayleigh-like surface waves propagating through an isotropic elastic media containing voids coated with a thin isotropic elastic layer with voids is derived. The layer and the half-space are in welded contact. The effective boundary condition method has been employed to obtain an approximate secular equation of second order in terms of the dimensionless thickness of layer. An explicit formula for Rayleigh-like wave speed is derived and the results have been plotted graphically.

Classification : 74J15

Format : Online Talk on Zoom

Author(s) : Savkirat Kaur (Dev Samaj College for Women, Chandigarh)

[02549] Copula for Markov Chain Model with Binomial Time Series Data

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E503

Type : Contributed Talk

Abstract : Markov Chain Model can be constructed by the concept of time dependency and approached by the Copula. Markov Chain Model using Clayton and Joe Copula is proposed to determine the 3-sigma control limit in statistical control process for time series binomial data. In this paper, Gumbel and Frank Copula use in determining the 3-sigma control limits. We conduct simulations to see the performance of the developed methods and analyze the number of defective pieces in the jewelry manufacturing process.

Classification : 62-08, 62A99

Author(s) : Pepi Novianti (Universitas Gadjah Mada, University of Bengkulu) Gunardi Gunardi (Universitas Gadjah Mada) Dedi Rosadi (Universitas Gadjah Mada)

[02552] The inverse elastography problem

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E705

Type : Contributed Talk

Abstract : Optical coherence elastography (OCE) is an imaging modality that maps mechanical properties by using optical coherence tomography (OCT) to measure tissue displacement after mechanical excitation.

From OCE elastograms, quantified elasticity mapping can be accomplished using an appropriate mathematical model of the tissue.

In this talk we present a mathematical model to reconstruct the mechanical properties of an elastic medium, in the OCE imaging technique.

We formulate the inverse model problem as a PDE-constrained optimization problem, where the objective function measures the discrepancy between observations and predictions.

We will discuss different strategies for learning the space varying elasticity coefficients.

Classification : 65Nxx, 65N21

Format : Talk at Waseda University

Author(s) : Silvia Barbeiro (University of Coimbra) Rafael Henriques (University of Coimbra)

[02554] Domain-invariant subcell-based blending limiter for Lax-Wendroff Flux Reconstruction

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D408

Type : Contributed Talk

Abstract : Lax-Wendroff flux reconstruction (LWFR) is a single-step, arbitrarily high order, quadrature free method for solving hyperbolic conservation laws. We propose a subcell-based blending scheme for LWFR. By using MUSCL-Hancock reconstruction on the subcells and Gauss-Legendre points in flux reconstruction, we improve small-scale resolution compared to the subcell-based RKDG scheme of Henneman et al. $($2020$)$. We also propose a cost-effective correction to obtain a provably domain-invariant Lax-Wendroff scheme. Efficient Julia implementation will be discussed.

Classification : 76M10, 76M12, 76-04, 35L65

Format : Talk at Waseda University

Author(s) : Arpit Babbar (Tata Institute of Fundamental Research - Centre for Applicable Mathematics (Bangalore)) Praveen Chandrashekar (Tata Institute of Fundamental Research - Centre for Applicable Mathematics (Bangalore)) Sudarshan Kumar Kenettinkara (School of Mathematics, Indian Institute of Science Education and Research)

[02555] A Mean Field Game Model for Renewable Investment under Uncertainty

Session Time & Room : 3D (Aug.23, 15:30-17:10) @D514

Type : Contributed Talk

Abstract : We consider a stylized model for investment into renewable power plants under long-term uncertainty. Risk-averse agents face heterogeneous weather conditions and a common noise including demand trends. The objective of each agent is to maximize profit by controlling investment at discrete time steps. We prove that the N-player game admits a Nash equilibrium that converges to the unique solution of a mean field game. The numerical experiments emphasize the impact of risk aversion and heterogeneity.

Classification : 91A16, 49N80, 91A80, 91A50

Author(s) : Clia Escribe (Ecole Polytechnique) Josselin Garnier (Ecole Polytechnique) Emmanuel Gobet (Ecole Polytechnique)

[02560] A Composite Adaptive Finite Point Method for 2D Burgers' Equation

Session Time & Room : 2E (Aug.22, 17:40-19:20) @E702

Type : Contributed Talk

Abstract : This paper focuses on solving the unsteady 2D Burgers equation. We present a minimal machinery algorithm based on an operator splitting technique into different temporal levels in conjunction with an adaptive finite point method (AFPM). The advisability of the AFPM is that it efficiently adjusts itself to fit into the local properties of the exact solution, and its user-friendliness makes it easy to implement and cost-effective. Mathematical estimates like stability, consistency, and convergence analysis support the presented method.

Classification : 65M06, 65M12

Author(s) : Ashish Awasthi (National Institute of Technology Calicut) Sreelakshmi A (National Institute of Technology Calicut) Shyaman V P (National Institute of Technology Calicut)

[02566] A spherically symmetric and steady flow describing the motion of a viscous gaseous star

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G602

Type : Contributed Talk

Abstract : We consider a system of equations describing a spherically symmetric n-dimensional motion of a gaseous star, whose gas is viscous, heat-conducting, self-gravitating and bounded by the free-surface, and flows around a central rigid sphere. We discuss first unique existence of the solution to the corresponding stationary problem, and next do a large-time behaviour of the flow, under a certain restricted but physically plausible condition on parameters and initial data.

Classification : 35M33, 35Q30, 35R35, 35Q85, 76N10

Format : Talk at Waseda University

Author(s) : Morimichi Umehara (University of Miyazaki)

[02568] A pressure-stabilized projection Lagrange--Galerkin scheme for the transient Oseen problem

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E604

Type : Contributed Talk

Abstract : We propose and analyze a pressure-stabilized projection Lagrange--Galerkin scheme for the transient Oseen problem. The proposed scheme inherits the advantages from the projection Lagrange--Galerkin scheme: computational efficiency and essential unconditional stability. Here we also use the equal-order approximation for the velocity and pressure, and add a symmetric pressure stabilization term. This enriched pressure space enables us to obtain accurate solutions for small viscosity.

Classification : 65M12, 65M25, 65M60, 76D07, 76M10

Format : Talk at Waseda University

Author(s) : Shinya Uchiumi (Gakushuin University)

[02572] LDA Hyper-parameters Regulation for Qualitative Studies in Management

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E505

Type : Contributed Talk

Abstract : The suitability of the number of topics in management qualitative research is a complex problem. Topic models on textual data often require judgment expertise in determining suitability for management problems. One of the things to note is the determination of hyperparameter values. We have designed various hyper-parameter value conditions as an experiment and calculated the document match probability based on the topic grouping results. Different hyperparameter values indicate different levels of probability.

Classification : 62P25, 68W99, 91C20

Format : Online Talk on Zoom

Author(s) : Evita Purnaningrum (Mathematics Department, Gadjah Mada University) Abdurakhman Abdurakhman (Mathematics Department, Gadjah Mada University) Nanang Susyanto (Mathematics Department, Gadjah Mada University)

[02573] Local convergence analysis of modified King's family for multiple roots

Session Time & Room : 2C (Aug.22, 13:20-15:00) @E501

Type : Contributed Talk

Abstract : We Introduce a new optimal King-like family of methods to solve nonlinear equations when the multiplicity of the root is known in advance. Local convergence of fourth order modified King's family, defined by first two steps of the new scheme is also studied. Radius of convergence balls of fourth order scheme are computed and compared with the existing methods. Comparison of these results show the superiority of our schemes over the existing ones.

Classification : 65A05, 65Gxx, 65H05, 65G99

Format : Talk at Waseda University

Author(s) : Saurabh Bhatia (Panjab University Chandigarh)

[02575] Propagation of Nonlinear Waves in Non-genuinely Nonlinear Characteristic Field

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G404

Type : Contributed Talk

Abstract : We consider a quasilinear hyperbolic system of partial differential equations to discuss the evolution of weakly nonlinear waves, where the evolution equation includes quadratic, cubic, and quartic nonlinear terms and the flux function admits two inflection points. We present an example from gasdynamics with analytical and numerical results demonstrating a wide range of wave phenomena, and study the interaction of expansion and compression waves evolving from a rectangular pulse.

Classification : 35B40, 35B65, 35C20, 35L65, 35L67

Format : Online Talk on Zoom

Author(s) : Triveni Prasad Shukla (National Institute of Technology Warangal)

[02580] Topological-sensitivity framework for detecting perfectly-conducting buried objects in layered media

Session Time & Room : 1E (Aug.21, 17:40-19:20) @D405

Type : Contributed Talk

Abstract : Identification of the location of a scattering object from its recorded scattering signature is one of the inverse problems that finds many applications in non-destructive testing. A typical application is a detection and removal of buried land mines. The underlying problem is linked to the discovery of buried objects in a two-layered medium. We present a topological derivatives-based algorithm for detecting a perfectly conducting object in the lower layer of a two-layer unbounded 3D background medium using electromagnetic plane waves. Since the underlying problem is highly ill-posed, most of the existing methods that are qualitative turn out to be quite sensitive to unavoidable medium and measurement noises. Our focus is on designing a direct algorithm based on the topological derivative of an L2-discrepancy function. We perform a rigorous analysis of the proposed algorithm and debate its localization and stability features regarding random medium and measurement noises.

Classification : 78A46, 65J20, Inverse scattering, Maxwells equations, Electromagnetic imaging, Topological derivative, Localization, Resolution analysis, Stability analysis, Medium noise, Measurement noise.

Format : Talk at Waseda University

Author(s) : Aibike Nagyz (Nazarbayev University) Abdul Wahab (Nazarbayev University)

[02581] Well-Posedness and smoothness of geometric flows with nonlinear boundary conditions

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G602

Type : Contributed Talk

Abstract : Geometric flows are geometric evolution equations often depicting physical phenomena. We consider a class of geometric flows of order $2m \in 2\mathbb{N}$ describing evolving n-manifolds attached to fixed hypersurfaces with some nonlinear boundary conditions. We modify the theory of Maximal Regularity to accommodate quasilinear parabolic PDEs with such boundary conditions. For initial conditions in $W_p^{2m \frac{2m}{p}}, p\geq \max\{2m, \frac{n}{2m}\}$) we show well-posedness and

instantaneous smoothing of the solution on a maximal interval of existence.
Classification : 35Kxx, 35Qxx
Format : Talk at Waseda University
Author(s) : Daniel Goldberg (Technion-Israel Institute of Technology)

[02583] Novel shock-capturing procedure for discontinuous Galerkin method for compressible flows

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D101

Type : Contributed Talk
Abstract : In this work we develop a novel shock capturing procedure based on adaptive reformation of finite volume sub-cells for higher order discontinuous Galerkin method. For this we developed a sub-cell shock indicator based on Hartens strategy to provide enhanced shock detection using just the degrees of freedom in respective mesh element. We apply this new procedure in the current state-of-the-art entropy stable discontinuous Galerkin method and demonstrate some numerical results for 1D compressible Euler equations.
Classification : 76M10, 76M12, 76-10, 35L65
Format : Online Talk on Zoom
Author(s) : Kedar Shridhar Wagh (Indian Institute of Science) S. V. Raghurama Rao (Indian Institute of Science) Sashikumaar Ganesan (Indian Institute of Science)

[02584] Malmquist Productivity Index under Fuzzy Environment

Session Time & Room : 4E (Aug.24, 17:40-19:20) @D408

Type : Contributed Talk
Abstract : Malmquist productivity index (MPI) is widely used to estimate the productivity change by calculating the relative performance of homogeneous organizations for different time periods using data envelopment analysis (DEA). Although in real-world applications, traditional MPI method is tedious due to ambiguous or imprecise data. Thus, traditional DEA is integrated with fuzzy. In this study, novel integrated MPI method is proposed under fuzzy environment. To show the applicability and effectiveness of the proposed model, numerical example is also discussed.
Classification : 90C70, 90C05, 90B50
Author(s) : Shivi Agarwal (Birla Institute of Technology and Science, Pilani)

Trilok Mathur (Birla Institute of Technology and Science, Pilani) Swati Goyal (Birla Institute of Technology and Science, Pilani)

[02585] Structured Dissipative mappings with their applications in Control Systems

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D402

Type : Contributed Talk
Abstract : In this paper, we find necessary and sufficient conditions to identify pairs of matrices X and Y for which there exists $\Delta \in \mathbb C^{n,n}$ such that $\Delta+\Delta^*$ is positive semidefinite and $\Delta X=Y$.
Such a Δ is called a dissipative mapping taking X to Y. The minimal-norm dissipative mapping is then used to determine the distance to asymptotic instability for dissipative-Hamiltonian systems under general structure-preserving perturbations.
Classification : 93Dxx, 65Fxx, 34Axx
Format : Talk at Waseda University
Author(s) : Mohit Kumar Baghel (Indian Institute of Technology Delhi) Nicolas Gillis (Universit de Mons) Punit Sharma (Indian Institute of Technology Delhi)

[02588] Synchronization in a model system of two bubbles

Session Time & Room : 5C (Aug.25, 13:20-15:00) @G401

Type : Contributed Talk
Abstract : We develop a model system of ODEs describing motions of bubbles interacting through the emission of sound waves of finite speed. In particular of the case of two bubbles, they fall into a state of synchronization, where the limit phase difference is 0 or π depending on the distance of the bubbles. We elucidate the mechanism by the analysis of the phase coupling function, and from the physical viewpoint.
Classification : 34E13, 35Q31, 76N30
Format : Talk at Waseda University
Author(s) : Masashi Ohnawa (Tokyo University of Marine Science and Technology)

[02589] Two scale convergence method in Orlicz setting and application

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G501

Type : Contributed Talk

Abstract : We discus extension to Orlicz spaces of two scale convergence method in homogenization and apllication. Reiterated two scale convergence method and unfolding method is also presented in those Space which generilize standard Sobolev spaces and capture more information. We apply Above method on a number of problem including nonlinear degenerated elliptic operator with nonstandart growth.

Classification : 35B27, 35B40, 35J25, 35J60, 35J70

Format : Talk at Waseda University

Author(s) : Joel Fotso Tachago (The University of Bamenda) Joel Fotso Tachago (The University of Bamenda) Hubert Nnang (University of Yaound 1) Elvira Zappale (University of Roma 1)

[02590] Non-Local Robust Quaternion Matrix Completion for Large-Scale Color Images and Videos Inpainting

Session Time & Room : 4E (Aug.24, 17:40-19:20) @A502

Type : Contributed Talk

Abstract : The image nonlocal self-similarity (NSS) prior refers to the fact that a local patch often has many nonlocal similar patches to it across the image. In this talk we apply such NSS prior to enhance the robust quaternion matrix completion (QMC) method and significantly improve the inpainting performance. A patch group based NSS prior learning scheme is proposed to learn explicit NSS models from natural color images. The NSS-based QMC algorithm computes an optimal low-rank approximation to the high-rank color image, resulting in high PSNR and SSIM measures and particularly the better visual quality. A new joint NSS-base QMC method is also presented to solve the color video inpainting problem based quaternion tensor representation. The numerical experiments on large-scale color images and videos indicate the advantages of NSS-based QMC over the state-of-the-art methods.

Classification : 94A08, 68U10

Format : Talk at Waseda University

Author(s) : Zhigang Jia (Jiangsu Normal University)

[02592] Pricing American barrier options with transaction costs

Session Time & Room : 4E (Aug.24, 17:40-19:20) @D505

Type : Contributed Talk

Abstract : When transaction costs in trading underlying stocks are considered, far more modelling effort is needed for pricing
options, as a unique fair price between the holder and writer no longer exists. It becomes even more complicated for
American and exotic options. In this talk, we shall discuss the valuation of American barrier options with transaction
costs and examine the impact of transaction costs on option pricing, particularly on how they affect the optimal
exercise boundary.

Classification : 91G20, 60G40, Mathematical finance

Format : Talk at Waseda University

Author(s) : Xiaoping Lu (University of Wollongong)

[02595] Image recovery under non-Gaussian noise

Session Time & Room : 4E (Aug.24, 17:40-19:20) @A502

Type : Contributed Talk

Abstract : Cauchy noise, as a typical non-Gaussian noise, appears frequently in many important fields, such as radar, medical, and biomedical imaging. Here, we focus on image recovery under Cauchy noise. Instead of the celebrated total variation or low-rank prior, we adopt a novel deep-learning-based image denoiser prior to effectively remove Cauchy noise with blur. To preserve more detailed texture and better balance between the receptive field size and the computational cost, we apply the multi-level wavelet convolutional neural network (MWCNN) to train this denoiser.

Frequently appearing in medical imaging, Rician noise leads to an interesting nonconvex optimization problem, termed as the MAP-Rician model, which is based on the Maximum a Posteriori (MAP) estimation approach. As the MAP-Rician model is deeply rooted in Bayesian analysis, we want to understand its mathematical analysis carefully. Moreover, one needs to properly select a suitable algorithm for tackling this nonconvex problem to get the best performance. Indeed, we first present a theoretical result about the existence of a minimizer for the MAP-Rician model under mild conditions. Next, we aim to adopt an efficient boosted difference of convex functions algorithm (BDCA) to handle this challenging problem. Theoretically, using the Kurdyka-Lojasiewicz (KL) property, the convergence

of the numerical algorithm can be guaranteed.

Classification : 94A08, 68U10

Format : Talk at Waseda University

Author(s) : Tingting WU (Nanjing University of Posts and Telecommunications)

[02603] AN H^1 GALERKIN MIXED FINITE ELEMENT METHOD FOR ROSENAU EQUATION

Session Time & Room : 4D (Aug.24, 15:30-17:10) @E711

Type : Contributed Talk

Abstract : In this paper, by applying a splitting technique, the non-linear fourth order Rosenau equation is split into a system of coupled equations. Then, an H^1 Galerkin mixed finite element method is proposed for the resultant equations after employing a suitable weak formulation. Semi-discrete and fully discrete schemes are discussed and respective optimal order error estimates are obtained without any constraints on the mesh. Finally, numerical results are computed to validate the efficacy of the method. The proposed method has advantages in respect of higher order error estimate, less requirement of regularity on exact solution and also with reduced size i.e. less than half of the size of resulting linear system over that of mentioned in Manickam et al., Numerical Methods for Partial Differential Equations, (14), (1998), pp. 695-716.

Classification : 65N30, 65N06, 65M60, 65M06

Format : Talk at Waseda University

Author(s) : Jones Tarcius Doss (Department of Mathematics, Anna University, Chennai)

[02604] Particle dynamics in the KP approximation

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E702

Type : Contributed Talk

Abstract : The Kadomtsev-Petviashvili (KP) equation is a model equation describing weakly nonlinear dispersive and small amplitude waves propagating in a quasi-two-dimensional situation. Encoded in the KP model are relations that may be used to reconstruct the velocity fields in the fluid below a given surface wave. In this talk, velocity fields associated to exact solutions of the KP equation are found, and particle trajectories are computed numerically. The solutions treated here comprise the one line-soliton solution and two-soliton solutions.

Classification : 65M25, 37M05

Format : Talk at Waseda University

Author(s) : Juan-Ming Yuan (Providence University) Jen-Hsu Chang (National Yang Ming Chiao Tung University) Henrik Kalisch (University of Bergen) Yusuke Shimabukuro (Math. Inst.)

[02606] Modeling Indonesian Government Bond Yield Curve during Covid-19 Pandemic Time

Session Time & Room : 3C (Aug.23, 13:20-15:00) @E504

Type : Contributed Talk

Abstract : Yield curve in bond investment will provide visualization of yields of bond as the function of the time to maturities. In this study, we analyze Indonesian Government Yield Curve (IGYSC) during the pandemic Covid-19. We apply the Nelson Siegel (NS) class model and compare the performance of the optimization method of based on numerical optimization and based on heuristic optimization. All the computation are done using R software.

Classification : 62J02, 62P05, 65K05, 68W50, 90C20

Format : Talk at Waseda University

Author(s) : Dedi Rosadi (Universitas Gadjah Mada) Dinda Awanda Ramadhani (Universitas Gadjah Mada) Agus Sihabuddin (Universitas Gadjah Mada)

[02608] Explorative computing for stable and consistent kinetic relaxation in lattice Boltzmann methods

Session Time & Room : 3E (Aug.23, 17:40-19:20) @E604

Type : Contributed Talk

Abstract : Using lattice Boltzmann methods with multiple relaxation times for robust and fast incompressible turbulent flow simulations requires tuning of the kinetic parameters. We outsource the perfect parallelizability of lattice Boltzmann methods to analyze kinetic relaxation with respect to non-linear stability and consistency based on explorative computing of artificial turbulence in three dimensions. Conclusively, numerical indication is provided, that accuracy and dissipation is adaptively balanced near the BhatnagarGrossKrook single relaxation time approximated in the scale-resolving limit.

Classification : 65M12, 35Q20, 35Q30, 76D05

Format : Talk at Waseda University

Author(s) : Stephan Simonis (Karlsruhe Institute of Technology) Mathias J. Krause (Karlsruhe Institute of Technology)

[02609] Reliable and efficient a posteriori error estimates for time-dependent wave equations

Session Time & Room : 2E (Aug.22, 17:40-19:20) @F310

Type : Contributed Talk
Abstract : I will discuss a novel equilibrated a posteriori error estimator for the space (semi) discretization of the scalar wave equation by finite elements. Specifically, I will show that the estimator provides fully-guaranteed upper bounds that are asymptotically constant-free and that it is efficient and polynomial-degree-robust, meaning that the efficiency constant does not deteriorate as the approximation order is increased. To the best of my knowledge, this work is the first to propose an estimator for the wave equation that is provably reliable and efficient in the same norm. I will present numerical examples illustrate the theory and suggest that it is sharp.
Classification : 35L05, 65M15, 65M20, 65M60
Format : Talk at Waseda University
Author(s) : Thophile Chaumont-Frelet (Inria)

[02610] Discrete Tensor Product BGG Sequences: Splines and Finite Elements

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E705

Type : Contributed Talk
Abstract : In this talk, we present a systematic discretization of the Bernstein-Gelfand-Gelfand diagrams and complexes over cubical meshes of arbitrary dimension via the use of tensor-product structures of one-dimensional piecewise-polynomial spaces, such as spline and finite element spaces. We demonstrate the construction of the Hessian, the elasticity, and div-div complexes as examples for our construction.
Classification : 65N99, 41A15, 41A63, 65N30
Format : Talk at Waseda University
Author(s) : Duygu Sap (University of Oxford) Kaibo Hu (University of Oxford) Guido Kanschat (Heidelberg University) Francesca Bonizzoni (Politecnico di Milano)

[02614] Convergence of a Second-Order Scheme for Nonlocal Traffic Flow Problems

Session Time & Room : 4E (Aug.24, 17:40-19:20) @E506

Type : Contributed Talk

Abstract : In this work, we focus on the construction and convergence analysis of a second-order numerical scheme for traffic flow models that incorporate non-local conservation laws to capture the interaction between drivers and the surrounding density of vehicles. Specifically, we combine MUSCL-type spatial reconstruction with strong stability preserving Runge-Kutta time-stepping to devise a fully discrete second-order scheme for these equations. We show that this scheme satisfies a maximum principle and obtain bounded variation estimates. Also, the scheme is shown to admit L1-Lipschitz continuity in time. Subsequently, employing the Kolmogorov's theorem with a modification and using a Lax-Wendroff type argument, the convergence of this scheme to the entropy solution of the underlying problem is established. Numerical examples are presented to validate our theoretical analysis. Additionally, we extend our analysis to two dimensional non-local problems, for which we present a positivity preserving second-order scheme. While first-order methods are typically reliable in computational fluid dynamics, higher-order methods can provide more accurate solutions at the same computational cost, especially for problems in two or three dimensions. Our proposed scheme thus has important implications for accurately approximating traffic flow equations, and our theoretical analysis provides a solid foundation for its practical implementation.

Classification : 35L65, 65M12, 65M08

Format : Talk at Waseda University

Author(s) : Nikhil Manoj (Indian Institute of Science Education and Research, Thiruvananthapuram) Sudarshan Kumar K (IISER Thiruvananthapuram) GD Veerappa Gowda (Center for Applicable Mathematics, TIFR Bangalore)

[02615] Theory of the cell motility mechanism in the absence of adhesions

Session Time & Room : 4E (Aug.24, 17:40-19:20) @D514

Type : Contributed Talk

Abstract : The existing paradigm of the cell motility cycle does not hold for in vivo cell movement in complex 3D environments. In physiologically relevant environments, cells frequently use pressure-driven round membrane protrusions for locomotion. The role of substrate adhesion is minimal, and it remains unknown if and how a cell can migrate without any adhesions. Here, we leverage modeling and computational tools to reveal the step-by-step cycle of locomotion for cells that use blebs as leading-edge protrusions in confined environments. We show that cells cannot effectively migrate when the cell cortex is a purely elastic material, even with asymmetric channel geometry. Cells migrate effectively if actin turnover is included with a viscoelastic description for the cortex. Lastly, we compare with previous experimental findings and identify the spatiotemporal force distribution during a motility cycle.

Classification : 92Bxx, 76Zxx

Format : Talk at Waseda University

Author(s) : Calina Anamaria Copos (Northeastern University) Calina Copos (Northeastern University) Wanda Strychalski (Case Western Reserve University)

[02619] Interplay of two finite reservoirs in bidirectional system

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G601

Type : Contributed Talk

Abstract : Motivated by the interplay of multiple species in several real world transport processes, we propose a bidirectional totally asymmetric simple exclusion process with two finite reservoirs regulating the inflow of oppositely directed particles corresponding to two different species. The systems stationary characteristics such as densities, currents, etc., are investigated using a theoretical framework based on mean-field approximation and are supported by extensive Monte Carlo simulations. The impact of species, quantified by filling factor, has been comprehensively analyzed.

Classification : 35Lxx, 70Exx, 70Lxx, 37Axx

Format : Talk at Waseda University

Author(s) : Ankita Gupta (Indian Institute of Technology Ropar) Bipasha Pal (Stockholm University) Arvind Kumar Gupta (Indian Institute of Technology Ropar)

[02620] Power contraction of RAS with local impedance problems for the Helmholtz equation

Session Time & Room : 5D (Aug.25, 15:30-17:10) @E709

Type : Contributed Talk

Abstract : The Helmholtz equation is notoriously difficult to solve, especially for the case of high wavenumber. The Restricted Additive Schwarz preconditioner with local impedance problems, often called the ORAS method, is arguably the most successful one-level parallel method for Helmholtz problems. This preconditioner can be applied on very general geometries, does not require parameter-tuning, and can even be robust to increasing wavenumber. To date, there is relatively little convergence analysis for this method. In the talk, I will present a novel analysis of the ORAS method.

Classification : 65N55

Format : Talk at Waseda University

Author(s) : Shihua Gong (The Chinese University of Hong Kong, Shenzhen)

[02621] Effect of magnetic field on natural convection through infinite plates with ramped velocity

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G401

Type : Industrial Contributed Talk

Abstract : In this talk , we found the analytical solution of unsteady free convective flow of an electrically conducting and viscous incompressible fluid between two infinite parallel plates when one plate moves with a ramped velocity. An applied Magnetic field has been taken into consideration. Laplace transform techniques were used to find the non-dimensional governing equations analytically. The effect of various values for magnetic field magnetic parameter, Grashof number and time parameter are demonstrated graphically.

Classification : 26A33, 33C65, 33C20

Format : Online Talk on Zoom

Author(s) : Sangeeta Kumari (Chandigarh University) Vanita Vatsa (Depaertment of Mathematics, DCRUST, Murthal, INDIA)

[02625] Topology-Driven Shape Programmability in Tissue Morphogenesid

Session Time & Room : 5D (Aug.25, 15:30-17:10) @D514

Type : Contributed Talk

Abstract : The ability of a pre-patterned and subsequently activated spontaneous strain field to drive shape transformations has gained increasing appreciation in device design, engineering, and the physics of metric shape-programmability. Many of these ideas may also hold relevance for understanding tissue morphogenesis. We show spatiotemporal patterns of active cell behaviours can be coarse-grained to yield similar spontaneous strain fields, and how topological defects in these fields can organise shape outcomes and provide robustness against natural variability.

Classification : 92C05, 92C15, 74M05, 92-10, 92-08

Format : Talk at Waseda University

Author(s) : Carl D Modes (Max Planck Institute of Molecular Cell Biology and Genetics)

[02626] Use of Origami Maths for minimizing packing & wrapping cost

Session Time & Room : 4C (Aug.24, 13:20-15:00) @G301

Type : Contributed Talk

Abstract : By using the knowledge of mathametical Origami &Kirigami (Japanese art using principles of topology, operational research & statistics) An analytical study was done to make 3D boxes,in triangular,cubical,spherical,Polihedron etc.shape with maximum volumes and minimum raw material. Boxes of different shape may be made by twisting & folding. Pop up boxes, cartons& Mobius strips can also be made by the same method to minimize the cost of packing & wraping of manufactured products.

Classification : 00A05

Format : Talk at Waseda University

Author(s) : Krishna Krishna (INDIAN ORIGAMI SOCIETY)

[02635] Application of mathematics in large-scale agriculture projects

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D408

Type : Industrial Contributed Talk

Abstract : Two large-scale projects, each involving a consorcium of breeding, growing and processing companies from potato industry in the Netherlands will be described, with the emphasis on the increasingly important role the mathematics is playing in these projects. Applied mathematics is required at the three major stages: design of experiments, data pre-processing, and association-regression studies. Successes and current challenges will be discussed.

Classification : 92F05, 65Z05, 62J02, 62J05, 62J07, mathematics for agriculture

Format : Talk at Waseda University

Author(s) : Neil Budko (Delft University of Technology)

[02638] A note on contribution of finite difference methods for fractional diffusion equations

Session Time & Room : 2C (Aug.22, 13:20-15:00) @G710

Type : Contributed Talk

Abstract : Since the last two decades, extensive research has been carried out on the numerical solution of fractional diffusion equations, particularly in finite difference methods. The finite difference schemes play a crucial role in obtaining the solution of fractional diffusion equations. The most popular are the explicit finite difference method, implicit finite difference method, and Crank-Nicolson finite difference method. This article focuses on developing finite difference schemes for fractional diffusion equations. Also, the stability and convergence of finite difference methods will be discussed by using the matrix norm method. Moreover, it will compare methods in the sense of accuracy and rate of convergence of these schemes. The last section will be devoted to the test problems.

Classification : 35R11, 65M06, 65M12

Format : Talk at Waseda University

Author(s) : GUNVANT ACHUTRAO BIRAJDAR (Department of Mathematics, Institute of Chemical Technology, Mumbai)

[02639] ON HYPERSOFT TOPOLOGY

Session Time & Room : 1C (Aug.21, 13:20-15:00) @

Type : Contributed Talk

Abstract : Hypersoft sets have acquired more importance as a generalization of soft sets and have been researched for possible extensions in many fields of Mathematics. In this paper we introduce the notion of hypersoft topological spaces using hypersoft sets and also we introduce and study the concepts of closure, interior and limit point of hypersoft sets.

Classification : 03E72, 06D72, 54A40, 91B06

Author(s) : INTHUMATHI V (Associate Professor) AMSAVENI M (Research Scholar)

[02640] High-Order Finite Element Schemes for Multicomponent Flow Problems

Session Time & Room : 4D (Aug.24, 15:30-17:10) @E711

Type : Contributed Talk

Abstract : The StokesOnsagerStefanMaxwell (SOSM) equations model the flow of concentrated mixtures of distinct chemical species in a common thermodynamic phase. We derive a novel variational formulation of these nonlinear equations in which the species mass fluxes are treated as unknowns. This new formulation leads to a large class of high-order finite element schemes with desirable linear-algebraic properties. The schemes are provably convergent when applied to a linearization of the SOSM problem.

Classification : 65N30, 76T30, 35Q35

Format : Talk at Waseda University

Author(s) : Aaron Matthew Baier-Reinio (University of Oxford) Patrick Farrell (University of Oxford)

[02641] Reconstructing electron backscatter diffraction data using vectorized total variation flow

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G702

Type : Contributed Talk

Abstract : Polycrystalline materials consist of crystal grains with distinct grain orientations and crystal structure. Electron backscatter diffraction is used to record the grain orientation. This orientation data might contain noise as well as the missing regions.

We propose reconstructing the orientation data using weighted total variation flow, which is a pde obtained from solving the minimization problem. We then fill the missing region using the TV flow. This talk discusses the application of this reconstruction technique.

Classification : 35A15

Author(s) : Emmanuel Atoleya Atindama (Clarkson University) Prashant Athavale (Clarkson University) Gunay Dogan (National Institute of Standards and Technology)

[02647] Poincar operators for BGG complexes

Session Time & Room : 5D (Aug.25, 15:30-17:10) @F402

Type : Contributed Talk

Abstract : Poincar integral operators give explicit potential and provide an inverse of differential operators in the sense of null-homotopy. These operators play a key role in the mathematical and numerical analysis of fluid and electromagnetic problems. Consequences include the well-posedness of the Stokes problem and the p-robustness of high-order finite element methods. In this talk, we derive such operators for the Bernstein-Gelfand-Gelfand (BGG) complexes with potential applications in elasticity and relativity. The idea is to carry over the results for the de-Rham complex by Costabel and McIntosh to these cases by homological algebra.

Classification : 58J10, 35N05, 58A12, 58A14, 65N30, finite element methods, Hilbert complexes, Bernstein-Gelfand-Gelfand construction, applied analysis

Format : Talk at Waseda University

Author(s) : Andreas ap (University of Vienna) Kaibo Hu (University of Oxford)

[02652] A multi-parametric approach for solid transportation problem under uncertainty conditions

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A201

Type : Contributed Talk

Abstract : Since most real-life issues take place in an imprecise environment, the uncertain parameters of models based on these issues are also more realistic. In the meantime, transportation issues are no exception. Uncertainty in solid transportation problems is one of the most important issues of the economy of each country and one of the applied issues in operations research too. In this research, we present a new two-phase approach based on the parametric method for solving solid transportation problem with fuzzy objective coefficients and flexible constraints. In this method, better use of resources is done, and it achieved the maximum satisfaction level.

Classification : 90B50

Author(s) : Seyed Hadi Nasseri Ojaki (Department of Mathematics Department of applied mathematics, University of Mazandaran) Amirhossein Nafei (National Taipei University of technology, Taipei , Taiwan) Seyedeh Zehra Nasseri Ojaki (Department of Computer Engineering, Noshirvani University of Technology, Babol, Iran)

[02653] Random generation of Phylogenetic networks

Session Time & Room : 1C (Aug.21, 13:20-15:00) @

Type : Contributed Talk

Abstract : Phylogenetic networks are complex structures used to represent evolutionary histories with reticulate events. Random generation of such networks is a fundamental problem in phylogenetics, as it allows for the exploration of the space of possible networks and can provide insights into the properties of the space. In this paper, we present a new algorithm for the random generation of phylogenetic networks with Boltzmann sampling. The algorithm uses a probabilistic model based on the decomposition of a network into smaller subnetworks, which are then sampled independently. The Boltzmann factor is used to control the frequency of the different subnetwork types in the generated network ensemble. We show that our algorithm is efficient, accurate and can generate diverse sets of networks with different properties. Our algorithm is expected to be useful in various applications, such as testing the performance of phylogenetic methods, exploring the space of evolutionary histories, and simulating reticulation events in biological systems.

Classification : 05-xx
Author(s) : Marefatollah Mansouri (University of Vienna)

[02661] Practicing Responsible Computation and Innovation in HPC: A Sociotechnical Approach

Session Time & Room : 3E (Aug.23, 17:40-19:20) @D502

Type : Industrial Contributed Talk
Abstract : Recent advances in high performance computing (HPC) and artificial intelligence (AI) have reignited discussions for more responsible and ethical computing regarding the use and design of HPC sociotechnical ecosystems within the context of cultures and evolving societal norms. This contributed talk provides practical guidelines derived from computational and social science that scientists, educators, and practitioners alike can employ to become more aware of personal values that may unconsciously shape approaches to computation and ethics.
Classification : 91C99, 68-01, 68-04, 68N01, ethics, sociotechnical approach, responsible computing
Format : Talk at Waseda University
Author(s) : Elaine M. Raybourn (Sandia National Laboratories) Osni Marques (Lawrence Berkeley National Laboratory) Killian Muollo (Sandia National Laboratories)

[02664] Numerical compression of QMC rules for integration

Session Time & Room : 4C (Aug.24, 13:20-15:00) @E704

Type : Contributed Talk
Abstract : We introduce an algorithm for Tchakaloff-like compression of Quasi-Monte Carlo (QMC) volume or surface integration of bivariate and trivariate compact domains.
The key tools of the algorithm are Davis-Wilhelmsen theorem on the so-called Tchakaloff sets for positive linear functionals on polynomial spaces, and Lawson-Hanson algorithm for NNLS.
We provide various examples, focusing, in particular, on the compression of volume and surface integration on union of balls.
Classification : 65D32, 65D30
Format : Online Talk on Zoom

Author(s) : Giacomo Elefante (University of Padova) Alvise Sommariva (University of Padova) Marco Vianello (University of Padova)

[02665] Modelling metal biosorption on algae-bacteria granular biofilms

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G809

Type : Contributed Talk

Abstract : A multiscale mathematical model describing the metals biosorption on algal-bacterial photogranules within a sequencing batch reactor is presented. The model is based on systems of mixed PDEs on a spherical free boundary domain and IDEs derived from mass conservation principles. The model is integrated numerically to examine the role of the microbial species and EPS in the adsorption process, and the effect of metal concentration and biofilm adsorption properties on metal removal.

Classification : 35R35, 35L45, 92-10, 92B05

Format : Talk at Waseda University

Author(s) : Fabiana Russo (Temple University) Alberto Tenore (Department of Mathematics and Applications "R. Caccioppoli", University of Naples Federico II) Maria Rosaria Mattei (Department of Mathematics and Applications "R. Caccioppoli", University of Naples Federico II) Luigi Frunzo (Department of Mathematics and Applications "R. Caccioppoli", University of Naples Federico II)

[02666] Dynamics of biofouling in microfiltration systems

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G809

Type : Contributed Talk

Abstract : Membrane technology is one of the most promising engineering strategies for freshwater production and wastewater treatment. The major concern results in the formation of a fouling layer leading to increasing hydraulic resistance and flux decline during membrane operations. A one-dimensional continuous model has been developed by considering a free boundary value problem describing biofouling dynamics in membrane bioreactors. Numerical results demonstrated the model accuracy in predicting biofouling effects and the implications on process management.

Classification : 35R35, 35L45, 92-10, 92B05

Format : Talk at Waseda University

Author(s) : Vincenzo Luongo (University of Naples Federico II) Nicholas Cogan (Florida State University)

[02667] Coupled Active Contour Segmentation of Clue Cells from Immunofluorescence Microscopy

Session Time & Room : 5C (Aug.25, 13:20-15:00) @D515

Type : Contributed Talk

Abstract : Presence of clue cells is a critical criterion for diagnosis of bacterial vaginosis. We propose a coupled active contour model for segmenting the clue cells from immunofluorescence microscope images of the samples. It enables jointly segmenting the boundaries of the epithelial cell, its nucleus, and distinct bacteria. Convexification is formulated on top of the levelset framework using characteristic functions. Our approach provides a global optimal solution. Efficacy of the method is demonstrated on clinical data.

Classification : 92C55, 92C50, 49N99, 90C25

Format : Talk at Waseda University

Author(s) : Yongjian Yu (Axon Connected, LLC) Jue Wang (Union College)

[02670] Glacier sliding as a viscous fluid flow modulated by cavitation

Session Time & Room : 4E (Aug.24, 17:40-19:20) @D401

Type : Contributed Talk

Abstract : Glacial ice slides due to lubrication by a thin film of water. Separation of ice from the bed results in water-filled cavities that modulate the stress balance, with important implications for glacier flow. We model the problem as a linearised Stokes flow over a wavy boundary. Complex variable methods are used to solve a Riemann-Hilbert problem that is coupled to a kinematic equation for cavity size. The model is used to discuss glacier friction laws.

Classification : 76M40, 86A40, 76D07, 76M45

Format : Talk at Waseda University

Author(s) : Ian Hewitt (University of Oxford)

[02673] Reduced-order Modelling of Normal Elastohydrodynamic Collision of Spheres

Session Time & Room : 3C (Aug.23, 13:20-15:00) @D403

Type : Contributed Talk

Abstract : I present a model for the normal impact of two elastic spheres colliding in incompressible constant-viscosity Newtonian fluid. Pressure is modelled by the Reynolds lubrication equation, and sphere deformation by Hertz contact theory. Modelling the radial pressure gradient by a Pad'e approximant that is characterized by the centerline gap and curvature, and by rate of gap closing, the problem is reduced to a fourth-order system of ODEs that can be integrated numerically in time.

Classification : 76Txx, 74Fxx, 70Gxx

Format : Talk at Waseda University

Author(s) : John C. WELLS (Ritsumeikan University)

[02674] General Equilibrium with Unhedgeable Fundamentals and Heterogeneous Agents

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A508

Type : Contributed Talk

Abstract : We solve a general equilibrium model in which aggregate consumption has uninsurable growth shocks, rendering the market dynamically incomplete. Agents' stochastic discount factors depend on the history of unhedgeable shocks, agents trade assets dynamically, and the dispersion of agents' preferences impacts both the interest rate and asset prices, hence no representative agent exists.

Classification : 91B50

Format : Talk at Waseda University

Author(s) : Marko Hans Weber (National University of Singapore) Paolo Guasoni (Dublin City University)

[02680] An analysis of a model of fear in disease transmission

Session Time & Room : 4C (Aug.24, 13:20-15:00) @A601

Type : Contributed Talk

Abstract : A model for disease transmission has been proposed that includes fear response both to disease and vaccine. It has been shown numerically that public health restrictions can create a bifurcation in the final size of the epidemic. In this talk we analyze this model to determine analytic conditions for stability and bifurcations to final disease size. We modify the model with additional terms such as adverse reactions from disease and a double-fear compartment.

Classification : 92-10, 92D30, 91D30, 91F99

Format : Talk at Waseda University
Author(s) : Iain Moyles (York University) Rebecca Tyson (University of British Columbia Okanagan) Avneet Kaur (University of British Columbia Okanagan)

[02683] When to Sell an Asset? A Distribution Builder Approach

Session Time & Room : 3C (Aug.23, 13:20-15:00) @A508

Type : Contributed Talk
Abstract : We revisit the question of the optimal time of an asset sale from the point of view of Sharpes Distribution Builder approach: Instead of assuming the investors risk preferences in form of a utility function, the investor provides themself a distribution that should be attained when selling the asset at a stopping time (specified a priori). This obviously begs the question of which distributions are attainable for an investor. We connect this problem to the Skorokhod embedding problem for one-dimensional diffusions and provide explicit representation for optimal stopping times as well as their expected values. In the case that the target distribution is specified from a parametrized family (e.g., log-normal distributions), we show that optimality involves a mean-variance trade-off similar to the efficient frontier in Markowitzs approach to portfolio optimization. This is joint work with Peter Carr.
Classification : 91B70, 60G40
Format : Talk at Waseda University
Author(s) : Stephan Sturm (Worcester Polytechnic Institute)

[02686] Double Conical degeneracy on band structures of periodic Schrdinger operators

Session Time & Room : 4E (Aug.24, 17:40-19:20) @E711

Type : Contributed Talk
Abstract : Our work investigates double Dirac cones occurring near fourfold degenerate points in the band structures of certain operators. It is known that such degeneracy originates in the symmetries of operators. Thus, we introduce a new symmetric structure-the super honeycomb structure and an innovative method to incorporate all the symmetries. Both rigorous proof and numerical simulation of the existence of double Dirac cones in the bands of Schroedinger operators with super honeycomb symmetries will be shown.
Classification : 68Q25, 68R10, 68U05

Format : Talk at Waseda University
Author(s) : Ying Cao (Tsinghua University)

[02687] Semi-Markov Compartment Models

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G306

Type : Contributed Talk
Abstract : Compartment models are a widely used class of models that are useful when considering the flow of objects or people or energy between different labelled states, referred to as compartments. Recently we have constructed a general framework for fractional order compartment models, where the governing equations involve fractional order derivatives, via the consideration of a semi-Markov stochastic process. Here we show extensions to this approach to obtain more general operators.
Classification : 34A08, 60K40, 92C45
Format : Talk at Waseda University
Author(s) : Christopher Angstmann (University of New South Wales) Bruce Henry (University of New South Wales)

[02688] Analytical Solutions of Delay Differential Equations

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G401

Type : Contributed Talk
Abstract : Delay differential equations are an interesting class of non-local equations that involve a function and its derivatives evaluated at different points in time. By introducing a new class of functions, we have been able to provide fundamental solutions for autonomous linear delay differential equations. These functions, referred to as delay functions, relate the power series solutions of ordinary differential and delay differential equations and can be easily extended to more generalised series solutions.
Classification : 34Kxx, 34K06, 44A10
Format : Talk at Waseda University
Author(s) : Stuart-James Malouf Burney (University of New South Wales) Christopher Angstmann (University of New South Wales) Bruce Henry (University of New South Wales) Byron Jacobs (University of Johannesburg) Zhuang Xu (University of New South Wales)

[02689] Double Dirac Cone in Subwavelength Bandstructure

Session Time & Room : 4E (Aug.24, 17:40-19:20) @G501

Type : Contributed Talk

Abstract : In this talk we wish to rigorously justify the existence of the double Dirac point for the super-honeycomb lattice in the subwavelength regime. First, we will give a rigorous characterization of the symmetry conditions. Then, representing the solution by periodic layer potentials when the frequency is nonzero, we can asymptotically solve the band structure by the periodic capacitance matrix. We also study how the perturbation to the inclusions affect the band structure numerically.

Classification : 35C20

Format : Talk at Waseda University

Author(s) : Borui Miao (Tsinghua University) Yi Zhu (Yau Mathematical Sciences Center)

[02692] Discovering extremal domains via shape optimization for passive tracers

Session Time & Room : 5D (Aug.25, 15:30-17:10) @G602

Type : Contributed Talk

Abstract : Work in passive tracers investigates how properties of a tracer distribution depend on boundary conditions and properties of the underlying fluid flow. We apply shape optimization to discover extremal domains for Poiseuille flow informed by analytic predictions of spatial moments - such as mean, effective diffusivity, skewness - derived in prior work. With this combination of asymptotic formulas and numerical study, we find and report on surprising nonlinear behavior depending on shape parameters.

Classification : 35Kxx, 90C90

Format : Talk at Waseda University

Author(s) : Manuchehr Aminian (California State Polytechnic University Pomona)

[02695] The position of the axon initial segment assembly site can be predicted from the shape of the neuron

Session Time & Room : 3D (Aug.23, 15:30-17:10) @E820

Type : Contributed Talk

Abstract : A unique compartment called the axon initial segment (AIS) was found critical for the proper development of neuronal polarity. It is unclear how AIS is assembled near the proximal end of the axon during axon specification. In this study, we show that the position of the AIS assembly site is correlated with the zero set of the leading eigenfunction of the Laplace-Beltrami operator solved over the geometry of the neuron. We will then discuss the implications from this observation.

Classification : 92C20, 92C15

Format : Talk at Waseda University

Author(s) : Zhuang Xu (The University of New South Wales) Paul Curmi (University of New South Wales) Christopher Angstmann (University of New South Wales)

[02701] Pricing Multi-Asset American Options in Dynamic Programming with Sparse Grids

Session Time & Room : 4C (Aug.24, 13:20-15:00) @E507

Type : Contributed Talk

Abstract : We introduce a sparse grid interpolation and quadrature scheme for pricing multi-asset American option based on dynamic programming. At each time step, we take advantage of the smoothness of the continuation value function, allowing for fast convergence of interpolation. In the multi-dimensional spatial domain, conditional expectations are estimated by sparse grid quadrature or QMC, depending on the asset models. Our algorithm is proven to have accurate error estimates, and numerical experiments demonstrate its efficiency.

Classification : 65D40, 65Kxx

Format : Talk at Waseda University

Author(s) : Jiefei Yang (The University of Hong Kong) Guanglian Li (The University of Hong Kong)

[02702] A mathematical model of cell expansion for cultivated meat production

Session Time & Room : 4D (Aug.24, 15:30-17:10) @D408

Type : Contributed Talk

Abstract : Cultivated meat represents a cruelty-free alternative to conventional production methods of animal protein. However, it currently faces pressing technological challenges that curtail its commercial viability. To facilitate its industrial scale-up, we propose a mathematical model of metabolism of a stem cell expansion system, a key step in the production of lab-grown meat. We evaluate our model with numerical simulations and perform a global parameter sensitivity analysis to gain further insights about our system

Classification : 92-10, 92C75, 92B05

Author(s) : Julia Krol (Mathematical Institute, University of Oxford) Sarah Waters (Mathematical Institute, University of Oxford) Hua (Cathy) Ye (Department of Engineering, Univeristy of Oxford) Akin Odeleye (Ivy Farm Technologies)

[02907] Robust Train Trajectory Optimization

Session Time & Room : 3E (Aug.23, 17:40-19:20) @G402

Type : Contributed Talk

Abstract : Variating operating conditions may produce delays in railways. We model the Robust Train Trajectory Optimization (RTTO) problem aiming to minimize the impact of model parameter uncertainty on the calculated energy-efficient trajectories, which would be drivable under any of the considered operating conditions. We analyze RTTO using the Robust Maximum Principle, reformulate the problem as a Quadratically-Constrained Quadratic Programming problem and showcase the performance of the model in a real case study.

Classification : 34H05, 49K35, 93-08, 90C47, 90C25

Format : Talk at Waseda University

Author(s) : Alex Cunillera (Delft University of Technology) Ramon M. Lentink (Nederlandse Spoorwegen) Niels van Oort (Delft University of Technology) Rob M. P. Goverde (Delft University of Technology)

[02961] An analysis of boundary variations in Laplace-Steklov eigenvalue problems

Session Time & Room : 2E (Aug.22, 17:40-19:20) @G402

Type : Contributed Talk

Abstract : We analyze the influence of boundary perturbations on the spectrum of Laplace-Steklov eigenvalue problems. Both the differential equation and a boundary condition involve the spectral parameter. We derive Hadamard type expressions for the variation of the eigenvalues as the problem domain deforms. Consequently, we provide the convergence characteristics of the eigenvalues on the perturbed domain as its boundary approaches to that of the unperturbed one. Numerical results are obtained using a finite element formulation.

Classification : 35-XX, 65-XX, FEM analysis of eigenvalues in PDEs

Format : Talk at Waseda University

Author(s) : nder Trk (Middle East Technical University)Eylem Bahadr (Gebze Technical University)