THE 2015

AMMCS-CAIMS CONGRESS

JUNE 7–12

WATERLOO, ONTARIO, CANADA

CONGRESS PROGRAM

Program Chair

Herb Kunze

Interdisciplinary AMMCS Conference Series

SCMAI CAIMS

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Students				
McMaster University	Diogo Poças			
Wilfrid Laurier University	Saqif Abdullah	Alysha Ahlin	Shazma Ameen	Zaamilah Balasubramaniam
	Moosa Baque	Andrew Harris	Bowen Hu	Syeda Hussain
	Maryo Ibrahim	Igor Ivashev	Nilam Lakhani	Anisha Mahant
	Zhijun Mao	Katia McDougall	Mbika Nfor	Kenneth Onuma
	Januka Shanmugarajah	Shada Tabet	Yuchen Zhu	Bingxia Zong
University of Guelph	Adrian Lee			
University of Waterloo	Amenda Chow	Moriah Magcalas	Lorena Cid Montiel	Alexander Howse
	Philip McCarthy	Krishan Rajaratnam		

2. Welcome

Welcome to the 2015 AMMCS-CAIMS Congress

On behalf of the Organizing, Scientific and Technical Committees of the 2015 AMMCS-CAIMS Congress, we would like to welcome you to this exciting event held from June 7 through 12, 2015 on the Waterloo Campus of the Wilfrid Laurier University, Canada.

The Congress is an international event combining the AMMCS and CAIMS meetings at the same location. The AMMCS Conference Series aims at promoting interdisciplinary research and collaboration involving mathematical, statistical and computational sciences within a larger international community. It focuses on recent advances in Applied Mathematics, Modeling and Computational Science (AMMCS). The Canadian Applied and Industrial Mathematics Society has a growing presence in industrial, mathematical, scientic and technological circles within and outside of Canada. CAIMS is a member society of the International Council for Industrial and Applied Mathematics, which hosts the ICIAM Congresses every four years. The first AMMCS meeting in 2011 was a satellite event of this International Congress held in Vancouver.

The present Congress has a number of embedded events, among which are the 23rd Annual Conference of the Computational Fluid Dynamics Society of Canada, the 2nd Canadian Symposium on Scientific Computing and Numerical Analysis, and others. This year the AMMCS-CAIMS Congress has an exciting scientific program featuring about 40 special and contributed sessions in several parallel tracks, 12 one-hour talks given by distinguished scientists and mathematicians, as well as 5 semi-plenary speakers. The Congress will also feature CAIMS Prize Winners lectures, and a number of student prizes and young researcher awards will be presented, including the AMMCS Kolmogorov-Wiener Prize for Young Researchers.

Each day of the Congress, the scientific program starts with a plenary session that features one of the Congress plenary speakers. The scientific program of the Congress provides a unique opportunity for in-depth technical discussions and exchange of ideas in applied mathematics, computational science and mathematical modeling with their applications in natural and social sciences, engineering and technology, industry and finance. We are proud that this Congress, combining the traditional AMMCS and CAIMS meetings, is held this year on the campus of Wilfrid Laurier University. It is the oldest university in the Cambridge-Kitchener-Waterloo-Guelph area, a beautiful part of Southwestern Ontario located in a comfortable driving distance from some of North Americas major tourist destinations, including the Niagara Escarpment, a UNESCO World Biosphere Reserve, Toronto and Niagara Falls. On behalf of the Organizing, Scientific and Technical Committees, we would like to thank all people involved in this event. In particular we would like to express our sincere thanks to special session and scientific theme organizers, to all the authors who submitted valuable results forming the basis of conference, and to our sponsors.

Thanks to all for your hard work to ensure a dynamic, enjoyable and professionally fulfilling conference. We also hope that you will enjoy this beautiful part of the world and will take home with you an intellectually inspiring and socially satisfying experience.

Jacques Bélair , Roman Makarov, and Roderick Melnik

Congress General Chairs

3. Information

Hyperlinks	Other than in this remark, • blue text signifies hyperlinks within this document • magenta text signifies external hyperlinks	
Wireless Network	Congress delegates have free wireless internet service on the Wilfrid Laurier University campus.	For connection information and to obtain a password • please go to the registration desk.
Computers	Rooms BA206 and BA207 contain computers that are available for use by Congress delegates.	For login information • please go to the registration desk.
Parking	Congress delegates may purchase parking passes for $9 per day.	Passes can be purchased at • the registration desk on Monday and Tuesday • the parking kiosk located at the main entrance to the campus, off of University Ave., (cash only) from 8:00 to 16:00.
	There are also two "Pay and Display" lots, with a cost of $9 per day.	Pay by cash or credit card at • the machine in the lot.
	Parking permits allow you to park in the white permit lots only.	
	Parking is free on weekends and after 16:30 on weekdays.	
Public Transit	Wilfrid Laurier University is serviced by routes 7, 8, 12, 29, 200, and 201 on University Ave. West and King St. North.	Route maps are available at • the registration desk • www.grt.ca.

4. Events

(Campus Maps)

Day	Time	Event	Location	Details
Sunday, June 7	19:00-21:00	Welcoming Reception	Science Courtyard	An informal social get-together, with food and drinks served. A conference registration table will be open.
Sunday, June 7	13:00-18:00	CAIMS Board Meeting	N1001	
Monday, June 8	10:30-12:30	NSERC Discovery Grant Information Session	BA201	
Tuesday, June 9	12:00-13:30	CAIMS Annual General Meeting	BA101	
Tuesday, June 9	18:00-20:00	Industrial Mathematics Networking Event	N1001	One-hour panel discussion, including representatives from NSERC and OCE, followed by a reception. Panel members will share their experiences and discuss programs available for students and faculty members interested in starting their own companies. The event is part of the Industrial Math theme, jointly organized by CAIMS, CRM, and PIMS.
Wednesday, June 10 Thursday, June 11	9:30-10:00 14:30-15:00	Congress Poster Sessions	BA Halls	Two-day poster sessions over four coffee breaks
Wednesday, June 10	12:00-12:30	Congress Photo Shoot	BA Lobby	Meet in the Bricker Academic building lobby for the Congress photo shoot
Thursday, June 11	19:00-22:00	Congress Banquet Dinner	The Ballroom, Waterloo Inn, 475 King Street North (Directions)	Banquet tickets will be part of your registration package if you purchased them in advance. Tickets will also be available for purchase at the registration desk until 15:30 on Tuesday, June 9, at a cost of $70. A bus to the banquet location will be provided for those requiring transportation.
Friday, June 12	15:00-17:00	MS2Discovery Institute Meeting	BA202	
Friday, June 12	18:00-18:15	Congress Prize Announcements	BA201	Announcement and awarding of the Congress Prizes

5. Congress Student Prizes and Young Researcher Award

The Congress Prizes will be announced and awarded at the closing of the Congress on Friday, June 12, 18:00-18:15, in BA201.

There are three student prizes, open to undergraduate and graduate students, described in the following table.

AMMCS-CAIMS2015 Prize	Description: To be eligible,
Best Poster	the student must be a co-author of the work presented and a designer of the poster. This competition will include a 10-minute discussion related to the content of the poster with a judging panel.
Best Student Paper in a Special Session	the student must be a co-author of the work and present it during a special session or minisymposium.
Best Student Paper in a Contributed Session	the student must be a co-author of the work and present it during a contributed session.

One additional award is open to young researchers, meaning recent Ph.D. graduates and postdoctoral fellows under the age of 35.

AMMCS-CAIMS2015 Award	Description: To be eligible,
Kolmogorov-Wiener Prize for Young Researchers	the young researcher must a. have earned their PhD degrees within 5 years of January 1 of the year of the award; b. have at least two peer refereed publications, minimum one of which has appeared in an internationally recognized journal; c. have presented their talks at an AMMCS event in the year of the award.

6. Congress Plenary Lectures

Wednesday, June 10, 13:30-14:30, in Room BA201

Réka Albert, Pennsylvania State University

About the speaker: Prof. Reka Albert received her Ph.D. in Physics from the University of Notre Dame (2001), working with Prof. Albert-Laszlo Barabasi. She did postdoctoral research in mathematical biology at the University of Minnesota with Prof. Hans Othmer. Prof. Albert then joined the Pennsylvania State University, where she currently is a Professor of Physics with adjunct appointments in the Department of Biology and the College of Information Science and Technology. Dr. Albert works on predictive modeling of biological regulatory networks at multiple levels of organization. Her pioneering publications on the structural heterogeneities of complex networks had a large impact on the field, reflected in their identification as "Fast breaking paper" and "High impact paper" by Thomson Reuters. Dr. Albert is a fellow of the American Physical Society, where she served as a member-at-large in the Division of Biological Physics. She was a recipient of a Sloan Research Fellowship (2004), an NSF Career Award (2007), and the Maria Goeppert-Mayer award (2011). Her service to the profession includes serving on the editorial board of the journals Physical Review E, The New Journal of Physics, IET Systems Biology, Biophysical Journal, SIAM Journal of Applied Dynamical Systems and Bulletin of Mathematical Biology, on the scientific advisory board of the Mathematical Biosciences Istitute at Ohio State, and as a peer reviewer for more than 35 journals.

Graph analysis and discrete dynamic modeling elucidates the outcomes of within-cell networks

Interaction networks formed by gene products form the basis of cell behavior (growth, survival, apoptosis, movement). Experimental advances in the last decade helped uncover the structure of many molecular-to-cellular level networks, such as protein interaction or metabolic networks. These advances mark the first steps toward a major goal of contemporary biology: to map out, understand and model in quantifiable terms the various networks that control the behavior of the cell. Such an understanding would also allow the development of comprehensive and effective therapeutic strategies.

This talk will focus on my group's recent work on discrete dynamic modeling of signal transduction networks in various organisms. These models can be developed from qualitative information yet show a dynamic repertoire that can be directly related to the real system's outcomes. For example, our model of the signaling network inside T cells predicted therapeutic targets for the blood cancer T-LGL leukemia, several of which were validated experimentally. I will then present an enriched network representation that includes the regulatory logic. Extension of existing graph measures and analyses, performed on this expanded network, allows an efficient way to determine the dynamic repertoire of the network and to predict manipulations that can stabilize or, conversely, block, certain outcomes.

Congress Plenary Lectures

Tuesday, June 9, 13:30-14:30, in Room BA201

Tomasz Bielecki, Illinois Institute of Technology

About the speaker: Tomasz Bielecki is a Professor of Applied Mathematics and the Director of the Master of Mathematical Finance program at Illinois Institute of Technology. He received his PhD degree from the Warsaw School of Economics. Prof. Bieleckis fields of expertise include Stochastic Analysis, Mathematical Finance, and Credit Risk Modeling. He is an Associate Editor of six well-known journals in areas of Mathematics and Finance, including Mathematical Finance and International Journal of Theoretical and Applied Finance. Prof. Bielecki is a co-author of three books in the area of Credit Risk Modeling and Financial Mathematics including his most recent book "Counterparty Risk and Funding: A Tale of Two Puzzles" co-authored with Stéphane Crépey and Damiano Brigo.

Dependence between components of multivariate conditional Markov chains: Markov consistency and Markov Copulae

Modeling of evolution of dependence between processes occurring in financial markets is important. Typically, one can identify marginal statistical properties of individual processes, and then one is confronted with the task of modeling dependence between these individual processes so that the marginal properties are obeyed. We have been advocating, for some time now, to address this modeling problem via the theory of Markov consistency and Markov copulae.

In this talk we shall examine the problem of existence and construction of a non-trivial multivariate conditional Markov chain with components that are given conditional Markov chains. In this regard we shall give sufficient and necessary conditions, in terms of relevant conditional expectations, for a component of a multivariate Markov chain to be a Markov chain in the filtration of the entire chain a property called strong Markov consistency, as well as in its own filtration a property called weak Markov consistency. These characterization results are proved via analysis of the semi-martingale structure of the chain.

Several financial applications will be indicated.

Tuesday, June 9, 8:30-9:30, in Room BA201

Chris Budd, University of Bath

About the speaker: I have broad research interests in interdisciplinary industrial and applied mathematics with a particular interest in complex nonlinear problems arising in real applications. Typically these involve the solution (analytically or numerically) of partial differential equations. A large amount of my work for the last ten years has been in numerical weather prediction and data assimilation in close collaboration with the Met Office (which I visit very frequently). My algorithms are now incorporated into the Met Office operational weather forecasting code where they have made a significant difference to their accuracy and received a Knowledge Transfer Award. I am also working on climate modelling using modern mathematical and computational methods and am actively involved in a number of international climate modelling networks, including CliMathNet which I co-direct and the Maths of Planet Earth programme. I also collaborate with the energy industry, the aerospace industry, the telecommunications industry and the food industry. Anywhere that maths can be applied is of interest to me.

Eight great reasons to do maths

The UK government has identified 8 great technologies which it believes will lead the advancement of science and technology into the future. Mathematics underpins all of these and developments of mathematics will be the engine for future growth in all of them. In this talk I will describe the 8 technologies and look at some of the maths behind them, from Big Data through to Energy.

Monday, June 8, 14:00-15:00, in Room BA201

Wing Kam Liu, Northwestern University

About the speaker: Dr. Wing Kam Liu, Walter P. Murphy Professor of Northwestern University, has made fundamental, innovative contributions to the theory, methodologies, and applications of multiscale simulations towards the understanding and design of nano-materials, polymers science, and multiresolution mechanics. His ISI and Google citations and H factors are (14,200, 60) and (37,750, 88), respectively. In 2014, Liu is selected as a highly cited researcher in Computer Science and a member of the Worlds Most Influential Scientific Minds by Thompson Reuters. Liu developed new exceptional accuracy meshfree methods for simulation of extremely deformation of solids and fluids including additive manufacturing; fractional-order viscoelasticity polymer science; fluid-structure interaction, and applicable to medical imaging. He was the PI of a multi-year multi-million research grant from Goodyear Tire and Rubber Company to develop and integrated design strategy to enable prediction, synthesis and characterization of new polymer nanocomposites to achieve enhanced performance. Liu is current the President of IACM and Chair of USNCTAM; Founding Director of the Summer Institute on Nano Mechanics and Materials; Founding Chair of the ASME NanoEngineering Council; Editors of Computational Mechanics & Int. J. of Applied Mathematics and Mechanics; Honorary Editor of Int. J. of Computational Methods; serve on numerous editorial boards; Consultant to 20+ organizations. Liu has written three books; and he is a Fellow of ASME, ASCE, USACM, AAM, and IACM. Lius selected awards and honors including: 2014 Japan Society for Computational Engineering and Science Grand Prize in recognition of his outstanding contributions in the field of computational mechanics; the Honorary Professorship from Dalian University of Technology in 2013; the 2012 IACM Gauss-Newton Medal; the 2012 ASME Design Automation Conference Best Paper Award; the 2009 ASME Dedicated Service Award, the 2007 ASME Robert Henry Thurston Lecture Award, the 2007 USACM John von Neumann Medal, the 2004 JSME Computational Mechanics Award, the 2002 IACM Computational Mechanics Award, the 2001 USACM Computational Structural Mechanics Award, the 1995 ASME Gustus L. Larson Memorial Award, the 1985 ASME Pi Tau Sigma Gold Medal, the 1979 ASME Melville Medal, the 1989 Thomas J. Jaeger Prize of the ISMIRT, and the 1983 Ralph R. Teetor Educational Award, American Society of Automotive Engineers.

Multiscale Modeling of Soft Materials and Related Biological Responses

Liquids, polymers, gels, foams and a number of biological materials are soft materials, which can be easily deformed by thermal stress or thermal fluctuations. Predominate physical behaviors of these soft materials occur at energy scale comparable with room temperature thermal energy. These behaviors cannot be, or are not easily, to be directly predicted from its atomic or molecular constituents. This is because the soft materials are always self-assemble into mesoscopic structures, which are much larger than the microscopic scale, and yet much smaller than the macroscopic scale of these materials. Especially, the mechanical and physical properties of soft materials originate from the interplay of phenomena at different spatial and temporal scales. As such, it is necessary to adopt multiscale methods when dealing with soft materials in order to account for all important mechanisms. The offerings of this lecture are twofold: (1) establishing a multiscale modeling framework to predict viscoelastic behaviors of polymers through fractional derivatives, (2) rapid computational prototyping and testing of drug carriers in tumor microvasculature through immersed molecular finite element method (IMFEM). In (1), we have incorporated the fractional diffusion of free chains into the integration kernel for the viscoelastic response of polymers and polymer nanocomposites using the Mittag-Leffler function. While conventional models for viscoelastic materials employ a discrete relaxation spectrum, the fractional-order model exhibits a continuous relaxation distribution, which is in accordance with experimental observations. In (2), the IMFEM is used to simulate the whole blood including blood plasma, red blood cells and nanoparticles. We elucidate how the size, shape and stiffness of nanoparticles will affect their dispersions in the microvasculature, with the accurate molecular interactions informed by molecular mean-field theory.

Congress Plenary Lectures

Monday, June 8, 9:00-10:00, in Room BA201

Stéphane Mallat, École Normale Supérieure

About the speaker: Stéphane Mallat received the Ph.D. degree in electrical engineering from the University of Pennsylvania, in 1988. He was then Professor at the Courant Institute of Mathematical Sciences. In 1995, he became Professor in Applied Mathematics at École Polytechnique, Paris. From 2001 to 2007 he was co-founder and CEO of a semiconductor start-up company. In 2012 he joined the Computer Science Department of École Normale Supérieure, in Paris.

Stéphane Mallats research interests include signal processing, computer vision, harmonic analysis and learning. He wrote a "Wavelet tour of signal processing: the sparse way." In 1997, he received the Outstanding Achievement Award from the SPIE Society and was a plenary lecturer at the International Congress of Mathematicians in 1998. He also received the 2004 European IST Grand prize, the 2004 INIST-CNRS prize for most cited French researcher in engineering and computer science, and the CNRS innovation medal in 2014. He was elected at the French Academy of Sciences in 2014.

Learning in High Dimension: from Images to Quantum Chemistry

Learning from data means approximating functionals in high dimensional spaces. Finding strong sources of regularity is necessary to avoid the curse of dimensionality. Invariance to action of small groups such as rigid displacements is too weak, but stability to action of diffeomorphisms is a much stronger property, satisfied by many physical functionals and most signal and image classification problems. We show that it is sufficient to approximate complex high-dimensional classification and regression functionals.

We introduce scattering operators, which are invariants to low-dimensional Lie groups, and Lipschitz continuous to actions of diffeomorphisms. They are computed with iterated multiscale wavelet transforms. These scattering operators provide a Euclidean embedding of geometric distances and a representation of stationary random processes, which captures intermittency phenomena. Applications will be shown for several image classification problems, and for learning quantum chemistry energy functionals.

Friday, June 12, 8:30-9:30, in Room BA201

Kees Oosterlee, Delft University of Technology and CWI

About the speaker: Prof. Kees Oosterlee (http://www.cwi.nl/people/2098, http://ta.twi.tudelft.nl/mf/users/oosterle/) works in numerical analysis and scientific computing at the CWI, center for mathematics and computer science, in Amsterdam, the Netherlands, as well as in the Delft University of Technology. His field of expertise is Computational Finance, working at the interface of numerical and financial mathematics. In Oosterlees group the COS method, pricing financial derivatives efficiently with Fourier cosine expansions, has been developed, which is in use at financial institutions world-wide. Prof. Oosterlee is the Editor-in-Chief of the Journal of Computational Finance. He has organized several international workshops and conferences, and taught Summer Schools abroad (in Spain, Japan, South Africa) on Computational Finance. His 90 journal publications range from multigrid solution methods for fluid flow problems to Monte Carlo methods in finance.

On Fourier cosine expansions and wavelets for derivative pricing and risk management in computational finance

In this talk, we discuss applications of Fourier cosine expansions and wavelets in computational finance. Next to the accurate and efficient valuation of various financial options, we recently generalized the methods towards risk management and the numerical solution of backward stochastic differential equations (BSDEs). Typically Fourier techniques in finance rely on the availability of the asset dynamics' characteristic function (ie. the Fourier transform of the asset's density function). We will discuss a numerical Fourier method for which the characteristic function need not be available. The resulting methods can then also be employed for problems with varying coefficients (local volatility, stochastic local volatility) models), such as for the Stochastic Alpha Beta Rho (SABR) method.

Congress Plenary Lectures

Friday, June 12, 13:30-14:30, in Room BA201

Sebastian Schreiber, University of California, Davis

About the speaker: Sebastian J. Schreiber is a Professor of Ecology and Evolution and member of the Center of Population Biology at the University of California, Davis. Prior to coming to Davis, he was an Associate Professor of Mathematics at the College of William and Mary and Western Washington University. Professor Schreibers research on the development and application of methods in stochastic processes and nonlinear dynamics to ecology, evolution, and epidemiology has been supported by grants from the U.S. National Science Foundation, the U.S. National Oceanic and Atmospheric Administration, the Bureau for Land Management, and the U.S. Fisheries and Wildlife Service. He has authored nearly eighty scientific papers in peer-reviewed mathematics and biology journals. Professor Schreiber is currently on the editorial boards of five research journals including Ecology and the Journal of Mathematical Biology.

Species Coexistence in Stochastic Environments: A Mathematical Perspective

Stochastic fluctuations in temperature, precipitation and a host of other environmental factors occur at multiple spatial and temporal scales. As the survival and reproduction of organisms, whether they be plants, animals, or viruses, depend on these environmental factors, these stochastic fluctuations often drive fluctuations in population abundances. This simple observation leads to a fundamental question in population biology. Namely, under what conditions do stochastic environmental fluctuations hinder or facilitate the maintenance of biodiversity? This question is particularly pressing in light of global climate models predicting increasing temporal variation in many climatic variables over the next century.

One fruitful approach to tackling this question from population biology is the development and analysis of models accounting for nonlinear feedbacks among species, population structure, and environmental stochasticity. In this talk, I will discuss progress in the development of a mathematical theory for stochastic coexistence where the dynamics of the interacting species are encoded by random difference equations and coexistence corresponds to the limit points of empirical measures being bounded away from an extinction set. I will illustrate the theory with empirical based examples involving checkerspot butterflies, Kansas prairies, and coastal dunes.

Wednesday, June 10, 8:30-9:30, in Room BA201

Eric Vanden-Eijnden, Courant Institute, New York University

About the speaker: My main focus is the development of mathematical tools and numerical methods for the analysis of dynamical systems which are both stochastic and multiscale. The particular areas of applications I am interested in include molecular dynamics, chemical and biological networks, materials science, atmosphere-ocean science, and fluids dynamics. My main objectives are to understand the pathways and rate of occurrence of rare events in complex systems; to develop and analyze multiscale algorithms for the simulation of random dynamical systems; and, more generally, to quantify the effects of random perturbations on the systems dynamics.

Multiscale Modeling in a Stochastic Setting

Applications from molecular dynamics, material science, biology, or atmosphere/ocean sciences present new challenges for applied and numerical mathematics. These applications typically involve systems whose dynamics span a very wide range of spatio-temporal scales, and are subject to random perturbations of thermal or other origin. This second aspect especially complicates the modeling and computation of these systems and requires one to revisit standard tools from numerical analysis from a probabilistic perspective. In this talk I will discuss recent advances that have been made in this context. For example, I will show how tools from Freidlin-Wentzell theory of large deviations and potential theoretic approaches to metastability can be used to develop numerical algorithms to accelerate the computations of reactive events arising in metastable systems. I will also explain how averaging theorems for singularly perturbed Markov processes can help develop schemes bridging micro- to macro-scales of description or compute free energies, etc. As illustrations, I will use a selection of examples from molecular dynamics, material sciences, and fluid dynamics and show how the confrontation with actual problems not only profits from the theory but also enriches it.

Congress Plenary Lectures

Thursday, June 11, 8:30-9:30, in Room BA201

Yingfei Yi, University of Alberta

About the speaker: Yingfei Yi obtained his B.S. degree in classical mechanics from Jilin University in 1984 and his Ph.D degree in applied mathematics from the University of Southern California in 1990. His professional career started at Georgia Institute of Technology, first as a Postdoctoral Fellow at the Center for Dynamical Systems and Nonlinear Studies from 1990-1992, then at the School of Mathematics as an Assistant Professor from 1992-1997, an Associate Professor from 1997-2000, and a Professor from 2000. He jointed the Department of Mathematical and Statistical Sciences, the University of Alberta in 2014 as a Killam Memorial Chair in Dynamical Systems. He received a Rosenbaum Fellowship from the University of Cambridge in 1995, a University Research Fellowship from Jilin University in 1998, an Outstanding Young Scientist Award from NSFC in 2004, a Changjiang Scholarship from MoE, China and Li Ka Shing Foundation in 2008, and a Chinese National Qianren Research Chair Professorship in 2009 from MoE, China. He is a Co-editor in Chief for the Journal of Dynamics and Differential Equations, a handling editor for the Journal of Differential Equations, an editor for the Proceedings of the American Mathematical Society, an editor for the SIAM DSweb Magazine, and he is also an associate editor or a member of editorial board of three other professional journals. His research interests lie in dynamical systems and qualitative theory of differential equations.

Multiscale Modeling of Soft Materials and Related Biological Responses

Dynamical systems are often subjected to noise perturbations either from external sources or from their own intrinsic uncertainties. While it is well believed that noises can have dramatic effects on the stability of a deterministic system at both local and global levels, mechanisms behind noise surviving or robust dynamics have not been well understood especially from distribution perspectives. This talk attempts to outline a mathematical theory for making a fundamental understanding of these mechanisms in white noise perturbed systems of ordinary differential equations, based on the study of stationary measures of the corresponding Fokker-Planck equations. New existence and non-existence results of stationary measures will be presented by relaxing the notion of Lyapunov functions. Limiting behaviors of stationary measures as noises vanish will be discussed in connection to important issues such as stochastic stability and bifurcations.

Congress Plenary Lectures

Thursday, June 11, 13:30-14:30, in Room BA201

Nicholas Zabaras, University of Warwick

About the speaker: Nicholas Zabaras received his PhD at Cornell University (1987) in the area of Theoretical and Applied Mechanics. Upon graduation he joined the faculty of Engineering at the University of Minnesota. In 1991 he returned to Cornell as a faculty member of the Sibley School of Mechanical and Aerospace Engineering where he was also member of various other academic fields including Applied Mathematics, Materials Science and Engineering and Computational Science and Engineering. He was the founding director of the Materials Process and Design Laboratory that integrated materials modelling and design with innovative mathematical approaches including inverse problems, uncertainty quantification, robust design, and scientific computing. In the summer of 2014 he joined the University of Warwick to establish and lead the Warwick Centre for Predictive Modelling. WCPM is a university wide initiative across many colleges and departments with emphasis on the integration of computational mathematics, computational statistics and scientific computing to address modelling and design of complex systems in the presence of uncertainties. He has received several awards including a Presidential Young Investigator Award in 1991. He is Fellow and member of various societies. In 2014, Prof. Zabaras was appointed as Hans Fisher Senior Fellow at the Institute of Advanced Study at the Technische Universität Mnchen. The same year he received the Royal Societys Wolfson Research Merit Award for his work on predictive modelling. He is currently an Associate Editor of the Journal of Computational Physics and the Editor in Chief of the International Journal for Uncertainty Quantification.

An Information Theoretic Approach to Computational Modelling in Engineering and the Sciences

Predictive modelling and design of materials gives rise to unique mathematical and computational challenges including (i) Modelling of hierarchical random heterogeneous material structures; (ii) Propagating uncertainties in a quantifiable manner across spatial and temporal length scales (stochastic coarse graining); (iii) Addressing the curse of stochastic dimensionality; (iv) Addressing the phenomenology typical of most materials science models; (v) Modelling failure and rare events in random media; and many more.

We will advocate an information theoretic approach to address some of these challenges. In particular, we will discuss data-driven models of material structure, forward uncertainty propagation in high dimensions using limited data, variational approaches to stochastic coarse graining, and quantifying epistemic uncertainty when using surrogate models. We will finally address the importance of using probabilistic graphical models for predictive modelling of multiscale and multiphysics problems.

With synergistic developments in materials physics, computational mathematics/statistics, and machine learning there is potential for developing data-driven materials models that allow us to understand where observable variabilities in properties arise and provide means to control them for accelerated materials design.

Congress Plenary Lectures: CFDSC Plenary Lecture

Tuesday, June 9, 8:30-9:30, in Room N1001

Rémi Abgrall, University of Zurich

About the speaker: Rémi Abgrall is a former student of École Normale Supérieure de Saint Cloud. After his PhD, he has been engineer at ONERA, then research scientist at INRIA. Since January 2014, he is professor at the University of Zürich, Institute of Mathematics, after having been Professor in the University of Bordeaux (Institut Polytechnique de Bordeaux) since 1996 and in secondment at INRIA from 2008 till the end of 2013. He has been awarded an Advanced Research Grant from the ERC in December 2008 and has been invited speaker at the International Conference of Mathematicians (ICM 2014) in Seoul. He is associate editor of several international journals, including the Journal of Computational Physics, Mathematics of Computation, Computers and Fluids, the Journal of Scientific Computing. He is also co-chief editor of the International Journal on Numerical Methods in Fluids. His research is about efficient algorithms for the simulation of compressible materials (single fluids, multiphase, interface problems, compressible solids) using high order schemes designed for unstructured meshes. He also has interest in (curved) meshes generation for high order scheme and model reduction for transport dominated problems with and without discontinuities in the solution.

Recent progress in the development of parameter free continuous finite element methods for compressible fluids

In this talk, I will review the current status of the so-called Residual Distribution schemes applied, in particular, to compressible fluid dynamics problems. Other physical models include the Shallow Water equation and generalization, MHD, etc.

After the early work of R. Ni at Bombardier, and the seminal work of P.L Roe, in particular his 1981 JCP paper and its extensions to scalar multidimensional schemes, these schemes can be considered as finite element methods of the streamline diffusion type. The emphasis is put on non-oscillatory properties, in order to be able to compute flow discontinuities, so that they are nonlinear by construction. Indeed shock capturing is done in a totally different manner as for streamline diffusion, allowing for a class of parameter free schemes. In a way, the Residual Distribution methods can be seen as a kind of compromise between high order TVD-like finite difference/finite volume schemes and classical finite element methods, in that they borrow ideas from both communities: geometrical flexibility, the residual concept on one side, and non oscillatory, maximum principle on the other one.

In the talk, we will first consider the case of steady scalar hyperbolic problems, showing how one can systematically construct parameter free essentially non-oscillatory schemes. Then we will move towards steady advection diffusion problems, showing how uniform accuracy, whatever the Peclet/Reynolds number is. The last part of the talk we will consider recent work on unsteady problems. Examples of compressible flows (laminar and turbulent) will be also shown, in order to demonstrate the efficiency of the method, both in accuracy, memory footprint and CPU time.

This is joint work with many colleagues and students among whom Dante de Santis, Mario Ricchiuto, Algiane Froehly, Adam Larat, Mohamed Mezine at INRIA, and many discussions with H. Deconinck (VKI, Belgium) as well as Phil Roe (Michigan, USA). This work has been funded by several EU contracts: the FP6 ADIGMA project (contract AST5-CT-2006-030719), the FP7 IDIHOM project (contract AAT-2010-RTD-1-265780) and the ERC Advanced Grant ADDECCO (contract #226316), as well as a grant of the Swiss National Fund.

Congress Plenary Lectures: CFDSC Plenary Lecture

Tuesday, June 9, 13:30-14:30, in Room N1001

Paul Fischer, University of Illinois

About the speaker: Paul Fischer is a Blue Waters Professor at the University of Illinois, Urbana-Champaign in the departments of Computer Science and Mechanical Science & Engineering. He received his Ph.D. in mechanical engineering from MIT and was a post-doc in applied mathematics at Caltech, where he was the first Center for Research in Parallel Computation fellow. His work is in the area of high-order numerical methods for partial differential equations, scalable linear solvers, and high-performance computing. He is the architect of the open source SEM-based fluid dynamics/heat transfer code Nek5000, which has been recognized with the Gordon Bell Prize in high-performance computing and which has successfully scaled beyond a million processes. Nek5000 is currently used by over 200 researchers for a variety of applications in turbulence and heat transfer.

DNS/LES of Complex Turbulent Flows beyond Petascale

Petascale computing platforms currently feature million-way parallelism and it is anticipated that exascale computers with billion-way concurrency will be deployed in the early 2020s. In this talk, we explore the potential of computing at these scales with a focus on turbulent fluid flow and heat transfer in a variety of applications including nuclear energy, combustion, oceanography, vascular flows, and astrophysics. Following Kreiss and Oliger 72, we argue that high-order methods are essential for scalable simulation of transport phenomena. We demonstrate that these methods can be realized at costs equivalent to those of low-order methods having the same number of gridpoints. We further show that, with care, efficient multilevel solvers having bounded iteration counts will scale to billion-way concurrency. Using data from leading-edge platforms over the past 25 years, we analyze the scalability of state-of-the-art solvers to predict parallel performance on exascale architectures. The analysis sheds light on the expected scope of exascale physics simulations and provides insight to design requirements for future algorithms, codes, and architectures.

7. Congress Semi-Plenary Lectures

Wednesday, June 10, 10:00-11:00, in Room BA211

Stephen Anco, Brock University

About the speaker: Stephen Anco is a full professor in the Department of Mathematics & Statistics at Brock University, Canada. He is a co-author of two books in the Springer Applied Mathematics Series and has published over 60 papers. His research encompasses several areas of mathematical physics, including classical gauge field theory, General Relativity, symmetries and conservation laws of differential equations, integrable systems, and geometric curve flows. At Brock, he has served as Department Chair from 2009 to 2012 and Graduate Program Director from 2005 to 2007.

Conservation laws of fluid flow on Riemannian manifolds

All local conservation laws of kinematic type on moving domains and moving surfaces for inviscid compressible fluid flow on curved Riemannian manifolds are derived. In particular, any such conservation laws will be found that hold only for (1) special dimensions of the manifold or the surface; (2) special conditions on the geometry of the manifold or the surface; (3) special equations of state. Importantly, the general form of these kinematic conservation laws will be allowed to depend on the intrinsic Riemannian metric, volume form, and curvature tensor of the manifold or the surface. All kinematic constants of motion that arise from the resulting kinematic conservation laws also will be determined. These results generalize earlier work on finding all kinematic local conservation laws on moving domains for inviscid compressible fluid flow in n-dimensional Euclidean space.

Congress Semi-Plenary Lectures

Thursday, June 11, 15:00-16:00, in Room BA209

Mike Bennett, University of British Columbia

About the speaker: Michael Bennett is Professor and Head of the Mathematics Department at the University of British Columbia. Prior to coming to UBC, he held positions at The University of Illinois, The Institute for Advanced Study in Princeton, The University of Michigan and the University of Waterloo. He has authored more than 60 papers in Number Theory. In 2004, he was a recipient of the Ribenboim prize of the Canadian Number Theory Association.

Computing elliptic curves of fixed conductor

I will discuss new, old and older still methods for computing elliptic curves with bad reduction outside given sets of primes. Applying these, we are now able to find models for all elliptic curves over the rationals with prime conductor bounded by $10^1$0 and, conjecturally, by $10^1$2. I will then mention extensions of these results to the case of more general conductors and to curves over number fields. This is a joint work with Andrew Rechnitzer.

Wednesday, June 10, 10:00-11:00, in Room BA102

Tom Hurd, McMaster University

About the speaker: Tom Hurd is Professor of Mathematics at McMaster University. He turned to the mathematical study of financial markets in the late 1990s, following his earlier research in mathematical physics. Since then he has written on a wide range of financial topics, with publications in portfolio theory, interest rate modelling, and credit risk. Over the past few years, his work has focussed on the mathematical modelling of systemic risk, that is, the stability of financial networks. His new book entitled "Contagion! The Spread of Systemic Risk in Financial Networks" is soon to be published. He has delivered a number of minicourses on this subject and, most recently, a one-semester PhD course at ETH Zurich. In addition to cofounding the M-Phimac Master program in Financial Mathematics at McMaster, which he continues to direct, he has supervised numerous undergraduate, M.Sc., Ph.D. and Postdoctoral researchers working in financial mathematics.

Modelling the Collapse of Financial Systems

The list of possible channels of systemic risk (SR) includes correlated asset shocks, default contagion, funding liquidity contagion and market illiquidity effects. A number of deliberately simplified modelling frameworks, beginning with the Eisenberg-Noe 2001 model, aim to reveal the pure contagion effects that can lead to cascading chains of defaulted and illiquid financial institutions. It turns out that analytic methods can be brought to bear to determine the characteristics of such cascades on large random financial networks (RFN) that have a property we call local tree-like independence (LTI). In this talk, we review the conceptual basis of these methods in percolation theory on random graphs, and investigate how to extend them to interesting models of complex financial networks.

Congress Semi-Plenary Lectures

Thursday, June 11, 10:00-11:00, in Room BA208

Eduard-Wilhelm Kirr, University of Illinois at Urbana-Champaign

About the speaker: Eduard-Wilhem Kirr is currently an associate professor in the Mathematics Department at University of Illinois Urbana-Champaign. He obtained his Ph.D. in Mathematics from University of Michigan in 2002 under the direction of Michael I. Weinstein and Anthony Bloch and was a Dickson Instructor at University of Chicago from 2002 to 2005 under the direction of Peter Constantin. During his graduate studies he was also a summer intern at Bell Laboratories. His main research interests focus on studying wave propagation and wave interaction using both theoretical methods and numerical simulations.

On long time dynamics in nonlinear wave equations

Since the first description in 1834 of the "wave of translation," currently called soliton, by John Scott Russell, scientist have studied intensely such particular solutions of nonlinear wave equations i.e., coherent structures that do not change shape as they propagate. They have been put to good use in nonlinear optics and telecommunications, and play an important role in understanding the formation of large waves in oceans and in analyzing large systems of quantum particles. Moreover their importance in describing the large time behavior of nonlinear wave models is summarized by the following: Asymptotic Completeness Conjecture: any initial data of a nonlinear wave equations evolves into a superposition of coherent structures plus a part that radiates to infinity. My presentation will summarize both our current knowledge on existence of coherent structures and recent progress towards solving the asymptotic completeness conjecture.

Congress Semi-Plenary Lectures

Monday, June 8, 15:30-16:30, in Room BA209

Georges Zaccour, École des Hautes Études commerciales de Montréal

About the speaker: Georges Zaccour holds the Chair in Game Theory and Management and is a full professor of Department of Management Sciences at HEC Montréal. He holds a Ph.D. in management science, an M.Sc. in international business from HEC Montéal and a licence in mathematics and economics from Université Paris-Dauphine. He served as the director of GERAD, an interuniversity research center and the director of marketing department and Ph.D. program at HEC Montréal. His research areas are differential games, optimal control and operations research applied to marketing, energy sector and environmental management, areas in which he has published more than 140 papers and co-edited thirteen volumes. He coauthors the books Differential Games in Marketing and Games and Dynamic Games. His research is regularly funded by the Natural Sciences and Engineering Research Council of Canada. He is the editor-in-chief of Dynamic Games and Applications and associate editor of the International Game Theory Review, Environmental Modeling & Assessment, Computational Management Science, INFOR, and other journals. He is a fellow of The Royal Society of Canada and was the president of the International Society of Dynamic Games (2002-2006).

Sustainability of Cooperation in Dynamic Games Played over Event Trees

A well-known problem in dynamic cooperative games is the sustainability of cooperation over time. The literature addressed this issue following different approaches, namely, the design of time-consistent payments, incentive equilibrium strategies and trigger strategies that deter credibly and effectively deviation from cooperation. In this talk, I will apply these different approaches to dynamic games played over event trees, that is, stochastic games where the uncertainty is not influenced by players actions but it is nature's decision. After introducing the main elements of this class of games, I will introduce node-consistent cooperative payments based on the Shapley value and imputations in the core as means for sustaining cooperation over nodes (and time). Further, I will show how incentive and trigger strategies can be constructed to strategically support the cooperative agreement designed at the starting date of the game.

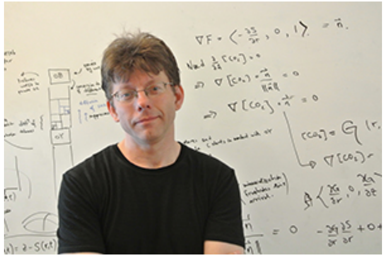
8. CAIMS Prize-Winning Lectures

CAIMS/Fields Industrial Mathematics Award

Wednesday, June 10, 17:00-18:00, in Room BA201

Sean Bohun, Ontario University Institute of Technology

About the speaker: C. Sean Bohun obtained his PhD in 1998 from the University of Victoria and has been a faculty member at UOIT since 2006. Active in the field of industrial and applied mathematics, he has been an invited participant of Study Groups around the globe for near 15 years. He has been a mentor for graduate training workshops since 2004 in Canada, the US and Oxford and has been one of the main organizers of the Canadian Study Groups for many years. Dr. Bohun specializes in mathematical modelling, has coauthored a text on the subject, and continues to breakdown barriers between the mathematical sciences and other disciplines, fields and industries.



The Mathematics of Fear and its Role in Social Change

Since the late 1960's various aspects of mathematical modelling have been applied to societal issues in an attempt to further our understanding of these highly integrated systems. In many cases standard mathematical models and tools are applied directly to a fixed sociological problems. Examples of this include the application of standard crystal growth theory to the growth of religions, and predator-prey models to infer dynamics of street gangs. A brief sampling of the current literature finds examples in such diverse topics as studies of the volunteer's dilemma, models of collective behaviour and social diffusion, and the related problems of panic propagation through a social network and the evolution of belief.

Attempts to quantify social influence and opinion can be found in the mathematics literature. In fact, research on how opinions are formed through interpersonal influences has been developed into a social learning framework whereby agents within the model repeatedly update their current opinion as well as the influence weights that they place on each other. Much of this recent mathematical research is not easily transferrable to the social sciences, primarily due to methodological differences between the two disciplines.

Within the sociological literature, it is well known that for an individual, fear removes their familiar environment and their frames of reference that are used to help them define rational choice. It is precisely this assumption of rational choice that pervades the mathematical literature and limits the applicability of many mathematical models of social behaviour within the field of sociology itself.

I will give some examples of an emerging set of problems where fear plays a significant role from both a mathematical and a sociological perspective. Understanding the role of fear is essential to understanding contemporary movements in society. Modelling the politics of fear can assist with preemptive actions to reduce terrorism, hate crimes and the limitations of minority's rights, freedoms and liberties.

CAIMS Prize-Winning Lectures
CAIMS/PIMS Early Career Award

Tuesday, June 9, 17:00-18:00, in Room BA201

Jane Heffernan, York University

About the speaker: Dr. Jane Heffernan is a York University Research Chair in the Department of Mathematics & Statistics. Dr. Heffernan leads the Modelling Infection and Immunity lab (MI2), and is the Director of the Centre for Disease Modelling (CDM). The MI2 lab develops multi-scale quantitative methods for evidence-based health policy, from within a host (immunology) to a population of hosts (epidemiology), including decision-making processes at government and individual levels. The MI2 lab is funded by NSERC, CIHR, MITACS, PHAC, and the Government of Ontario. Dr. Heffernan is involved in international immunization and public health research networks, and serves on the international Society for Mathematical Biology board of directors. She has organized workshops, summer schools and mentoring programs, and has developed an undergraduate program in Mathematical Biology. Awards include the Governor Generals Gold Medal, NSERC Postdoctoral Fellowship (Warwick, UK), NSERC University Faculty Award, MRI Ontario Early Researcher Award, and the Petro-Canada Young Innovators Award.

Infectious disease modelling over many scales

Protective immunity against a pathogen can be developed after natural infection or vaccination. A goal of vaccination campaigns is to achieve a certain coverage threshold such that herd immunity can be obtained. Immunity, however, is developed by individuals in a population, and individual effects, such as waning immunity, vaccine hesitancy, and variable vaccine uptake decisions will affect population health outcomes. Mathematical models of infectious disease typically focus on describing the dynamics of disease progression in a population, or within a host. However, both of these scales are intimately linked, affecting disease progression and persistence at each level. We will discuss mathematical models of infectious diseases in-host, between-host, and over populations. Multi-scale modelling strategies that couple individual and population effects, including the effects of mass media reports, will also be discussed. Modelling results that are particularly relevant to infectious disease outcomes and public health will be highlighted.

CAIMS Prize-Winning Lectures
Cecil Graham Doctoral Dissertation Award

Thursday, June 11, 17:00-18:00, in Room BA201

Diego Ayala Rodriguez, University of Michigan

About the speaker: Dr. Ayala is a Postdoctoral Assistant Professor in the Mathematics Department at the University of Michigan. He obtained his bachelor degree in Engineering from ITESM (Mexico, 2005), and his doctoral degree in Mathematics from McMaster University (Canada, 2014). Dr. Ayala was a participant at the Program in Mathematics of Turbulence organized by the Institute for Pure and Applied Mathematics, UCLA, in 2014. His research interests include computational fluid dynamics, large-scale computing and optimization.

Extreme Vortex States in Incompressible Flows

In this investigation we assess the sharpness of analytic estimates for the instantaneous rate of production of palinstrophy in two-dimensional (2D) flows, and for the instantaneous rate of production of enstrophy in three-dimensional (3D) flows. Families of localized extreme vortex structures, both in 2D and 3D, are obtained by solving suitable constrained optimization problems and we present compelling evidence supporting the sharpness of the analytic estimates, thus confirming the findings of Lu & Doering (2008). The results obtained for 3D flows provide a numerical characterization of a region of “guaranteed regularity”, corresponding to the well-known result of existence and uniqueness of smooth solutions to the Navier-Stokes equation for sufficiently small initial data. Moreover, results from direct numerical simulations indicate that the flow triggered by the 3D optimal fields produces a larger finite-time growth of enstrophy when compared to other widely-used initial conditions, such as the Taylor-Green vortex, Lamb dipoles and perturbed anti-parallel vortex tubes. Although numerical in nature, these results provide a plausible route for finding an initial condition that could lead to the formation of a singularity in finite time.

9. Special Symposia & Organizers

Session ID	Session Name	Session Organizers	Session Blocks
SS-AAIP	Inverse Problems	Herb Kunze (University of Guelph) Davide La Torre (University of Milan) Kim Levere (University of Guelph)	SS-AAIP #1 Friday A.M. SS-AAIP #2 Friday P.M.
SS-CMPMC	Computational Methods in Physical and Macromolecular Chemistry	Styliani Consta (University of Western Ontario)	SS-CMPMC Wednesday A.M.
SS-CNT	Computational Number Theory	Chester Weatherby (Wilfrid Laurier University) Kevin Hare (University of Waterloo) Renate Scheidler (University of Calgary)	SS-CNT #1 Friday A.M. SS-CNT #2 Friday A.M. SS-CNT #3 Friday A.M. SS-CNT #4 Friday P.M.
SS-CP	Computational Physics	Alex Fedoseyev (CFD Research Corporation) Marek Wartak (Wilfrid Laurier University)	SS-CP Tuesday P.M.
SS-DASO	Data Analytics for System Optimization	Jianhong Wu (York University) Jimmy Huang (York University) Wenying Feng (Trent University)	SS-DASO Friday A.M.
SS-DDEMM	Delay Differential Equations as Mathematical Models of Real World Phenomena	Elena Braverman (University of Calgary) Anatoli Ivanov (Pennsylvania State University)	SS-DDEMM #1 Thursday P.M. SS-DDEMM #2 Friday A.M.
SS-DDMDS	Data-Driven Methods for Dynamical Systems	Dimitris Giannakis (New York University) Tyrus Berry (Pennylvania State University)	SS-DDMDS #1 Thursday A.M. SS-DDMDS #2 Thursday P.M.
SS-EBMSAHS	Equation-Based Modeling: Structural Analysis and Hybrid Systems	Ned Nedialkov (McMaster University) John Pryce (Cardiff University)	SS-EBMSAHS Wednesday P.M.
SS-FCP	Fractional Calculus and Probability	József Lörinczi (Loughborough University) Mark M. Meerschaert (Michigan State University) Enrico Scalas (University of Sussex)	SS-FCP Thursday P.M.
SS-GAMCCM	Geometric and Analytic Methods in Classical and Celestial Mechanics	Manuele Santoprete (Wilfrid Laurier University) Lennard Bakker (Brigham Young University) Ray McLenaghan (University of Waterloo)	SS-GAMCCM #1 Monday A.M. SS-GAMCCM #2 Monday P.M. SS-GAMCCM #3 Tuesday A.M.

Session ID	Session Name	Session Organizers	Session Blocks
SS-GLS	Geocomputational Landscapes and Spaces	Steven A. Roberts (Wilfrid Laurier University) Colin Robertson (Wilfrid Laurier University)	SS-GLS Thursday A.M.
SS-GTA	Game Theory: Applications and Evolutionary Games	Monica Cojocaru (University of Guelph) Joe Apaloo (St. Francis Xavier) Ross Cressman (Wilfrid Laurier University)	SS-GTA #1 Monday A.M. SS-GTA #2 Monday P.M. SS-GTA #3 Tuesday A.M.
SS-MACHS	Modeling, Analysis and Control in Hybrid Systems	Xinzhi Liu (University of Waterloo) Mohamad Alwan (University of Waterloo) Peter Stechlinski (Massachusetts Institute of Technology)	SS-MACHS #1 Monday A.M. SS-MACHS #2 Monday P.M.
SS-MFMCR	Mathematical Finance - Modeling, Computation and Risk Management	Joe Campolieti (Wilfrid Laurier University) Adam Metzler (Wilfrid Laurier University)	SS-MFMCR #1 Tuesday A.M. SS-MFMCR #2 Tuesday P.M. SS-MFMCR #3 Wednesday A.M.
SS-MMNN	Mathematical Models for Nanoscience and Nanotechnology	Xinzhi Liu (University of Waterloo) Mohamad Alwan (University of Waterloo) Peter Stechlinski (Massachusetts Institute of Technology)	SS-MMNN #1 Thursday A.M. SS-MMNN #2 Thursday P.M.
SS-MMPND	Matrix Manifold Problems subject to Noisy Data	Forbes Burkowski (University of Waterloo) Henry Wolkowicz (University of Waterloo)	SS-MMPND Tuesday A.M.
SS-MSMB	Modeling & Simulation in Medicine and Biology	Suzanne Shontz (University of Kansas) Corina Drapaca (Pennsylvania State University) Siv Sivaloganathan (University of Waterloo)	SS-MSMB #1 Thursday A.M. SS-MSMB #2 Thursday P.M.
SS-RALSMCL	Recent Advances in Lie Symmetry Methods and Conservation Laws for Differential Equations and Applications	M. Abudiab (Texas A&M University) C.M. Khalique (North-West University) M.L. Gandarias (Universidad de Cadiz)	SS-RALSMCL #1 Wednesday A.M. SS-RALSMCL #2 Wednesday P.M. SS-RALSMCL #3 Thursday A.M.
SS-SSMMBP	Simulations in Soft Matter and Molecular Bio-Physics	Cristiano Dias (New Jersey Institute of Technology) Zhaoqian Su (New Jersey Institute of Technology) Farbod Mahmoudinoba (New Jersey Institute of Technology)	SS-MMBP #1 Friday A.M. SS-MMBP #2 Friday P.M.
SS-TMN	Topics in Mathematical Neuroscience	Lydia Bilinsky (Duke University) Priscilla Greenwood (Duke University)	SS-TMN #1 Monday A.M. SS-TMN #2 Monday P.M.
SS-WDSEE	Wealth Distribution and Statistical Equilibrium in Economics	Enrico Scalas (University of Sussex) Bertram Düring (University of Sussex)	SS-WDSEE #1 Monday A.M. SS-WDSEE #2 Monday P.M.

Session ID	Session Name	Session Organizers	Session Blocks
SS-WPA	Wave Propagation and Applications	Eduard Kirr (University of Illinois at Urbana-Champaign) Nicolae Tarfulea (Purdue University Calumet) Catalin Turc (New Jersey Institute of Technology)	SS-WPA #1 Thursday A.M. SS-WPA #2 Thursday P.M. SS-WPA #3 Thursday A.M.
ST-AADS	Applied Analysis and Dynamical Systems	Xingfu Zou (University of Western Ontario) Dmitry Pelinovsky (McMaster University) David Iron (Dalhousie University)	ST-AADS #1 Monday P.M. ST-AADS #2 Tuesday A.M. ST-AADS #3 Tuesday P.M.
ST-ACM	Applied and Computational Mechanics	Marek Stastna (University of Waterloo) Bartek Protas (McMaster University) Il Yong Kim (Queen's University)	ST-ACM #1 Monday A.M. ST-ACM #2 Monday P.M. ST-ACM #3 Tuesday A.M. ST-ACM #4 Tuesday P.M.
ST-IM	Industrial Mathematics	Huaxiong Huang (York University) John Stockie (Simon Fraser University) Odile Marcotte (Université du Québec à Montréal) Sean Bohun (University of Ontario Institute of Techology)	ST-IM #1 Tuesday P.M. ST-IM #2 Wednesday A.M. ST-IM #3 Wednesday P.M.
ST-MB	Mathematical Biology	Frithjof Lutscher (University of Ottawa) Lea Popovic (Concordia University) Rebecca Tyson (University of British Columbia) Connell McCluskey (Wilfrid Laurier University)	ST-MB #1 Monday A.M. ST-MB #2 Monday P.M. ST-MB #3 Tuesday A.M. ST-MB #4 Tuesday P.M. ST-MB #5 Wednesday A.M. ST-MB #6 Wednesday P.M. ST-MB #7 Thursday A.M. ST-MB #8 Thursday P.M.
ST-SCNA	The 2nd Canadian Symposium on Scientific Computing and Numerical Analysis	Scott MacLachlan (Memorial University of Newfoundland Justin Wan (University of Waterloo) Hans de Sterck (University of Waterloo) Ben Adcock (Simon Fraser University)	ST-SCNA #1 Monday A.M. ST-SCNA #2 Monday P.M. ST-SCNA #3 Tuesday A.M. ST-SCNA #4 Tuesday P.M. ST-SCNA #5 Wednesday A.M. ST-SCNA #6 Wednesday P.M. ST-SCNA #7 Thursday A.M.
ST-CFDSC	The 23rd Conference of the CFD Society of Canada	Lilia Krivodonova (University of Waterloo) Lucian Ivan (University of Waterloo)	ST-CFDSC #1,4,6 Monday A.M. ST-CFDSC #2,5,7 Monday P.M. ST-CFDSC #3,8,12 Tuesday A.M. ST-CFDSC #11,13,9 Tuesday P.M. ST-CFDSC #10,14 Wednesday A.M.

10. Contributed Sessions

Session ID	Session Name	Session Blocks
CS-APMRE	Applied Problems and Methods in Research & Education	CS-AMPRE Thursday P.M.
CS-BSM	Mathematics and Computation in Biological Sciences and Medicine	CS-BSM #1 Tuesday A.M. CS-BSM #2 Tuesday A.M. CS-BSM #3 Wednesday A.M.
CS-CACO	Computational Algebra, Combinatorics and Optimization	CS-CACO Wednesday P.M.
CS-CPC	Computational Physics and Chemistry	CS-MCPC Wednesday P.M.
CS-DSDE	Applications of Dynamical Systems and Differential Equations	CS-DSDE #1 Wednesday P.M. CS-DSDE #2 Wednesday A.M. CS-DSDE #3 Wednesday P.M.
CS-ENV	Mathematical Modelling in Environmental Sciences and Models for Complex Media	CS-ENV Friday A.M.
CS-FINANCE	Financial Mathematics and Computation	CS-FINANCE #1 Friday A.M. CS-FINANCE #2 Friday P.M.
CS-MECHE	Computational Mechanics and Engineering	CS-MECHE #1 Wednesday A.M. CS-MECHE #2 Wednesday P.M.
CS-MODELING	Partial Differential and Integral Equations in Mathematical Modeling	CS-MODELING #1 Friday A.M. CS-MODELING #2 Friday P.M.

11. High-Level Congress Schedule

Mon: A.M.=10:30-12:30; P.M.=3:30-5:30
Tues-Fri: A.M.=10:00-12:00; P.M.=3:00-5:00

Mon: Use BA206 in place of BA305
Mon: Use BA207 in place of BA306

Room		N1001/02/44	BA101	BA102	BA202	BA208	BA209	BA210	BA211	BA305	BA306
June 8	A.M.	ST-CFDSC The 23rd Conference of the CFD Society of Canada (Tentative, TBD)	ST-MB Mathematical Biology	SS-TMN Topics in Mathematical Neuroscience	ST-SCNA The 2nd Canadian Symposium on Scientific Computing & Numerical Analysis	ST-ACM Applied and Computational Mechanics	SS-GTA Game Theory: Applications and Evolutionary Games	NSERC Discovery Grant Information Session	SS-MACHS Modeling, Analysis and Control in Hybrid Systems	SS-WDSEE Wealth Distribution and Statistical Equilibrium in Economics	SS-GAMCCM Geometric and Analytic Methods in Classical and Celestial Mechanics
	P.M.							ST-AADS Applied Analysis and Dynamical Systems			
June 9	A.M.			SS-MFMCR Mathematical Finance - Modeling, Computation and Risk Management					SS-MMPND Matrix Manifold Problems subject to Noisy Data	CS-BSM Mathematics and Computation in Biological Sciences and Medicine	
	P.M.						ST-IM Industrial Mathematics	CS-DSDE Applications of Dynamical Systems and Differential Equations	ST-AADS Applied Analysis and Dynamical Systems		SS-CP Computational Physics
June 10	A.M.					CS-MECHE Computational Mechanics and Engineering			SS-RALSMCL Recent Advances in Lie Symmetry Methods and Conservation Laws Methods for Differential Equations and Applications		SS-CMPMC Computational Methods in Physical and Macromolecular Chemistry
	P.M.			SS-EBMSAHS Equation-Based Modelling: Structural Analysis and Hybrid Systems						CS-CACO Computational Algebra, Combinatorics and Optimization	CS-CPC Computational Physics and Chemistry
June 11	A.M.			SS-MSMB Modeling and Simulation in Medicine and Biology		SS-WPA Wave Propagation and Applications	SS-CNT Computational Number Theory	SS-DDMDS Data-Driven Methods for Dynamical Systems		SS-MMNN Mathematical Models for Nanoscience and Nanotechnology	SS-GLS Geocomputational Landscapes and Spaces
	P.M.				SS-FCP Fractional Calculus and Probability				SS-DDEMM Delay Differential Equations as Mathematical Models of Real World Phenomena		CS-APMRE Applied Problems and Methods in Research & Education
June 12	A.M.		CS-MODELING Partial Differential and Integral Equations in Mathematical Modeling	CS-FINANCE Financial Mathematics and Computation	CS-ENV Math Modeling in Environmental Sciences and Models for Complex Media			SS-DASO Data Analytics for System Optimization		SS-AAIP Inverse Problems	SS-SSMMBP Simulations in Soft Matter and Molecular Bio-Physics
	P.M.				MS2Discovery Institute Meeting						

Monday, June 8

Time	Room				
8:30-9:00	BA201	**AMMCS-CAIMS Congress Opening** **Deborah MacLatchy**, Wilfrid Laurier University Vice President Academic / Provost and Vice President Research (Acting) **Paul Jessop**, Dean of Science, Wilfrid Laurier University **Angela Vieth**, Councillor, City of Waterloo			
9:00-10:00	BA201	**Congress Plenary Lecture** *Learning in High Dimension: from Images to Quantum Chemistry* **Stéphane Mallat**, École Normale Supérieure, Abstract & Biography on p. 12 (Chair: J. Bélair (tentative))			
10:00-10:30	BA Halls	**Coffee Break**			
10:30-12:30	N1001/02/44	BA101	BA102	BA206	BA207
	ST-CFDSC #1-3 The 23rd Conference of the CFD Society of Canada	ST-MB #1 Mathematical Biology *Human-Environment Systems*	SS-TMN #1 Topics in Mathematical Neuroscience	SS-WDSEE #1 Wealth Distribution and Statistical Equilibrium in Economics	SS-GAMCCM #1 Geometric and Analytic Methods in Classical and Celestial Mechanics
	BA202	BA208	BA209	BA210	BA211
	ST-SCNA #1 The 2nd Canadian Symposium on Scientific Computing and Numerical Analysis	ST-ACM #1 Applied and Computational Mechanics	SS-GTA #1 Game Theory: Applications and Evolutionary Games	NSERC Discovery Grant Information Session	SS-MACHS #1 Modeling, Analysis and Control in Hybrid Systems
12:30-14:00	**Lunch**				
14:00-15:00	BA201	**Congress Plenary Lecture** *Multiscale Modeling of Soft Materials and Related Biological Responses* **Wing Kam Liu**, Northwestern University, Abstract & Biography on p. 11 (Chair: I.Y. Kim (tentative))			
15:00-15:30	BA Halls	**Coffee Break**			
15:30-17:30	N1001/02/44	BA101	BA102	BA206	BA207
	ST-CFDSC #4-6 The 23rd Conference of the CFD Society of Canada	ST-MB #2 Mathematical Biology *Evolution*	SS-TMN #2 Topics in Mathematical Neuroscience	SS-WDSEE #2 Wealth Distribution and Statistical Equilibrium in Economics	SS-GAMCCM #2 Geometric and Analytic Methods in Classical and Celestial Mechanics
	BA202	BA208	BA209	BA210	BA211
	ST-SCNA #2 The 2nd Canadian Symposium on Scientific Computing and Numerical Analysis	ST-ACM #2 Applied and Computational Mechanics	SS-GTA #2 Game Theory: Applications and Evolutionary Games	ST-AADS #1 Applied Analysis and Dynamical Systems	SS-MACHS #2 Modeling, Analysis and Control in Hybrid Systems

Tuesday, June 9

Time	Room				
8:30-9:30	Congress: BA201 CFDSC: N1001	**Congress Plenary Lecture** *Eight Great Reasons to do Maths* **Chris Budd**, University of Bath, Abstract & Biography on p. 10 (Chair: H. Huang (tentative))		**CFDSC Plenary Lecture** *Recent progress in the development of parameter free continuous finite element methods for compressible fluids* **Rémi Abgrall**, University of Zurich, Abstract & Biography on p. 18 (Chair: L. Krivodonova)	
9:30-10:00	BA/Science Halls	**Coffee Break**			
10:00-12:00	N1001/02/44	BA101	BA102	BA305	BA306
	ST-CFDSC #7-9 The 23rd Conference of the CFD Society of Canada	ST-MB #3 Mathematical Biology *Biofilms and Industrial*	SS-MFMCR #1 Mathematical Finance - Modeling, Computation and Risk Management	CS-BSM #1 Mathematics and Computation in Biological Sciences and Medicine	SS-GAMCCM #3 Geometric and Analytic Methods in Classical and Celestial Mechanics
	BA202	BA208	BA209	BA210	BA211
	ST-SCNA #3 The 2nd Canadian Symposium on Scientific Computing and Numerical Analysis	ST-ACM #3 Applied and Computational Mechanics	SS-GTA #3 Game Theory: Applications and Evolutionary Games	ST-AADS #2 Applied Analysis and Dynamical Systems	SS-MMPND Matrix Manifold Problems subject to Noisy Data
12:00-13:30	**Lunch**				
13:30-14:30	Congress: BA201 CFDSC: N1001	**Congress Plenary Lecture** *Dependence Between Components of Multivariate Conditional Markov Chains: Markov Consistency and Markov Copulae* **Tomasz Bielecki**, Illinois Institute of Technology, Abstract & Biography on p. 9 (Chair: R. Makarov)		**CFDSC Plenary Lecture** *DNS/LES of Complex Turbulent Flows beyond Petascale* **Paul Fischer**, University of Illinois, Abstract & Biography on p. 19 (Chair: L. Ivan)	
14:30-15:00	BA/Science Halls	**Coffee Break**			
15:00-17:00	N1001/02/44	BA101	BA102	BA305	BA306
	ST-CFDSC #10-12 The 23rd Conference of the CFD Society of Canada	ST-MB #4 Mathematical Biology	SS-MFMCR #2 Mathematical Finance - Modeling, Computation and Risk Management	CS-BSM #2 Mathematics and Computation in Biological Sciences and Medicine	SS-CP Computational Physics
	BA202	BA208	BA209	BA210	BA211
	ST-SCNA #4 The 2nd Canadian Symposium on Scientific Computing and Numerical Analysis	ST-ACM #4 Applied and Computational Mechanics	ST-IM #1 Industrial Mathematics *Mathematical Modelling in the Agriculture and and Food Science Sector*	CS-DSDE #1 Applications of Dynamical Systems and Differential Equations	SS-AADS #3 Applied Analysis and Dynamical Systems
17:00-18:00	**Refreshments Served** BA201	**CAIMS Prize Winner's Lecture: CAIMS/PIMS Early Career Award** *Infectious disease modelling over many scales* **Jane Heffernan**, York University, Abstract & Biography on p. 26 (Chair: P. van den Driessche)			

Wednesday, June 10

Time	Room				
8:30-9:30	BA201	**Congress Plenary Lecture** *Multiscale Modeling in a Stochastic Setting* **Eric Vanden-Eijnden**, Courant Institute, NYU, Abstract & Biography on p. 15 (Chair: H. Kunze)			
9:30-10:00	BA Halls	**Coffee Break & Poster Session**			
10:00-12:00	N1001/02	BA101	BA102	BA305	BA306
	ST-CFDSC #13-14 The 23rd Conference of the CFD Society of Canada	ST-MB #5 Mathematical Biology *Epidemiology 1*	SS-MFMCR #3 Mathematical Finance - Modeling, Computation and Risk Management	CS-BSM #3 Mathematics and Computation in Biological Sciences and Medicine	SS-CMPMC Computational Methods in Physical and Macromolecular Chemistry
	BA202	BA208	BA209	BA210	BA211
	ST-SCNA #5 The 2nd Canadian Symposium on Scientific Computing and Numerical Analysis	CS-MECHE #1 Computational Mechanics and Engineering	ST-IM #2 Industrial Mathematics *Inverse Problems in Industrial Applications*	CS-DSDE #2 Applications of Dynamical Systems and Differential Equations	SS-RALSMCL #1 Recent Advances in Lie Symmetry Methods and Conservation Laws for Differential Equations and Applications
12:00-13:30	**Conference Photo Shoot at 12:00 & Lunch**				
13:30-14:30	BA201	**Congress Plenary Lecture** *Graph Analysis and Discrete Dynamic Modeling Elucidates the Outcomes of Within-cell Networks* **Réka Albert**, Pennsylvania State University, Abstract & Biography on p. 8 (Chair: R. Melnik)			
14:30-15:00	BA Halls	**Coffee Break & Poster Session**			
15:00-17:00	N1001/02/44	BA101	BA102	BA305	BA306
		ST-MB #6 Mathematical Biology *Epidemiology 2*	SS-EBMSAHS Equation-Based Modeling: Structural Analysis and Hybrid Systems	CS-CACO Computational Algebra, Combinatorics and Optimization	CS-CPC Computational Physics and Chemistry
	BA202	BA208	BA209	BA210	BA211
	ST-SCNA #6 The 2nd Canadian Symposium on Scientific Computing and Numerical Analysis	SS-MECHE #2 Computational Mechanics and Engineering	ST-IM #3 Industrial Mathematics *Modelling of Transport Processes in Industry*	CS-DSDE #3 Applications of Dynamical Systems and Differential Equations	SS-RALSMCL #2 Recent Advances in Lie Symmetry Methods and Conservation Laws for Differential Equations and Applications
17:00-18:00	**Refreshments Served** BA201	**CAIMS Prize Winner's Lecture: CAIMS/Fields Industrial Mathematics Award** *The Mathematics of Fear and its Role in Social Change* **Sean Bohun**, Ontario University Institute of Technology, Abstract & Biography on p. 25 (Chair: M. Grasselli)			

Thursday, June 11

<table>
<tr><th>Time</th><th>Room</th><th colspan="4"></th></tr>
<tr><td>8:30-9:30</td><td>BA201</td><td colspan="4">Congress Plenary Lecture
Noise Impact on Finite Dimensional Dynamical Systems
Yingfei Yi, University of Alberta, Abstract & Biography on p. 16
(Chair: X. Zou (tentative))</td></tr>
<tr><td>9:30-10:00</td><td>BA Halls</td><td colspan="4">Coffee Break & Poster Session</td></tr>
<tr><td rowspan="4">10:00-12:00</td><td>N1001/02/44</td><td>BA101</td><td>BA102</td><td>BA305</td><td>BA306</td></tr>
<tr><td></td><td>ST-MB #7
Mathematical Biology
Ecology, Non-spatial</td><td>SS-MSMB #1
Modeling & Simulation in Medicine and Biology</td><td>SS-MMNN #1
Mathematical Models for Nanoscience and Nanotechnology</td><td>SS-GLS
Geocomputational Landscapes and Spaces</td></tr>
<tr><td>BA202</td><td>BA208</td><td>BA209</td><td>BA210</td><td>BA211</td></tr>
<tr><td>ST-SCNA #7
The 2nd Canadian Symposium on Scientific Computing and Numerical Analysis</td><td>SS-WPA #1
Wave Propagation and Applications</td><td>SS-CNT #1
Computational Number Theory</td><td>SS-DDMDS #1
Data-Driven Methods for Dynamical Systems</td><td>SS-RALSMCL #3
Recent Advances in Lie Symmetry Methods and Conservation Laws for Differential Equations and Applications</td></tr>
<tr><td>12:00-13:30</td><td colspan="5">Lunch</td></tr>
<tr><td>13:30-14:30</td><td>BA201</td><td colspan="4">Congress Plenary Lecture
An Information Theoretic Approach to Computational Modelling in Engineering and the Sciences
Nicholas Zabaras, University of Warwick, Abstract & Biography on p. 17
(Chair: R. Melnik (tentative))</td></tr>
<tr><td>14:30-15:00</td><td>BA Halls</td><td colspan="4">Coffee Break & Poster Session</td></tr>
<tr><td rowspan="4">15:00-17:00</td><td>N1001/02/44</td><td>BA101</td><td>BA102</td><td>BA305</td><td>BA306</td></tr>
<tr><td></td><td>ST-MB #8
Mathematical Biology
Ecology, Spatial</td><td>SS-MSMB #2
Modeling & Simulation in Medicine and Biology</td><td>SS-MMNN #2
Mathematical Models for Nanoscience and Nanotechnology</td><td>CS-APMRE
Applied Problems and Methods in Research & Education</td></tr>
<tr><td>BA202</td><td>BA208</td><td>BA209</td><td>BA210</td><td>BA211</td></tr>
<tr><td>SS-FCP
Fractional Calculus ahd Probability</td><td>SS-WPA #2
Wave Propagation and Applications</td><td>SS-CNT #2
Computational Number Theory</td><td>SS-DDMDS #2
Data-Driven Methods for Dynamical Systems</td><td>SS-DDEMM #1
Delay Differential Equations as Mathematical Models of Real World Phenomena</td></tr>
<tr><td>17:00-18:00</td><td>Refreshments Served
BA201</td><td colspan="4">CAIMS Prize Winner's Lecture: Cecil Graham Doctoral Dissertation Award
Extreme Vortex States in Incompressible Flows
Diego Ayala Rodriguez, University of Michigan, Abstract & Biography on p. 27
(Chair: J. Watmough)</td></tr>
<tr><td>19:00-22:00</td><td>Waterloo Inn</td><td colspan="4">Congress Banquet Dinner</td></tr>
</table>

Friday, June 12

Time	Room				
8:30-9:30	BA201	**Congress Plenary Lecture** *On Fourier cosine expansions and wavelets for derivative pricing and risk management in computational finance* **Kees Oosterlee**, Delft University of Technology and CWI, Abstract & Biography on p. 13 (Chair: S. Maclachlan (tentative))			
9:30-10:00	BA Halls	**Coffee Break**			
10:00-12:00	N1001/1002	BA101	BA102	BA305	BA306
		CS-MODELING #1 Partial Differential and Integral Equations in Mathematical Modeling	CS-FINANCE #1 Financial Mathematics and Computation	SS-AAIP #1 Inverse Problems	SS-SSMMBP #1 Simulations in Soft Matter and Molecular Bio-Physics
	BA202	BA208	BA209	BA210	BA211
	CS-ENV Mathematical Modelling in Environmental Sciences and Models for Complex Media	SS-WPA #3 Wave Propagation and Applications	SS-CNT #3 Computational Number Theory	SS-DASO Data Analytics for System Optimization	SS-DDEMM #2 Delay Differential Equations as Mathematical Models of Real World Phenomena
12:00-13:30	**Lunch**				
13:30-14:30	BA201	**Congress Plenary Lecture** *Species Coexistence in Stochastic Environments: A Mathematical Perspective* **Sebastian Schreiber**, University of California, Davis, Abstract & Biography on p. 14 (Chair: F. Lutchser (tentative))			
14:30-15:00	BA Halls	**Coffee Break**			
15:00-17:00	N1001/02/44	BA101	BA102	BA305	BA306
		CS-MODELING #2 Partial Differential and Integral Equations in Mathematical Modeling	CS-FINANCE #2 Financial Mathematics and Computation	SS-AAIP #2 Inverse Problems	SS-SSMMBP #2 Simulations in Soft Matter and Molecular Bio-Physics
	BA202	BA208	BA209	BA210	BA211
	MS2Discovery Institute Meeting		SS-CNT #4 Computational Number Theory		SS-DDEMM #3 Delay Differential Equations as Mathematical Models of Real World Phenomena

12. Parallel Sessions Schedule

The following pages give the detailed speaker list for the morning and afternoon parallel session each day of the Congress.

Monday, June 8

Monday, June 8: Morning

Time	Room BA101	BA102	BA206	BA207
	ST-MB #1 Mathematical Biology *Human-Environment Systems* Chair: F. Lutscher University of Ottawa	SS-TMN #1 Topics in Mathematical Neuroscience Chair: P. Greenwood University of British Columbia	SS-WDSEE #1 Wealth Distribution and Statistical Equilibrium in Economics Chair: E. Scalas University of Sussex	SS-GAMCCM #1 Geometric and Analytic Methods in Classical and Celestial Mechanics Chair: L. Bakker Brigham Young University
10:30-10:50	*Modelling human-environment interactions and their impact bistability in forest-grassland mosaics* M. Anand University of Guelph	*Exploring firing patterns of stellate cells* P. Rowat University of California San Diego	*Statistical Mechanics of Inequality in Distributions of Money, Income, Debt, and Energy Consumption* V. Yakovenko University of Maryland	*Orthogonal separation of the Hamilton-Jacobi equation on Spaces of Constant curvature* K. Rajaratnam University of Waterloo
10:50-11:10	*A Local Optimization Approach to Resolving Conservation Conflicts in Mosaic Ecosystems* S. Nowack University of Guelph	*Nonlocal oscillations in membrane potential provoked by a slow current ramp* L. Bilinksy Duke University	*Thermodynamics of inequalities* M. Smerlak Perimeter Institute for Theoretical Physics	*Aspects of Finsler geometry behind Lagrangian mechanical systems* T. Mestdag Ghent University
11:10-11:30	*The MIRACLE project: Tools and analysis methods for output from agent-based models of coupled human-natural systems* D. Parker University of Waterloo	*Sleep and Thermoregulation* J. Best Ohio State University	*The Equilibrium-Seeking Behaviour of a Very Simple Model of Wealth* G. Boyle Orrery Software	*Compatible quadratic Poisson brackets related to a family of elliptic curves* T. Wolf Brock University
11:30-11:50	*Interactions Between Simultaneous Behaviourally-Driven Disease Interventions in a Model of Seasonal Influenza* M. Andrews University of Guelph	*Projecting Biochemistry Over Long Distances* M. Reed Duke University	*Kinetic models for wealth distribution* B. Düring University of Sussex	*Canonoid and Poissonoid Transformations, Symmetried and Bi-Hamiltonian Structures* M. Santoprete Wilfrid Laurier University
11:50-12:10	*Modelling human-environment interactions and their impact on conservation incentive effectiveness in forest ecosystems* C. Bauch University of Waterloo			
12:10-12:30				

Monday, June 8: Morning

Time	BA202	BA208	BA209	BA210	BA211
	ST-SCNA #1 The 2nd Canadian Symposium on Scientific Computing and Numerical Analysis Chair: H. De Sterck University of Waterloo	ST-ACM #1 Applied and Computational Mechanics Chair: I.Y. Kim Queen's University	SS-GTA #1 Game Theory: Applications and Evolutionary Games Chair: J. Apaloo St. Francis Xavier University	NSERC Discovery Grant Information Session	SS-MACHS #1 Modeling, Analysis and Control in Hybrid Systems Chair: X. Liu University of Watelroo
10:30-10:50	*Implicitly Padded Convolutions on Hybrid Parallel Architectures* J. Bowman University of Alberta	*A quadrilateral spectral multidomain penalty method model for the simulation of environmental stratified flow processes: towards an efficient pressure solver* P. Diamessis Cornell University	*Truncation selection and the ESS* B. Morsky University of Guelph		*On Pinning Control, Synchronization and Controllability of Complex Networks* G. Chen City University of Hong Kong
10:50-11:10	*A Fast Solver for Dense Linear Systems: The Inverse Fast Multipole Method* P. Coulier Katholieke Universiteit Leuven	*Large eddy simulation of stratified turbulence* M. Waite University of Waterloo	*The Maximum Number of Coexisting Species in Evolutionary Dynamics* J. Apaloo St. Francis Xavier University		*Switching controlled synchronization of nonlinear systems with time-delays* P. Stechlinski Massachusetts Institute of Technology
11:10-11:30	*The Sphere Decoding Approach for Mixed Integer Least Squares Problems* X-W. Chang McGill University	*Internal Wave Boundary Layer Interaction: a novel instability over broad topography* S. Harnanan University of Waterloo	*Evolutionary game theory under time constraint* R. Cressman Wilfrid Laurier University		*A new measure of robust stability for impulsive differential equations* K. Church University of Ottawa
11:30-11:50	*A Nonlinearly Preconditioned Conjugate Gradient Algorithm for Rank-R Canonical Tensor Approximation* M. Winlaw University of Waterloo	*Coriolis forces control the secondary circulation and erosion patterns in large submarine turbidity currents* M. Wells University of Toronto	*The worlds biomes and primary production as a foraging game played by plants* G. McNickle Wilfrid Laurier University		*Pinning Stabilization of Cellular Neural Networks with Time-Delay Via Delayed Impulses* K. Zhang University of Waterloo
11:50-12:10	*Matrix Manifold Optimization Methods for Tucker Tensor Approximations* A. Howse University of Waterloo	*The influence of bottom topography on energy transfer between length scales* M. Stastna University of Waterloo	*Understanding the Dynamics of Infinite Niche Packing through Simulations* A. Holloway University of Illinois at Chicago		*Input-to-State Stability and H_∞ Performance for Stochastic Control Systems with Piecewise Constant Arguments* M. Alwan University of Waterloo
12:10-12:30	*Reconstruction of Dynamic SPECT Images* M. Trummer Simon Fraser University	*A moving-mesh method for spectral collocation solutions of partial differential equations* C. Subich Environment Canada	*Evolution of cooperation in a multidimensional phenotype space* D. Kroumi Université de Montréal		*Switched singularly perturbed systems with reliable controllers* T. Sugati University of Waterloo

Monday, June 8: Morning

Time	N1001	N1002	N1044
	ST-CFDSC #1 The 23rd Conference of the CFD Society of Canada *CFD Methods I* Chair: L. Ivan University of Waterloo	**ST-CFDSC #4** The 23rd Conference of the CFD Society of Canada *Turbulence I* Chair: L. Freret University of Toronto, Institute of Aerospace Studies	**ST-CFDSC #6** The 23rd Conference of the CFD Society of Canada *Separation and Transition* Chair: J. McDonald University of Ottawa
10:30-10:50	*Efficient high order differentiation of implicitly-defined curves with applications to homotopy continuation algorithms for CFD flow solvers* D. Brown University of Toronto, Institute for Aerospace Studies	*Evaluation of Hybrid RANS/LES Turbulence Models For Gas-Turbine Combustor-Relevant Flows* J. West University of Toronto, Institute for Aerospace Studies	*A Preliminary DNS Study of the Effect of a Blunt Leading Edge on the Instability of a Separating Laminar Boundary Layer* J. Brinkerhoff University of British Columbia
10:50-11:10	*Treatment of Non-Conforming Faces in the Framework of Spectral Discontinuous Galerkin Discretization* M. Chrust University of Ottawa	*Large-eddy simulation of the flow around a single and two staggered infinite-length circular cylinders* J. Sloviak University of Manitoba	*2D Analysis of a Flow Past a Square Cylinder Using the Spectral Element Method* C. Mavriplis University of Ottawa
11:10-11:30	*An Implicit Cartesian Grid Method for CFD using Finite Volume and Finite Difference Discretizations* P. Nikrityuk University of Alberta	*A Dynamic Subfilter-scale Stress Model for Large Eddy Simulations Based on Physical Flow Scales* A. Rouhi Queen's University	*The Effects of Wall Roughness on Adverse Pressure Gradient Boundary Layer* P. Mottahgian Queen's University
11:30-11:50	*An h-adaptive implementation of the discontinuous Galerkin method for nonlinear hyperbolic conservation laws on unstructured meshes for graphics processing units* A. Giuliani University of Waterloo	*Direct Numerical Simulation of the Flow Around a Wing Session at Moderate Reynolds Numbers* S.M. Hosseini Royal Institute of Technology	*Direct Numerical Simulation of Transition on a Laminar Morphing Wing: 2D vs 3D* J. Laplante University of Ottawa
11:50-12:10	*Optimising Flux Reconstruction Schemes for Large Eddy Simulation* R. Watson University of Cambridge	*A Projection Method Based Fast Transient Solver for Incompressible Turbulent Flows* C. Sideroff Applied CCM Canada	*Numerical Implementation of a Plasma Actuator in a RANS Flow Solver with Experimental Comparison* M.N. Parenteau École Polytechnique de Montréal
12:10-12:30	*Considerations in the Parallelization of a High-Order Discontinuous Galerkin Scheme* P. Jha University of Ottawa	*High-order Solutions of the Negative Spalart-Allmaras Turbulence Model by a Correction Procedure via Flux Reconstruction Scheme* F. Navah McGill University	

Monday, June 8: Afternoon

Time	BA101	BA102	BA206	BA207
Room	ST-MB #2	SS-TMN #2	SS-WDSEE #2	SS-GAMCCM #2
	Mathematical Biology *Evolution* Chair: H. Eberl University of Guelph	Topics in Mathematical Neuroscience Chair: L. Bilinsky Duke University	Wealth Distribution and Statistical Equilibrium in Economics Chair: B. Düring University of Sussex	Geometric and Analytic Methods in Classical and Celestial Mechanics Chair: M. Santoprete Wilfrid Laurier University
15:30-15:50	*Modelling RNA Replication in the RNA World* P. Higgs McMaster University	*PDEs with stochastically switching boundary conditions and application to the control of neurotransmitter concentration* S. Lawley University of Utah	*Exploring the origin of inequality in academic background-oriented society* J. Inoue Hokkaido University	*Nose-Hoover Thermostats* L. Butler North Dakota State University
15:50-16:10	*Multitype Branching Processes in Continuous Time Predict Adaptation Rates in Bacteria* L. Wahl Western University	*A computational model of the influence of depolarization block on initiation of seizure-like activity* D. Nykamp University of Minnesota	*Finitary probabilistic methods in Economics* E. Scalas University of Sussex	*On the Problem of Similar Motions of a Chain of Coupled Heavy Rigid Bodies* D. Chebanov City University of New York
16:10-16:30	*Information Theory and the Evolvability of Biological Populations* T. Day Queen's University	*Bursting in Networks of Integrate and Fire Neurons* S.A. Campbell University of Waterloo		*A continuation theorem in classical mechanics* C. Stoica Wilfrid Laurier University
16:30-16:50	*The Birth-Death-Diversification Model of Mobile Genetic Elements in Prokaryotes* M. Rabbani University of Western Ontario	*Neuromodulation and heterogeneity in neural networks* V. Booth University of Michigan		*An extended notion of Entropy* R. Smirnov Dalhousie University
16:50-17:10	*Refining a theory for the alternative life history strategies of a freshwater fish* G. Wild University of Western Ontario	*Modeling Populations of Neurons* P. Greenwood University of British Columbia		*Aspects and Applications of Quasi-homogeneous Potentials* J. Arredondo Konrad Lorenz University
17:10-17:30				

Monday, June 8: Afternoon

Time	Room				
	BA202	BA208	BA209	BA210	BA211
	ST-SCNA #2	ST-ACM #2	SS-GTA #2	ST-AADS #1	SS-MACHS #2
	The 2nd Canadian Symposium on Scientific Computing and Numerical Analysis Chair: Steve Ruuth Simon Fraser University	Applied and Computational Mechanics Chair: M. Stastna University of Waterloo	Game Theory: Applications and Evolutionary Games Chair: M. Cojocaru University of Guelph	Applied Analysis and Dynamical Systems Chair: X. Zou University of Western Ontario	Modeling, Analysis and Control in Hybrid Systems Chair: P. Stechlinski Massachusetts Institute of Technology
15:30-15:50	*B-spline Adaptive Gaussian Collocation for Error Controlled Numerical Solutions of ODEs and PDEs* P. Muir Saint Mary's University	*Dynamics of vortex Rossby waves in tropical cyclones* L. Campbell Carleton University	**Semi-plenary Lecture** *Sustainability of Cooperation in Dynamic Games Played over Event Trees* G. Zaccour École des Hautes Études commerciales de Montréal Abstract & Biography on p. 24	*Derivation of the Stochastic Hartree Equation in the Presence of Multiplicative Noise* W. Abou Salem University of Saskatchewan	*Stability Properties of Singular Systems Subject To Impulsive Effects* H. Kiyak University of Waterloo
15:50-16:10	*Optimal Backward Error and the Dahlquist Test Problem* T. Corless University of Western Ontario	*Double Diffusive Sedimentation in Sediment Laden Interflows* S. Davaparnah Jazi University of Toronto		*Some partial results on the dynamics of a nonlinear wave equation* J. Esquivel-Avila Universidad Autónoma Metropolitana	*On a Topological Obstruction in the Reach Control Problem* M. Ornik University of Toronto
16:10-16:30	*Adaptive Time-stepping in the Numerical Solution of the Reaction-Diffusion Master Equation* J. Padgett Ryerson University	*Modeling the behavior of confined colloidal particles under shear flow* C. Denniston University of Western Ontario		*A modified discrete time nonlinear sliding mode observer with application to diffusion equation* S. Afshar University of Waterloo	*New master-slave synchronization criteria of chaotic Lur'e systems with time-varying-delay feedback control* K. Shi University of Electronic Science and Technology of China
16:30-16:50	*A high-order solution-adaptive simulation framework for hyperbolic conservation laws on cubed-sphere grids* L. Ivan University of Waterloo	*Eulerian modelling of air-droplets flow: Perspectives and numerical solutions* K. Sana University of Ottawa	*The Emergence of Cooperative Breeding Systems with Resource Allocation* J. Dunn University of Western Ontario	*Strong convergence and stability of Kirk-multistep-type iterations for contractive-type operators with Applications* H. Akewe University of Lagos	*Passivity analysis of the stochastic system with time delay* Y. Du University of Electronic Science and Technology of China
16:50-17:10	*A fast-marching method for non-monotonically evolving fronts* A. Tcheng McGill University	*Self-similar reversing interfaces (contact lines) for the porous medium equation with absorption* J. Foster McMaster University	*An Evolutionary Game Approach for Dynamic Resource Allocation Problems* A. Pashaie University of Toronto	*Computability of Fixed Points in Analog Systems* D. Poças McMaster University	
17:10-17:30	*A numerical framework for tracking interfaces in generalized Mullins-Sekerka dynamics* B. Wetton University of British Columbia		*Time-dependent casual encounters games and HIV spread* S. Athar University of Guelph	*A Holistic Framework for Analysing General Failure and Safety Problems* F. Sun University of Waterloo	
17:30-17:50			*The evolution of inequity aversion under local competition* P. Barclay University of Guelph		

Monday, June 8: Afternoon

Time	Room N1001	N1002	N1044
	ST-CFDSC #2 The 23rd Conference of the CFD Society of Canada *CFD Methods II* Chair: C. Mavriplis University of Ottawa	ST-CFDSC #5 The 23rd Conference of the CFD Society of Canada *Turbulence II* Chair: A. Straatman Western University	ST-CFDSC #7 The 23rd Conference of the CFD Society of Canada *Low Speed Turbines* Chair: R. Watson University of Cambridge
15:30-15:50	*A Modified Discontinuous Galerkin Method with an Improved CFL Number* L. Krivodonova University of Waterloo	*2.5-D CFD Simulation of Swept High-Lift Wing Configurations* K. Sermeus Bombardier Aerospace	*A numerical investigation of wind turbine far wake and performance using the actuator disc model* G. Schneider University of Waterloo
15:50-16:10	*A Characteristic-based CFL Number for the Discontinuous Galerkin Method on Triangular Meshes* N. Chalmers University of Waterloo	*Simulation of Integrated Nozzle/Jet Compressible Subsonic Turbulent Flow* A. (Abbas) Ghasemi University of Waterloo	*A Morphing Blade Design for Vertical-Axis Wind Turbines* D. MacPhee San Diego State University
16:10-16:30	*Equivalence between the Energy Stable Flux Reconstruction and Filtered Discontinuous Galerkin Schemes* P. Zwanenburg McGill University	*Flow alteration around a wall-mounted bluff body using a front splitter plate* T. Sheel Trent University	*CFD Investigation of a Horizontal Axis Open-Center Tidal Turbine* A-L. Gunter Concordia University
16:30-16:50	*p-Multigrid for High-Order Methods via Flux Reconstruction* L. Yang McGill University	*Numerical Study of the Installed Controlled Diffusion Airfoil at Transitional Reynolds Number* H. Wu Queen's University	*A Dual-Rotor Horizontal Axis Wind Turbine In-House Code (DR_HAWT)* M. Miller Carleton University
16:50-17:10	*Comparison of Two High-Order Solution-Adaptive Schemes: Finite Volume and Discontinuous Galerkin* P. Jha University of Ottawa	*Flow regimes of mesoscale circulations forced by inhomogeneous surface heating* M.A. Hossain Memorial University of Newfoundland	*CFD Study of a Savonius Wind Turbine on a Rooftop* F. Schily Concordia University
17:10-17:30	*Shock Capturing for High-Order Correction Procedure via Reconstruction Methods* N. Ringue McGill University	*Application of CFD Modelling to the Restoration of Eutrophic Lakes* A. Najafi Nejad Nasser Concordia University	*Numerical Investigation on Periodic Simulation of Ducted Axial Fan* G. Schneider University of Waterloo

Tuesday, June 9

Tuesday, June 9: Morning

Time	BA101	BA102	BA305	BA306
Room	ST-MB #3	SS-MFMCR #1	CS-BSM #1	SS-GAMCCM #3
	Mathematical Biology *Biofilms and Industrial* Chair: T. Day Queen's University	Mathematical Finance - Modeling, Computation and Risk Management Chair: J. Campolieti Wilfrid Laurier University & University of Waterloo	Mathematics and Computation in Biological Sciences and Medicine Chair: TBA Affiliation	Geometric and Analytic Methods in Classical and Celestial Mechanics Chair: R. McLenaghan University of Waterloo
10:00-10:20	*A Fully Spatially Structured Metapopulation Model for Predator-Prey Dynamics* M. Garvie University of Guelph	*A Framework for Efficient Valuation of Large Portfolios of Unit-Linked Insurance Products* K. Jackson University of Toronto	*Mathematical Model of HIV and HCV coinfection* B. Aggarwal University of Calgary	*Index theory in Celestial Mechanics: recent results and new perspectives* A. Portaluri Università di Torino
10:20-10:40	*Non-standard numerical schemes for approximating predator-prey dynamics* B. Corbett University of Guelph	*Dimension and Variance Reduction for Monte Carlo Methods for High-Dimensional Models in Finance* K. Jackson University of Toronto	*In-host HIV model describes differences in disease progression among patients infected with HIV-1 subtypes A, C and D* D. Dick University of Western Ontario	*Morse index and linear stability of some equivariant solutions for N-body-type problems via index theory* V. Barutello University of Turin
10:40-11:00	*Dispersal Under Recolonization of Regenerating Landscape* R. Tyson University of British Columbia (Okanagan)	*Efficient Convergent Lattice Method for Asian Options Pricing with Superlinear Complexity* W. Xu University of Waterloo	*Population dynamics of lysogenic and lytic strategies during phage-bacteria interactions* Q. Ali University of Western Ontario	*A Separating Surface for Sitnikov-like $(n+1)$-Body Problems* L. Bakker Brigham Young University
11:00-11:20	*Wave Blocking Phenomena in Periodic Landscapes* J. Dowdall University of Ottawa	*Accurate Operator Splitting Approximation for Pricing CEV Spread Options* C-F. Lo Chinese University of Hong Kong	*A numerical study of the effects of inhomogeneous media in Diffusion Weighted Imaging* J. Cervi University of Ontario Institute of Technology	*Stability and Bifurcation of the Hip-Hop orbit* P.L. Buono University of Ontario Institute of Technology
11:20-11:40	*On a reaction diffusion system for the sterile insect release method in a bounded domain* X. Zou University of Western Ontario	*Algorithms for Finding Copulas Minimizing Convex Functions of Sums and Applications to Finance and Risk Management* C. Bernard Grenoble École de Management		
11:40-12:00		*Correlated Poisson Processes* A. Kreinin IBM, Risk Analytics		

Tuesday, June 9: Morning

Time	BA202	BA208	BA209	BA210	BA211
Room	ST-SCNA #3 The 2nd Canadian Symposium on Scientific Computing and Numerical Analysis Chair: R. Haynes Memorial University of Newfoundland	ST-ACM #3 Applied and Computational Mechanics Chair: J. Foster McMaster University	SS-GTA #3 Game Theory: Applications and Evolutionary Games Chair: R. Cressman Wifrid Laurier University & University of Waterloo	ST-AADS #2 Applied Analysis and Dynamical Systems Chair: D. Pelinovsky McMaster University	SS-MMPND Matrix Manifold Problems subject to Noisy Data Chair: F. Burkowski & H. Wolkowicz University of Waterloo
10:00-10:20	*Numerical solution of the Kuramoto-Sivashinsky initial-boundary value problem* L. van Veen University of Ontario Institute of Technology	*Topology optimization and its applications in aerospace design and planetary vehicle design* I.Y. Kim McMaster University	*Deck Based Versions of Mathematical Games* D. Ashlock University of Guelph	*Bifurcations in a system of two coupled delayed feedback loops* J. Bélair Université de Montréal	*Higher-order singular value decomposition from incomplete data* Y. Xu University of Waterloo
10:20-10:40	*Padé Time Stepping Method of Rational Form for PDEs* S. Algami King Fahd University of Petroleum & Minerals	*Application of a Genetic Algorithm to Optimize Work Hardening Parameters Used in Plasticity Modelling of a Zirconium Alloy* T. Skippon Queen's University	*Coalitional operating room planning and scheduling* D. Aleman University of Toronto	*Degenerate Hopf Bifurcations in DDEs and Endemic Bubbles* V. LeBlanc University of Ottawa	*Scalable Manifold Learning by Isometric Patch Alignment* A. Ghodsi University of Waterloo
10:40-11:00	*An embedding method for the numerical approximation of partial differential equations on moving surfaces* S. Ruuth Simon Fraser University	*A New Numerical Approach for Linear and Non-Linear Advection* J-C. Nave McGill University	*Spatial Spread of an Epidemic through Public Transportation Systems with a Hub* F. Xu Wilfrid Laurier University	*The Slow Dynamics of Localized Spot Patterns for Reaction-Diffusion Systems on the Sphere* M. Ward University of British Columbia	*On rigidity theory of bar frameworks* A. Alfakih University of Windsor
11:00-11:20	*A multirate accelerated Schwarz Waveform Relaxation Method* K. Mohammad Memorial University of Newfoundland	*Formation and Switching Dynamics of Nematic Liquid Crystalline Domains* N.M. Abukhdeir University of Waterloo	*Using Heritage To Determine Strategy In Multi-Agent Systems* A. Hlynka University of Windsor	*Non-radial multi-vortex solutions to the magnetic Chern-Simon-Higgs equations* F. Ting Hong Kong Polytechnic University	*Protein Structure Network Models on the Euclidean Distance Matrix Cone* X-B. Li University of Waterloo
11:20-11:40	*Relaxation method for the nonlinear p-curl problem in applied superconductivity : a relaxed Yee scheme* M. Laforest École Polytechnique de Montréal	*Multiscale computational mechanics for non-linear behavior of lattice materials* D. Pasini McGill University	*The Emergence of Equilibrium Help Strategies in a Model of Competitive Helping* E. Wild University of Guelph	*Studies of Annular Smectic Electroconvection* M. Pugh University of Toronto	*Modeling protein loops using Frenet frames, inverse kinematics* F. Burkowski University of Waterloo
11:40-12:00	*The multiplier method of constructing conservative finite difference schemes for differential equations* A. Wan McGill University	*The Interaction Between Swimming Plankton and Internal Waves* J. Shaw University of Waterloo	*The evolution of body size in ecological food web networks* R. Rael Tulane University		*Noisy Sensor Network Localization: Robust Facial Reduction and the Pareto Frontier* H. Wolkowicz University of Waterloo

Tuesday, June 9: Morning

Time	Room N1001	N1002	N1044
	ST-CFDSC #3 The 23rd Conference of the CFD Society of Canada *CFD Methods III* Chair: S. Nadarajah McGill University	ST-CFDSC #8 The 23rd Conference of the CFD Society of Canada *Multi-Phase Flows* Chair: J. Brinkerhoff University of British Columbia	ST-CFDSC #12 The 23rd Conference of the CFD Society of Canada *High-Speed, Non-Equilibrium Flow and MHD* Chair: L. Krivodonova University of Waterloo
10:00-10:20	*A Finite Difference Cut-Stencil Formulation for the Solution of Lid-Driven Cavity Flow* M. Esmaeilzadeh University of Windsor	*CFD Modelling of Mixing and Segregation of Particles in Fluidized Bed: Eulerian-Lagrangian Approach* M. Bayati University of Alberta	*Development and Implementation of a Preconditioner for a Five-Moment One-Dimensional Moment Closure* J. McDonald University of Ottawa
10:20-10:40	*Application of High-Order Summation-by-Parts Operators to the Reynolds-Averaged Navier-Stokes Equations* X. Shen University of Toronto, Institute for Aerospace Studies	*Modelling particle dispersion in a turbulent channel flow by using CFD* M. Ahmadi Golestan École de Technologie Supérieure	*Parallel JFNK Solver for Hypersonic Viscous Flows* S. Gao McGill University
10:40-11:00	*A Hybrid Central Solver for Compressible Euler Equations* H. Naliganahalli Indian Institute of Science	*Prediction of bioaerosols dispersion and spatial distribution in a hospital isolation room* G. Khosravi École de Technologie Supérieure	*The lattice Boltzmann method for compressible flows at high Mach number* Y. Deng University of Waterloo
11:00-11:20	*A comparison between two and three-dimensional simulations of finite amplitude sound waves in a trumpet* J. Resch University of Waterloo	*Stochastic Methods For Reproducing The Continuity Effect In Turbulent Particle-Laden Flows* S. Murray McMaster University	*Application of a Maximum-Entropy-Based 14-Moment Closure for Multi-Dimensional Non-Equilibrium Flows* B. Tensuda University of Toronto
11:20-11:40	*Anisotropic Non-Uniform Block-based Adaptive Mesh Refinement for Three-Dimensional Inviscid and Viscous Flows* L. Freret University of Toronto, Institute of Aerospace Studies	*Thermocapillary migration of a deformable droplet* B. Sarameh University of Toronto	*A Fourth-Order CENO Finite-Volume Scheme for Resistive MHD Equations on Three-Dimensional Multiblock Hexahedral Grids* L. Ivan University of Waterloo
11:40-12:00		*CFD Analysis of the Hydrodynamics of an Air-Water Multiphase System in a Rotating Toroid Wheel* N.R. Sarker University of Alberta	

Tuesday, June 9: Afternoon

Time	BA101	BA102	BA305	BA306
Room	ST-MB #4	SS-MFMCR #2	CS-BSM #2	SS-CP
	Mathematical Biology Chair: L. Wahl University of Western Ontario	Mathematical Finance - Modeling, Computation and Risk Management Chair: A. Metzler Wilfrid Laurier University & University of Waterloo	Mathematics and Computation in Biological Sciences and Medicine Chair: E. Agyingi Rochester Institute of Technology	Computational Physics Chair: M. Wartak Wilfrid Laurier University
15:00-15:20	*Spatially Structured Neural Systems* P. Greenwood University of British Columbia	*On Optional Processes and Financial Market Modelling* A. Melnikov University of Alberta	*A quantitative model of cutaneous melanoma diagnosis using thermography* E. Agyingi Rochester Institute of Technology	*Numerical simulation of Stimulated Brillouin Scattering instability in LPI* H. Xiaoyan Institute of Applied Physics and Computational Mathematics
15:20-15:40	*Modelling and Analysis of the Relapse-Remission Behavior in Autoimmune Diseases* W. Zhang York University	*Comparative Analysis of Warrants Pricing Models* A.X. Zhou University of Western Ontario	*Effects of a Mixed Immuno-chemotherapy of Tumor by Impulsive Control* Q. Wang Shepherd University	*Two dimensional nodal Riemann solver based on one dimensional Riemann solver for a cell-centered Lagrangian scheme* Y. Liu Institute of Applied Physics and Computational Mathematics
15:40-16:00	*Modeling dynamic changes in immune tolerance during type 1 diabetes progression* M. Jaberi-Douraki McGill University	*Financial Modeling with multivariate mixed Fractional Brownian motion* A. Alvarez Ryerson University	*Regulation and Interaction of Cytokines During a Cytokine Storm* M. Wilcox University of Guelph	*New accurate reduced mathematical model for particle beam simulation* F. Assous Ariel University
16:00-16:20	*A Model of Microtubule Organization in the Presence of Motor Proteins* G. de Vries University of Alberta	*Cumulative prospect theory with skewed return distribution* T. Pirvu McMaster University	*Assessing the Robustness of Limited Sampling Strategies* L. Kheibarshekan Université de Montréal	*A Single-Stage High-Resolultion Constrained Transport Method for Magnetohydrodynamic Equations* X. Feng Michigan State University
16:20-16:40		*Risk Measurement of Variable Annuity Under Stochastic and Correlated Risk Factors* H. Gao Bank of Montreal	*Provirus as a Reservoir of Viral DNA* A. Nadeem University of Western Ontario	*Performance study of an optimum SLW model in solution of non-gray radiative heat transfer problems* B. Abrar Sharif University of Technology
16:40-17:00		*Exponentially affine pricing kernels: from GARCH to diffusions* A. Badescu University of Calgary		

Tuesday, June 9: Afternoon

Time	BA202	BA208	BA209	BA210	BA211
Room	ST-SCNA #4	ST-ACM #4	ST-IM #1	CS-DSDE #1	ST-AADS #3
	The 2nd Canadian Symposium on Scientific Computing and Numerical Analysis Chair: X-W. Chang McGill University	Applied and Computational Mechanics Chair: L. Campbell Carleton University	Industrial Mathematics *Mathematical Modelling in the Agriculture and Food Science Sector* Chair: J. Stockie Simon Fraser University	Applications of Dynamical Systems and Differential Equations Chair: K. Morris University of Waterloo	Applied Analysis and Dynamical Systems Chair: D. Iron Dalhousie University
15:00-15:20	*Utilizing Support Vector Machines to Improve Graph Transduction* E. Cheung University of Waterloo	*A dynamic perspective of viscoelastic turbulence: new insights into a decades-old question* L. Xi McMaster University	*Mathematical modeling of cellulose degradation by Clostridium thermocellum* H. Eberl University of Guelph	*Stabilization of the Kuramoto-Sivashinsky equation* K. Morris University of Waterloo	*Biological invasions, random walks and interfaces* F. Lutscher University of Ottawa
15:20-15:40	*Data mining and probabilistic models for error estimate analysis of finite element method* J. Chaskalovic University Pierre and Marie Curie (Paris 6)	*Water Quality modeling of storm-water ponds for eutrophication management* N. Nakhaei Queen's University	*Post-harvest diseases of apples: From spore dispersal to epidemiology* R. Tyson University of British Columbia (Okanagan)	*On Stabilization of an Unbalanced Lagrange Gyrostat* D. Chebanov City University of New York	*Conservative Plankton Models with Time Delay* S.A. Campbell University of Waterloo
15:40-16:00	*An integral equation method for flow in porous media* B. Quaife University of Texas	*Numerical evaluation of the near-wall convection velocity and Kolmogorov constants for use in the inertial dissipation method* A. Jabbari Queens University	*Flow currents and ventilation in Langstroth beehives due to brood thermoregulation efforts of honeybees* R. Sudarsan University of Guelph	*Existence and stability of a synchronous oscillation in a neural system with delayed coupling* I. Ncube Alabama A & M University	*Modeling informed optimal and adaptive public health information for emerging infection risk control* J. Wu York University
16:00-16:20	*Auto Insurance Fraud Detection Using Unsupervised Spectral Ranking for Anomaly* K. Nian University of Waterloo	*A Feasibility Study on Yazd Solar Trough Parabolic Powerplant to Improve the Efficiency by Tilting its Solar Coil* M. Darbandi Sharif University of Technology	*Estimating parameter sensitivity in a spatially continuous model of fermentation and transport processes in the human colon* A. Moorthy University of Guelph	*Dynamic Boundary Stabilization of Schrödinger Equation through a Kelvin-Voigt Damped Wave Equation* L. Lu Beijing Institute of Technology	*Relaxation Oscillations in an SIR Epidemic Model* M. Li University of Alberta
16:20-16:40	*Infinite-dimensional l1 minimization techniques for multivariate function interpolation* B. Adcock Simon Fraser University	*On Numerical Approach to the Solution of Gardner Equation* O. Morufu Oyedunsi Osun State University	*A multiscale model for maple sap exudation* J. Stockie Simon Fraser University	*Global Stability of Coupled Lorenz Systems Controlled with Two Adaptive Controllers* Y. Wu Georgia Southern University	*Ecological models with multiple stable states* J. Watmough University of New Brunswick
16:40-17:00					*Oscillations in Phytoplankton Growth due to Limitation by Light and Nitrogen* G. Wolkowicz McMaster University

Tuesday, June 9: Afternoon

Time	Room N1001	N1002	N1044
	ST-CFDSC #11 The 23rd Conference of the CFD Society of Canada *Heat Exchangers and Cooling* Chair: C. Lange University of Alberta	**ST-CFDSC #13** The 23rd Conference of the CFD Society of Canada *Applications* Chair: C. Mavriplis University of Ottawa	**ST-CFDSC #9** The 23rd Conference of the CFD Society of Canada *Stratified and Buoyancy-Driven Flows* Chair: P. Nikrityuk University of Alberta
15:00-15:20	*The Numerical Performance Comparison between Nominal and As-Manufactured Heat Transfer Enhancement Surfaces* A. Buckrell University of Waterloo	*Turbulent Schmidt Number Sensitivity of Adjoint-based Pollutant Quantification* C. Brereton Carleton University	*High density difference buoyant displacement flows in an inclined 2D channel* K. Alba University of Houston
15:20-15:40	*Numerical Analysis of Turbulent Convective Heat Transfer in Hydro-generators* D-D. Dang École de Technologie Supérieure	*Ice Accretion Effects on Fully-articulated Rotors in Forward Flight* D. Kelly McGill University	*Trailing front behavior in heavy-light displacement flows in an inclined 2D channel* K. Alba University of Houston
15:40-16:00	*CFD Modeling and Validation of a Multipass Compact Heat Exchanger* M. Ismail University of Windsor	*Modelling of Outflow Control Device in Steam Assisted Gravity Drainage Process* L. Lei University of Alberta	*Three-dimensional numerical analysis for stratified iso-viscous miscible displacement pipe flows* S. Yoon University of British Columbia
16:00-16:20	*Laminar Free Convection from a Pair of Horizontal Cylinders: A Three-Temperature Problem* S.S. Mohaddes Foroushani University of Waterloo	*Prediction of Mixing Layer Critical Reynolds Number in Different Free-Stream Temperatures* S. Rahbarimanesh University of Ottawa	*Stratified Instabilities on the sub-centimeter scale* M. Stastna University of Waterloo
16:20-16:40	*Laminar and Turbulent Natural Convective Heat Transfer from a Horizontal Isothermal Circular Element with an Unheated Inner Circular Session* P. Oosthiuzen Queen's University	*CAE-specific Criteria for Technology Readiness Levels (TRL) in the Industrial R&D Environment* K. Sermeus Bombardier Aerospace	*Discontinuous Galerkin methods for incompressible continuously-stratified flow* D. Steinmoeller University of Waterloo
16:40-17:00	*Numerical Modeling of Indirect Evaporative Cooling using a Conjugate Domain Approach* F. Khan Western University		*Displacement flows in a plane channel with an oscillatory wall* S.M. Taghavi Laval University

Wednesday, June 10

Wednesday, June 10: Morning

Time	BA101	BA102	BA305	BA306
Room	ST-MB #5	SS-MFMCR #3	CS-BSM #3	SS-CMPMC
	Mathematical Biology *Epidemiology 1* Chair: P. van den Driessche University of Victoria	Mathematical Finance - Modeling, Computation and Risk Management Chair: J. Campolieti Wilfrid Laurier University & University of Waterloo	Mathematics and Computation in Biological Sciences and Medicine Chair: A. Willms University of Guelph	Computational Methods in Physical and Macromolecular Chemistry Chair: S. Consta University of Western Ontario
10:00-10:20	*Backward Bifurcation in an Mathematical Model for HIV Infection in vivo with Anti-Retroviral Treatment* M. Li University of Alberta	**Semi-plenary Lecture** *Modelling the Collapse of Financial Systems* T. Hurd McMaster University Abstract & Biography on p. 22	*Populations Dynamics and Infections in Honey Bees* M. Betti University of Western Ontario	*Charge-induced instabilities of droplets containing macromolecular complexes* F. Sheriff University of Western Ontario
10:20-10:40	*The importance of cell-to-cell transmission during the acute stage of HIV infection* C. Wells Yale University		*Escherichia coli Contamination Spread in Ground Beef Production* A. Willms University of Guelph	*Interactions between carbon nanoparticles and fragmentation of a droplet of organic solvent* M. Paliy University of Western Ontario
10:40-11:00	*Disease extinction and re-emergence in differential-equation models* S. Greenhalgh Yale University		*Mathematical Study of the Pest Control for Jatropha Curcas Plant* P.K. Roy Jadavpur University	*Effect of Counterions on the Charging Mechanisms of a Poly(ethylene glycol) in Aqueous Nanodrops* M. Sharawy University of Western Ontario
11:00-11:20	*A Social Contact Model With Applications to Choice Disability, HIV Transmission, and Sexual Assault* R. deBoer University of Ottawa	*Disorderly hedge fund liquidation under asymmetric information and market impact* C. Hyndman Concordia University	*A Computational Model of Dynamic Cell Fates Via Signal Regulation in Retina Angiogenesis* C. Calmelet California State University	*Conformational selection or induced-fit docking: results of computational studies* A. Malevanets Cyclica Inc.
11:20-11:40	*Strategies for Early Vaccination During Novel Influenza Outbreaks* Y. Xiao University of Alberta	*Modelling Default Risk with Occupation Times* R. Makarov Wilfrid Laurier University	*Coupled and Multi-scale Lattice Boltzmann Modeling of Bidomain type models in Cardiac Electrophysiology* S. Corre Institut Nationale des Sciences Appliquées (INSA) de Rennes & Institut de Recherche Mathématiques de Rennes (IRMAR)	*Effect of Solvent on Solvation and Sodiation Mechanisms of Poly(ethylene glycol) in Droplets* M.I. Oh University of Western Ontario
11:40-12:00	*Identifying the Conditions Under Which Antibodies Protect Against Infection by Equine Infectious Anemia Virus* R. Smith? University of Ottawa	*Bond and CDS Pricing with Recovery Risk: The Stochastic Recovery Black-Cox Model* A. Cohen Michigan State University	*Mobile Genetic Elements in Prokaryotes: Analysis of the Birth-Death-Diversication Model* N. Drakos University of Western Ontario	*Simulation of effect of solvent in charging mechanism of a macromolecule in droplet by classical molecular dynamics* S. Soltani University of Western Ontario

Wednesday, June 10: Morning

Time	BA202	BA208	BA209	BA210	BA211
Room	**ST-SCNA #5** The 2nd Canadian Symposium on Scientific Computing and Numerical Analysis Chair: J. Wan University of Waterloo	**CS-MECHE #1** Computational Mechanics and Engineering Chair: TBA Affiliation	**ST-IM #2** Industrial Mathematics *Inverse Problems in Industrial Applications* Chair: C.S. Bohun University of Ontario Institute of Technology	**CS-DSDE #2** Applications of Dynamical Systems and Differential Equations Chair: TBA Affiliation	**SS-RALSMCL #1** Recent Advances in Lie Symmetry Methods and Conservation Laws for Differential Equations and Applications Chair: M. Abudiab Texas A&M University
10:00-10:20	*A New Penalization Method for the Shallow Water Equations with Applications to Global Ocean Flow* N. Kevlahan McMaster University	*High-Order Semi-Implicit Time-Stepping Methods for Navier-Stokes Equations* K. Loy University of Ottawa	*Full waveform inversion in seismic imaging* M. Lamoureux University of Calgary	*The quantum finite square well problem and the Lambert W function* S.R. Valluri King's University College University of Western Ontario	**Semi-plenary Lecture**
10:20-10:40	*Monolithic Multigrid Methods for Two-Dimensional Resistive Magnetohydrodynamics* S. MacLachlan Memorial University of Newfoundland	*The High-order Path-conservative Scheme for a Model of Compressible Non-conservative Two-phase Flow* Y. Jia Institute of Applied Physics and Computational Mathematics	*Recent results on scattering in layered media* P. Gibson York University	*Investigating an Exemplar Dynamic Model for Sound Classification* B. Goodman Simon Fraser University	*Conservation laws of fluid flow on Riemannian manifolds*
10:40-11:00	*A Novel Approach for a Coupled Fire-Atmosphere Model with Application to the Propagation of Wildfires* L-X. Proulx Université de Montréal	*Investigation of the Reynolds Number Effect on Fluid-elastic Instability of Moving Cylinder Arrays* A. (Ali) Ghasemi McMaster University	*Coulomb explosions as a molecular imaging technique* C.S. Bohun University of Ontario Institute of Technology	*Bifurcations in the solution structure of market equilibrium problems* F. Etbaigha University of Guelph	S. Anco Brock University Abstract & Biography on p. 20
11:00-11:20	*Stability and dynamics of liquid threads and annular layers in a corrugated tube* Q. Wang York University	*Free Vibration Analysis of Axially Functionally Graded Beams using the Differential Quadrature Method* H. Sakurai National Institute of Technology, Sendai College	*Estimating fugitive emissions of metallic particulates using a Gaussian plume model* B. Hosseini Simon Fraser University	*Numerical Solutions for Accelerated and Decelerated MHD Falkner-Skan Flows* A. Malek Tarbiat Modares University	*Some conservation laws for a Fisher equation with variable coefficients* M.L. Gandarias University of Cadiz
11:20-11:40	*Three-dimensional effects in miscible pipe displacement flows in the viscous regime* I. Frigaard University of British Columbia	*An effective high-order shock-capturing limiter for discontinuous Galerkin methods* D. Seal Michigan State University		*Power Geometry For Finding Periodic Solutions in System of ODE* A. Soleev Samarkand State University	*Benjamin-Bona-Mahony Equation with Variable Coefficients: Conservation Laws and Exact Solutions* C.M. Khalique North-West University
11:40-12:00	*An Immersed Boundary Method for Mass Transfer Cross Permeable Interfaces* H. Huang York University	*Designing vehicle parameters using Split and discard decision making strategy* D. Syeda Indian Institute of Technology Kanpur			*Solutions and conservation laws for a Kaup-Boussinesq system* M. Abudiab Texas A&M University

Wednesday, June 10: Morning

Time	Room N1001	N1002	N1044
	ST-CFDSC #10 The 23rd Conference of the CFD Society of Canada *Complex Flows* Chair: M. Karimi Ford Motor Company	ST-CFDSC #14 The 23rd Conference of the CFD Society of Canada *Impinging Jets* Chair: L. Krivodonova University of Waterloo	
10:30-10:50	*Non-Newtonian Simulations for the Design of a Micro-Couette Blood Flow Device* C. Mavriplis University of Ottawa	*On the similarities and differences between plane and radial wall-jets* R. Banyassady Queen's University	
10:50-11:10	*Numerical Simulations of Developing Laminar Flows of Non-Newtonian Liquids in Straight Pipes* I. Lokhmanets McGill University	*Piston Cooling Technology Using Jet Impingement* G. Nasif University of Windsor	
11:10-11:30	*Buoyant displacement flows of viscoplastic fluids in horizontal channels* S.M. Taghavi Laval University	*Transient Substrate Pressure Variation in the Shock Induced Spray Process* G. Rankin University of Windsor	
11:30-11:50	*On the Simulation of Porous Media Flow Using a New Meshless Lattice Boltzmann Method* M. Ashrafizaadeh Isfahan University of Technology	*Reynolds-averaged and wall-modelled large-eddy simulations of impinging jets with embedded azimuthal vortices* W. Wu Queen's University	
11:50-12:10	*Numerical Investigation of an Ethane-air Diffusion Flame Using Various Reaction Mechanisms* F. Morency École de Technologie Supérieure	*Effect of Micro-Jet Impingement on Nano-Aerosol Soot Formation in a Turbulent Paraffin-Oil Flame* G. Schneider University of Waterloo	
12:10-12:30	*CFD Modelling of the Dehydrogenation of Alkanes to Alkenes in A Fixed Bed Reactor* T.J. Jamaleddine SABIC Technology and Innovation Center	*CFD Investigation and Experimental Validation on the Effects of Viscosity for High Speed Liquid Jets Emitted from Needle Free Jet Injectors* R. Portaro Concordia University	

Wednesday, June 10: Afternoon

Time	BA101	BA102	BA305	BA306
Room	ST-MB #6 Mathematical Biology *Epidemiology 2* Chair: C. McCluskey Wilfrid Laurier University	SS-EBMSAHS Equation-Based Modeling: Structural Analysis and Hybrid Systems Chair: N. Nedialkov McMaster University	CS-CACO Computational Algebra, Combinatorics and Optimization Chair: Y. Gningue Laurentian University	CS-CPC Computational Physics and Chemistry Chair: TBA Affiliation
15:00-15:20	*A Metapopulation Cholera Model* P. van den Driessche University of Victoria	*A graphical view of reducing a DAE to an ODE by dummy derivatives* J. Pryce Cardiff University	*Improving the NNA for the Travelling Salesman Problem using a Modified Vogel Method* Y. Gningue Laurentian University	*A force balance model for rise, impact and bounce of bubbles in clean systems* R. Manica Institute of High Performance Computing
15:20-15:40	*The potential impact of vaccination on the dynamics of dengue infections* D. Knipl York University	*The Numerical Solution of Reduced Differential Algebraic Equation* J. Ernsthausen McMaster University	*Continuous Approaches to Quadratic Boolean Problems Solving* O. Pichugina Brock University	*The fourth-order density gradient expansion of a fluid free energy* G. Piatkovska University of Western Ontario
15:40-16:00	*Compartmental Modeling for the Transmission of Dengue in Guanzhou, China* W. Zhang York University	*Symbolic-Numeric Techniques for Improving Structural Analysis of DAEs* G. Tan McMaster University	*Exact Solution of a Boundary Value Problem using Computer Algebra System* Pratibha Indian Institute of Technology Roorkee	*Dynamics of disc-shaped colloids in nematic liquid crystal* A. Antipova University of Western Ontario
16:00-16:20	*Modelling Contact Tracing in Control of Epidemic Diseases* X. Huo Ryerson University & York University	*Solving DAEs Using The Signature Matrix Method To Exploit Underlying Structures* R. McKenzie Cardiff University	*Numerical verification of mixed precision algorithms using Monte Carlo arithmetic* M. Baboulin Université Paris-Sud	*Molecular-Dynamics Simulations Using Spatial Decomposition and Task-Based Parallelism* C. Mangiardi Laurentian University
16:20-16:40	*Nilpotent Singularities and Dynamics in an SIR Type of Compartmental Model with Hospital Resources* C. Shan University of Alberta	*Regularization and Numerical Integration of DAEs Based on the Signature Method* A. Steinbrecher Technische Universität Berlin	*Random butterfly transformations for accelerated parallel machines* M. Baboulin Université Paris-Sud	*Accurate Determination of Concentration Dependent Material Properties in Electrochemical Systems Using In-Situ NMR and Inverse Modelling* A. Krishnaswamy Sethurajan McMaster University
16:40-17:00	*On the co-infection of malaria and schistosomiasis* K. Okosun Vaal University of Technology		*Quasi-Cyclic Codes over Finite Rings* K. Guenda University of Algiers	*Solutions of Time-Fractional Diffusion Equations with Reflecting and Absorbing Boundary Conditions using Matlab* I. Ali King Fahd University of Petroleum & Minerals

Wednesday, June 10: Afternoon

Time	BA202	BA208	BA209	BA210	BA211
	ST-SCNA #6	CS-MECHE #2	ST-IM #3	CS-DSDE #3	SS-RALSMCL #2
	The 2nd Canadian Symposium on Scientific Computing and Numerical Analysis Chair: S. MacLachlan Memorial University of Newfoundland	Computational Mechanics and Engineering Chair: TBA Affiliation	Industrial Mathematics *Modelling of Transport Processes in Industry* Chair: H. Huang York University	Applications of Dynamical Systems and Differential Equations Chair: TBA Affiliation	Recent Advances in Lie Symmetry Methods and Conservation Laws for Differential Equations and Applications Chair: C.M. Khalique North-West University
15:00-15:20	*Derivation and some asymptotic estimates of the convergence rate of a Schwarz waveform relaxation domain decomposition method for some quantum wave equations* E. Lorin Carleton University & Centre de Recherches Mathématiques	*The Distributive Interoperable Executive Library (DIEL) for Multi-disciplinary System-wide Simulations* K. Wong University of Tennesee	*A novel heat transfer switch* I. Karimfazli University of British Columbia	*Homoclinic Structure for a Generalized Davey-Stewartson System* C. Babaoglu Istanbul Technical University	*Local Conservation Laws of a Generalized Variable-Coefficient Gardner Equation with Generalized Evolution* M.S. Bruzon University of Cadiz
15:20-15:40	*Some optimal and optimized Schwarz iterations for Nonlinear BVPs* R. Haynes Memorial University of Newfoundland	*Server Side Algorithms for WHLK Framework* N. Gupta University of Jammu	*The effects of cycling on the 'connectedness' of the binder in lithium-ion cathodes* J. Foster McMaster University	*Symmetry-Breaking Bifurcations in Laser Systems with All-to-All Coupling* J. Collera University of the Philippines Baguio	*Solutions and conservation laws of a coupled Korteweg-de Vries modified Korteweg-de Vries system* A.R. Adem North-West University
15:40-16:00	*Sparse Jacobian Matrix Determination using Two-sided Compressions* S. Hossain University of Lethbridge	*Mode coalescence of instability in two-fluid flows* A. Kaffel University of Maryland	*The barbeque pool heater: An algorithm to construct tubular networks that occupy arbitrary regions in* $\mathbb{R}^3$ B. Kettlewell University of Waterloo	*Modeling the effect of climatic factors on malaria transmission* G. Abiodun University of the Western Cape	*On the nonlinear self-adjointness of similar equations* R. Tracina University of Catania
16:00-16:20	*Nonrecourse stock loans* P. Azimzadeh University of Waterloo		*Some novel circle-packing algorithms devised for the construction of tubular networks in* $\mathbb{R}^3$ W. Jiang University of Waterloo		*Exact solutions of semilinear radial Schroedinger equations by separation of group foliation variables* T. Wolf Brock University
16:20-16:40	*Multigrid Method for Oligopolistic Competition Modelled by Stochastic Differential and Mean-Field Games* J. Wan University of Waterloo		*Conditioning of uneven boreholes in primary cementing* A. Roustaei University of British Columbia		
16:40-17:00	*Eye Tracking Studies of Category Learning: Fitting Complex Models to Individuals* P. Tupper Simon Fraser University				

Thursday, June 11

Thursday, June 11: Morning

Time	BA101	BA102	BA305	BA306
Room	**ST-MB #7** Mathematical Biology *Ecology, Non-spatial* Chair: R. Tyson University of British Columbia (Okanagan)	**SS-MSMB #1** Modeling & Simulation in Medicine and Biology Chair: C. Drapaca Pennsylvania State University	**SS-MMNN #1** Mathematical Models for Nanoscience and Nanotechnology Chair: Z. Miskovic University of Waterloo	**SS-GLS** Geocomputational Landscapes and Spaces Chair: S.A. Roberts & C. Robertson Wilfrid Laurier University & University of Waterloo
10:00-10:20	*Target Reproduction Numbers in Population Biology* Z. Shuai University of Central Florida	*Dynamics and bifurcations in low-dimensional models of intracranial pressure* D. Evans Pennsylvania State University	*Ionic screening of charged impurities in electrolytically gated graphene using Greens function approach* P. Sharma University of Waterloo	*Geocomputational Spaces of Social Media: User-level patterns and processes* C. Robertson Wilfrid Laurier University
10:20-10:40	*Sensitivity of the General Rosenzweig–MacArthur Model to the Mathematical form of the Functional Response: a Bifurcation Theory Approach* G. Wolkowicz McMaster University	*Role of iron-dependent oxidative stress in breast cancer* S. Arat Virginia Tech and University of Connecticut Health Center	*Boundary conditions for quantum hydrodynamic model of electron gas* N. Kang University of Waterloo	*New metrics for new datasets: A comparison of local spatial analysis methods for homogeneous patch extraction in user-generated content* H. Lawrence University of Waterloo
10:40-11:00	*A matrix population model for the abundance of Culex mosquitoes with temperature in different seasons* L. Chen York University	*A hybrid mathematical model of directed endothelial cell motility in angiogenesis* N. Tarfulea Purdue University Calumet	*Photoluminescent Decay Dynamics in Nanocrystals* B. Fernandes University of Waterloo	*Using geospatial media to aid in understanding of place sensing* S. Zhang University of Waterloo
11:00-11:20	*An interplay between division of labour and disease in a honeybee colony* V. Ratti University of Guelph	*Modeling and forecasting of mosquito abundance and risk of West Nile virus in Great Toronto area* H. Zhu York University	*Random Telegraph Signal and 1/f Noise in Graphene Semiconductors* L. Daniels University of Waterloo	*Maritime Anomaly Detection Via a Shape Based Local Association Measure* S. Roberts Wilfrid Laurier University
11:20-11:40	*Seasonality and predation: what happens when hunting behavior changes?* F. Lutscher University of Ottawa	*The evolution of group dispersal with leaders and followers* C. Koyyka University of Western Ontario	*Topological characterization of phase space manifolds corresponding to collective charge fluctuations in nanoparticle assemblies* B. Tadic Jozef Stefan Institute	*Prediction Model of Ship Movement Resulting from the Effects of Environmental Covariates* B. Friedrich Wilfrid Laurier University
11:40-12:00	*Coupling Fishery Dynamics, Human Health and Social Learning in a Model of Fish-borne Pollution Exposure* M. Yodzis University of Guelph	*Absenteeism impact on local economy during an epidemic via constrained hybrid SI dynamics* M. Cojocaru University of Guelph		*Modelling the Risk Landscape of Japanese Encephalitis in Kathmandu Valley, Nepal* J. Metelka Wilfrid Laurier University

Thursday, June 11: Morning

Time	BA202	BA208	BA209	BA210	BA211
	ST-SCNA #7 The 2nd Canadian Symposium on Scientific Computing and Numerical Analysis Chair: Ben Adcock Simon Fraser University	SS-WPA #1 Wave Propagation and Applications Chair: N. Tarfulea Purdue University Calumet	SS-CNT #1 Computational Number Theory Chair: C. Weatherby Wilfrid Laurier University	SS-DDMDS #1 Data-Driven Methods for Dynamical Systems Chair: T. Berry Pennsylvania State University	SS-RALSMCL #3 Recent Advances in Lie Symmetry Methods and Conservation Laws for Differential Equations and Applications Chair: M.L. Gandarias Universidad de Cadiz
10:00-10:20	*Particle settling in yield stress fluids: limiting time, distance and applications* I. Frigaard University of British Columbia	**Semi-plenary Lecture** *On long time dynamics in nonlinear wave equations* E-W. Kirr University of Illinois at Urbana-Champaign Abstract & Biography on p. 23	*Computing Galois groups with Magma* A-S. Elsenhans Universität Paderborn	*Timescale separation and forecasting with dynamics-adapted kernels* D. Giannakis New York University	*On Infinite Symmetries and Infinite Conservation Laws for Euler Equations* V. Rosenhaus California State University
10:20-10:40	*Smooth regularizations of the Dirac delta distribution* B. Hosseini Simon Fraser University		*Unconditional Class Group Tabulation for Imaginary Quadratic Fields to* 2^40 A. Mosunov University of Waterloo	*Spectral clustering with local scaling* T. Sauer George Mason University	*Symmetries and exact solutions for a nonlinear generalization of the Camassa-Holm equation* E. Racio Brock University
10:40-11:00	*The Double Exponential Sinc Collocation Method for Singular Sturm-Liouville Problems* H. Safouhi University of Alberta		*Shorter Compact Representations in Real Quadratic Fields* M. Jacobson University of Calgary	*High order kernels for data extension* N. Rabin Afeka - Tel Aviv Academic College of Engineering	*Closed-form solutions for the Lucas-Uzawa model with externality via the Partial Hamiltonian Approach* R. Naz Lahore School of Economics
11:00-11:20	*Numerical methods for parameter identification of cardiac electrophysiology models* Y. Bourgault University of Ottawa	*Vortex filament dynamics* W. Craig The Fields Institute	*Fast algorithms for finding a (short) generator of a principal ideal* J-F. Biasse University of Waterloo	*Analog forecasting with dynamics-adapted kernels* Z. Zhao Cornell University	*Nonclassical symmetry analysis of heated two-dimensional flow problems* I. Naeem Lahore University of Management Sciences
11:20-11:40	*Time-Stepping Methods in Cardiac Electrophysiology* T. Roy University of Ottawa	*A generalized Camassa-Holm equation and its peakon solutions.* S. Anco Brock University	*Euclid's Algorithm in Multiquadratic Fields* A. Feaver The King's University	*Objective coordinate change for anisotropic covariance modelling in high dimension* O. Pannekoucke Meteo-France	
11:40-12:00	*Three tales of success for numerical methods in heart simulation* R. Spiteri University of Saskatchewan	*Local boundary conditions in nonlocal wave equations.* F. Celiker Wayne State University			
12:00-12:20		*Bifurcations and stability of standing waves in the nonlinear Schrodinger equation on the tadpole graph* D. Pelinovsky McMaster University			

Thursday, June 11: Afternoon

Time	BA101	BA102	BA305	BA306
Room	**ST-MB #8** Mathematical Biology *Ecology, Spatial* Chair: G. Wolkowicz McMaster University	**SS-MSMB #2** Modeling & Simulation in Medicine and Biology Chair: S. Shontz University of Kansas	**SS-MMNN #2** Mathematical Models for Nanoscience and Nanotechnology Chair: H. Majedi University of Waterloo	**CS-APMRE** Applied Problems and Methods in Research & Education Chair: TBA Affiliation
15:00-15:20	*Modeling, analysis, and simulation of a chemostat with wall attached and suspended bacterial growth, with an application to nitrification in a wastewater biofilm reactor* H. Eberl University of Guelph	*Computational simulations of the onset and treatment of hydrocephalus in infants and mice based on a novel mesh warping algorithm* S. Shontz University of Kansas	*Coupling Electromagnetic wave to Dirac Electrons in Graphene: A Hydrodynamic Modelling* N. Ghafarian University of Waterloo	*Computational and Statistical Challenges with High Dimensionality: Efficient Algorithms for Feature Selection based on Manifold Learning* A. Baggag Qatar Computing Research Institute
15:20-15:40	*New reaction kinetics for models of disinfection of microbial biofilms by antibiotics* K. Rahman University of Guelph	*Lagrangian shape optimization for segmentation of multiphase images* G. Dogan Theiss Research, NIST	*Quantum Field Modelling of Nonlinear Optical Response in Graphene* B. Semnani University of Waterloo	*Spatial dependence modeling and allocation of wind/solar resources using C-Vine copulas and value-at-risk* A. Narayan University of Waterloo
15:40-16:00	*Mathematical Analysis of a Quorum Sensing Induced Biofilm Dispersal Model* B. Emerenini University of Guelph	*Mathematical challenges in medical image registration* M. Ebrahimi University of Ontario Institute of Technology	*Feasibility of single electron spin control with gate potential in III-V semiconductor quantum dots without magnetic field* S. Prabhakar Wilfrid Laurier University	*Optimal and Robust Designs of Step-stress Accelerated Life Testing Experiments for Proportional Hazards Models* W-Y. Huang Brock University
16:00-16:20	*To a Predictive Model of Pathogen Die-off in Soil Following Manure Application* A. Skelton University of Guelph	*Discovery of principles of nature from matrix and tensor modeling of large-scale molecular biological data* O. Alter University of Utah	*Pattern Analysis Using Shapelets for Nanoscale Self-Assembly Imaging* N.M. Abukhdeir University of Waterloo	*Computational Thinking in Teaching Accounting* A. Czegledi Conestoga College
16:20-16:40	*Mathematical Approach to Reduce the Enzymatic Inhibition for Maximum Production of Biodiesel through J.C. Oil* P.K. Roy Jadavpur University	*Effect of non-Newtonian rheology on transition to turbulence* M.O. Khan University of Toronto	*Modeling of Coupled Surface and Diffusion Forces for the Transport and Retention of Nanoparticles in Porous Media* F. Javadpour University of Texas at Austin	*New Hyper Binomial Probability Distribution* Y. Gningue Laurentian University
16:40-17:00		*Black-box simulations for vehicle transport* B. Quaife University of Texas		

Thursday, June 11: Afternoon

Time	BA202	BA208	BA209	BA210	BA211
Room	SS-FCP	SS-WPA #2	SS-CNT #2	SS-DDMDS #2	SS-DDEMM #1
	Fractional Calculus and Probability Chair: E. Scalas University of Sussex	Wave Propagation and Applications Chair: C. Turc New Jersey Institute of Technology	Computational Number Theory Chair: K. Hare University of Waterloo	Data-Driven Methods for Dynamical Systems Chair: D. Giannakis New York University	Delay Differential Equations as Mathematical Models of Real World Phenomena Chair: E. Braverman University of Calgary
15:00-15:20	*Exactly-solvable non-Markovian dynamic network* E. Scalas University of Sussex	*A High Order Method for Electromagnetic Scattering from Metallic Gratings* M. Haslam York University	**Semi-plenary Lecture** *Computing elliptic curves of fixed conductor* M. Bennett University of British Columbia Abstract & Biography on p. 21	*Variable-free and equation-free computation* Y. Kevrikidis Princeton University	*Zero-Hopf bifurcation in the Van der Pol oscillator with delayed feedback* J. Bramburger University of Ottawa
15:20-15:40	*Integro-differential operators and non-decreasing processes with independent increments* B. Toaldo University of Rome	*Efficient high-order integral equation methods for problems of scattering by defects in layered media* C. Perez-Arancibia California Institute of Technology		*Data-driven reduction for multiscale stochastic dynamical systems* R. Talmon Technion - Israel Institute of Technology	*Delay Stochastic Models in Finance* A. Swishchuk University of Calgary
15:40-16:00	*Source solution for the fractal Burgers equation with the critical exponent* T. Jakubowski Wroclaw University of Technology	*High order penalty methods: a Fourier approach to solving PDE's on domains with curved boundaries* D. Shirokoff New Jersey Institute of Technology		*Geometric Methods for the approximation of high-dimensional dynamical systems* M. Maggiori Duke University	*Investigating the impact of pharmacokinetic variability on physiological models with delays: A case study of neutrophil development, zalypsis, and filgrastim* M. Craig Université de Montréal
16:00-16:20	*Spectral representation of the solution to the Cauchy problem associated to fractional operators* Y. Zhao Cornell University	*Discontinuous Galerkin Schemes for the Relativistic Vlasov-Maxwell System* J. Rossmanith Iowa State University	*Divisor Tripling On Genus 2 Hyperelliptic Curves* S. Lindner University of Calgary	*Nonparametric uncertainty quantification methods for gradient flows with isotropic diffusions* J. Harlim Pennsylvania State University	*Periodic solutions of a singular delay differential equation* A. Ivanov Pennsylvania State University
16:20-16:40	*Ground state properties of non-local Schrdinger operators and jump processes* J. Lörinczi Loughborough University	*Integral equation methods for Laplace eigenvalue problems* E. Akhmetgaliyev California Institute of Technology	*Picard curves with good reduction away from $p = 3$* B. Malmskog Villanova University	*Data-driven forecasting without a model and with a partially known model* T. Berry Pennsylvania State University	*Post-Newtonian Gravitation* E. Verriest Georgia Institute of Technology
16:40-17:00		*A robust inversion method for quantitative 3D shape reconstruction from coaxial eddy-current measurements* M. Riahi New Jersey Institute of Technology	*Computing rational curves on quasihyperbolic surfaces* N. Bruin Simon Fraser University		*Existence and stability of hybrid systems with time delay* X. Liu University of Waterloo
17:00-17:20					*Transmission Dynamics of Multiple Species of Malaria Parasites with Time Delay* M. Ngwa Rochester Institute of Technology

Friday, June 12

Friday, June 12: Morning

Time	Room			
	BA101	BA102	BA305	BA306
	CS-MODELING #1	CS-FINANCE #1	SS-AAIP #1	SS-SSMMBP #1
	Partial Differential and Integral Equations in Mathematical Modeling Chair: R. Barron University of Windsor	Financial Mathematics and Computation Chair: R. Makarov Wilfrid Laurier University	Inverse Problems Chair: D. La Torre University of Milan	Simulations in Soft Matter and Molecular Bio-Physics Chair: H.S. Chan University of Toronto
10:00-10:20	*Fourth-Order Finite Difference Schemes for Numerical Solution of PDEs Using the Cartesian Cut-Stencil Method* R. Barron University of Windsor	*Pricing Options with Hybrid Stochastic Volatility Models* G. Jones Wilfrid Laurier University	*A V-variable approach to fractal image compression* F. Mendivil Acadia University	*Spatial organization of a chain molecule in a crowded and confined space* B-Y. Ha University of Waterloo
10:20-10:40	*A Simple Method for Solving PDEs on Point Clouds* Z. Lahdari Université de Caen Basse-Normandie	*Simulation of timer options under stochastic interest rates* B. Hu Wilfrid Laurier University	*A smoothing technique for image processing with sparsity* D. La Torre University of Milan	*Nanomotor dynamics in a chemically oscillating environment* B. Robertson University of Toronto
10:40-11:00	*Optimal dissipation in partial differential equations* A. Vest University of Waterloo	*Machine learning: modeling risky behaviour and financial fraud detection* D. Sawh University of Waterloo	*Predicting visual degradation of image subblocks produced by JPEG and JPEG2000 compression* A. Cheeseman University of Waterloo	*Mesoscopic simulation method of lipid bilayers and active membrane machines* M-J. Huang University of Toronto
11:00-11:20	*Spectral Convergence And Turing Patterns For Nonlocal Diffusion Systems* G. Zhao University of the West Indies	*On double barrier exit probabilities for the classical risk process with diffusion* D. Teneng University of Tartu	*Circle Inversion Map and Star-shaped Set Inversion Map Fractals* B. Boreland University of Guelph	*Role of Multilamellar Lipid Matrices in Polymerization of Organic Monomers in the Prebiotic World* M. Nategholeslam McMaster University
11:20-11:40	*Approximate Solution Of Some Boundary Value Problems* M. Chumburidze Akaki Tsereteli State University		*Inverse problems via the “Generalized Collage Theorem” for vector-valued Lax Milgram-based variational problems* K. Levere University of Guelph	*Concentration Dependent Properties of RNA Nanoclusters in Salt-Based Solutions using Molecular Dynamics Simulation* S. Badu Wilfrid Laurier University
11:40-12:00	*Method of Lines Transpose: High-order L-stable schemes for the reaction-diffusion equations using resolvent expansion* H. Cho Michigan State University			*Simulated force spectroscopy of superoxide dismutase (SOD1) protein* M. Habibi University of British Columbia

Friday, June 12: Morning

Time	BA202	BA208	BA209	BA210	BA211
Room	CS-ENV	SS-WPA #3	SS-CNT #3	SS-DASO	SS-DDEMM #2
	Mathematical Modelling in Environmental Sciences and Models for Complex Media Chair: TBA Affiliation	Wave Propagation and Applications Chair: E-W. Kirr University of Ilinois	Computational Number Theory Chair: C. Weatherby Wilfrid Laurier University	Data Analytics for System Optimization Chair: W. Feng & J. Huang Trent University & York University	Delay Differential Equations as Mathematical Models of Real World Phenomena Chair: A.F. Ivanov Pennsylvania State University
10:00-10:20	*Fractal Modelling of Hydrocarbon Bearing Rocks using Iterative Function Systems* Kamal Indian Institute of Technology Roorkee	*Semilinear Hyperbolic Partial Differential Equations in Curved Spacetimes* A. Galstyan University of Texas-Pan American	*Some Primality Tests that Eluded Lucas* H. Williams University of Calgary	*Can we do a better job in ranking then BM25?* S. Wang York University	*Effect of treatment on the global dynamics of delayed pathological angiogenesis models* E. Braverman University of Calgary
10:20-10:40	*Influence of the Coriolis force on internal waves in Lake Simcoe* B. Flood University of Toronto	*On the global Cauchy problem for non-linear Schrödinger equation with magnetic potential* N. Boussaid Université de Franche-Comté	*Simple linear relations for conjugate algebraic numbers* J. Jankauskas University of Waterloo	*Viral information propagation* J. McVittle University of Toronto	*Phase models and clustering in networks of oscillators with delayed, all-to-all coupling* Z. Wang University of Waterloo
10:40-11:00	*Persistent Homology for Analyzing Environmental Lake Monitoring Data* B. Fraser Nipissing University	*Expansion of a wedge of non-ideal gas into vacuum.* M. Zafar Indian Institute of Technology Bombay	*Binary sequences with merit factors greater than 6.34* S. Choi Simon Fraser University	*Analysis and detection of coalition attacks for online advertising* Q. Zhang Trent University	*An SEI Model with Age-of-Infection and Immigration* C. McCluskey Wilfrid Laurier University
11:00-11:20	*Stochastic Modeling and Performance Analysis for Electric Vehicle Charging Stations* H-T. Ha Gachon University	*A Leap-frog Discontinuous Galerkin Scheme for Solving 2D Wave Propagation in Anisotropic Materials* M. Khaksar Ghalati University of Coimbra	*Sums of Digits in q-ary Expansions* J.C. Saunders University of Waterloo	*An advanced data analytic tool: Okapl system and its easy adaption* S. Zhu York University	*Oscillation and driving mechanism in models of West Nile virus with time delay* H. Zhu York University
11:20-11:40			*Radial asymptotics and algebraic independence in Mahler's method* M. Coons University of Newcastle	*Denoising-autoEncoder with modified Elliot function and a sparsity term* H. Burhani Trent University	*Modelling virus dynamics with both virus-to-cell infection and cell-to-cell transmission by a DDE system* X. Zou University of Western Ontario
11:40-12:00			*Higher Mahler measure of some n-variable polynomial families* M. Lalin Université de Montréal	*Weighted integrative AICs criterion to perform model selection* Y. Xu University of Waterloo	*Distributed delays in a model of chemotherapy-induced myelosuppression* J. Bélair Université de Montréal

Friday, June 12: Afternoon

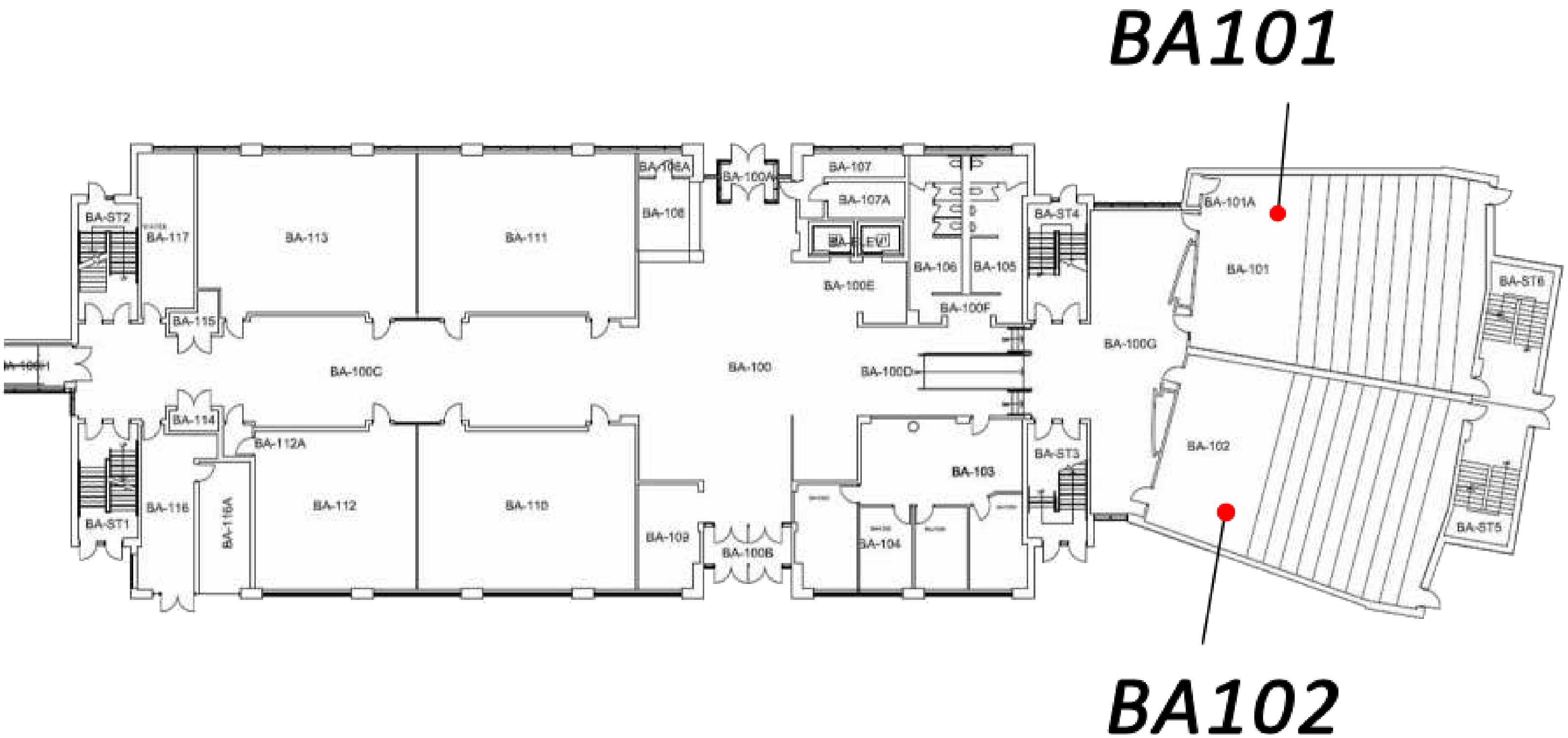
Time	BA101	BA102	BA305	BA306
Room	CS-MODELING #1 Partial Differential and Integral Equations in Mathematical Modeling Chair: TBA Affiliation	CS-FINANCE #2 Financial Mathematics and Computation Chair: TBA Affiliation	SS-AAIP #2 Inverse Problems Chair: K. Levere University of Guelph	SS-SSMMBP #2 Simulations in Soft Matter and Molecular Bio-Physics Chair: B-Y. Ha University of Waterloo
15:00-15:20	*Regularization results for ill-posed problems in Banach space* M. Fury Pennsylvania State University (Abington)	*Series Approximations for Value-At-Risks and Expected Shortfalls of Financial Delta-Gamma Methods* H-T. Ha Gachon University	*Parameter estimation for discrete-time models through goal programming with application to economics and management* D. La Torre University of Milan	*How Does A Protein Unknot? – Statistical Physics of DNA Disentangling by Topoisomerases* H.S. Chan University of Toronto
15:20-15:40	*Non-singular formulation of boundary integral equations in physics and engineering* D. Chan University of Melbourne	*Time series modelling with non-parametric aut-ocopula* I. Asadzadeh University of Calgary	*Collage-based Approach to Inverse Problems for Elliptic PDEs on Perforated Domains* H. Kunze University of Guelph	*A thermodynamic study of Amyloid-beta fibrils using computer simulations* C. Dias New Jersey Institute of Technology
15:40-16:00	*Boundary Integral Equation Method in the Mathematical Theory of Double Porosity Materials* M. Svanadze Ilia State University	*First passage time of skip-free Markov chains with application to ruin theory* M. Choi Cornell University	*Modelling an Aquaponic Ecosystem using Ordinary Differential Equations* C. Bobak University of Guelph	*Coarse-Grained computer simulations of Alzheimers beta-amyloid peptides, using the Mercedes-Benz Hydrogen Bond Potential* A. Linhananta Lakehead University
16:00-16:20	*Compressibility Coefficients in Nonlinear Transport Models in Unconventional Gas Reservoirs* I. Ali King Fahd University of Petroleum & Minerals	*Numerical Solution of Backward SDEs: Regression Later Algorithm* K.K. Gnameho Maastricht University	*Normalization of Eigenvectors and Certain Properties of Parameter Matrices Associated with the Inverse Problem for Vibrating Systems* M. El-Gebeily King Fahd University of Petroleum & Minerals	*Generalizing Euclidean distance to understand polymer uncrossing and knotting: A physicists foray into protein folding* S.S. Plotkin University of British Columbia
16:20-16:40		*Structure and Dynamics of Global Financial Network After Financial Crisis of 2008* S. Kumar University of Delhi		
16:40-17:00				

Friday, June 12: Afternoon

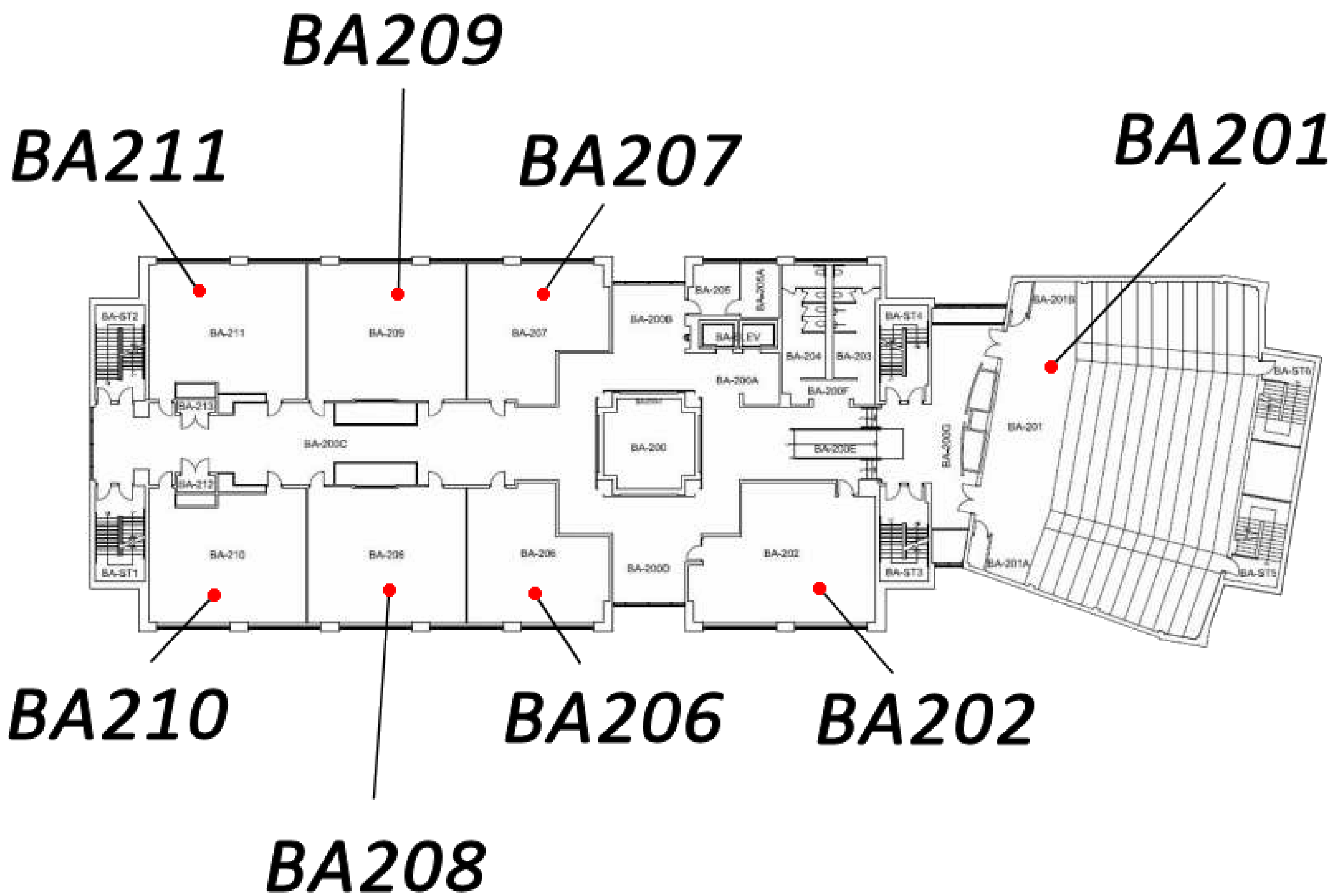
Time	BA202	BA208	BA209	BA210	BA211
	MS2Discovery Institute Meeting		SS-CNT #4 Computational Number Theory Chair: K. Hare University of Waterloo		SS-DDEMM #3 Delay Differential Equations as Mathematical Models of Real World Phenomena Chair: TBA Affiliation
15:00-15:20			*Computing periodic points for Hénon maps over number fields* P. Ingram Colorado State University		*Placeholder; may note be needed*
15:20-15:40			*Ring-LWE Cryptography for the Number Theorist* K. Strange University of Colorado Boulder		
15:40-16:00			*Looking for the Best ABC triple* S. Yazdani Google Inc & University of Waterloo		
16:00-16:20			*The explicit formula and zeros of L-functions* M. Rubinstein University of Waterloo		
16:20-16:40			*Common Subexpression Algorithms for Space-Complexity Reduction of Gaussian Normal Basis Multiplication* D. Jao University of Waterloo		
16:40-17:00					

13. Maps

Bricker Academic Building: First Floor

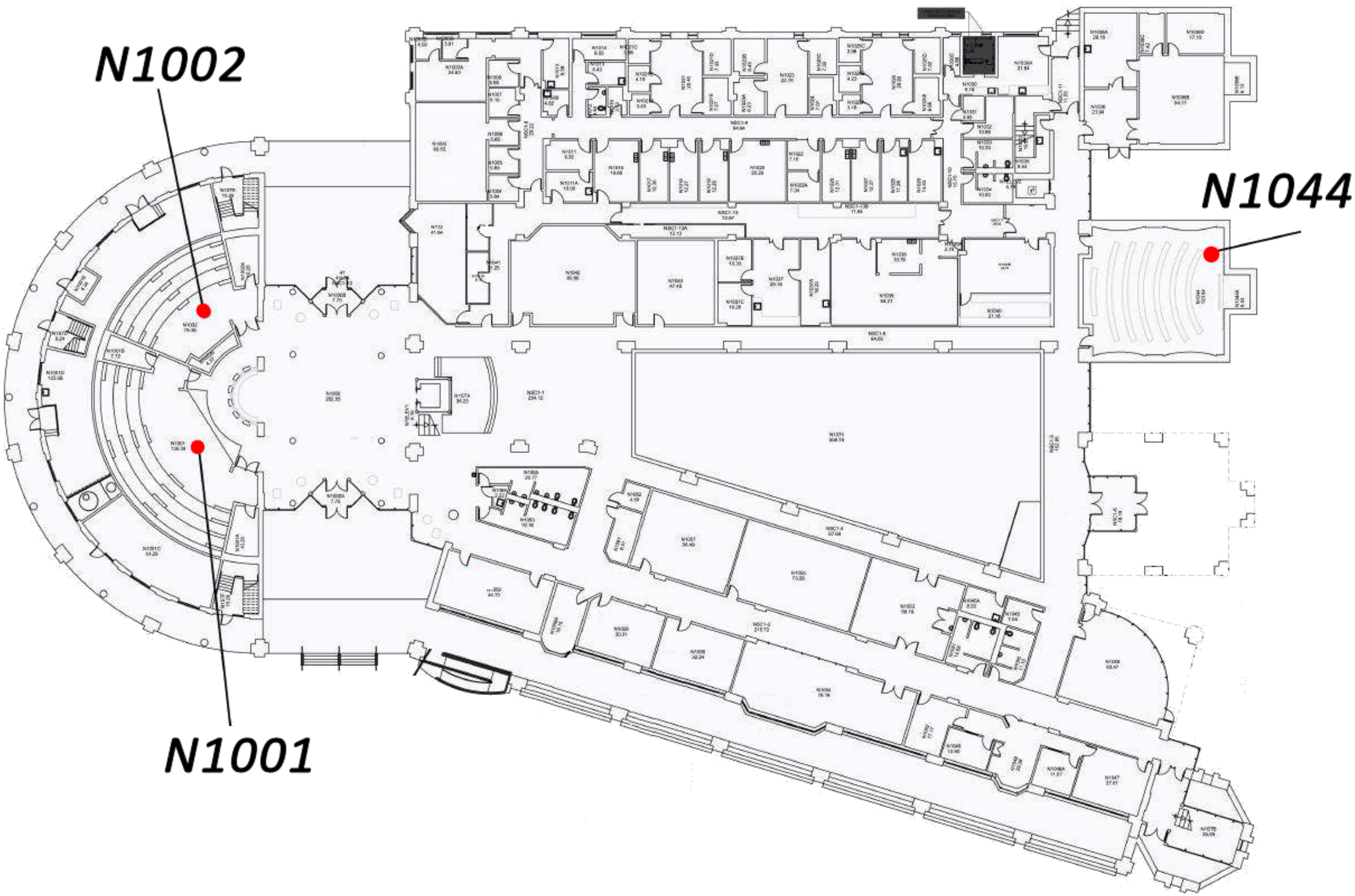


Bricker Academic Building: Second Floor

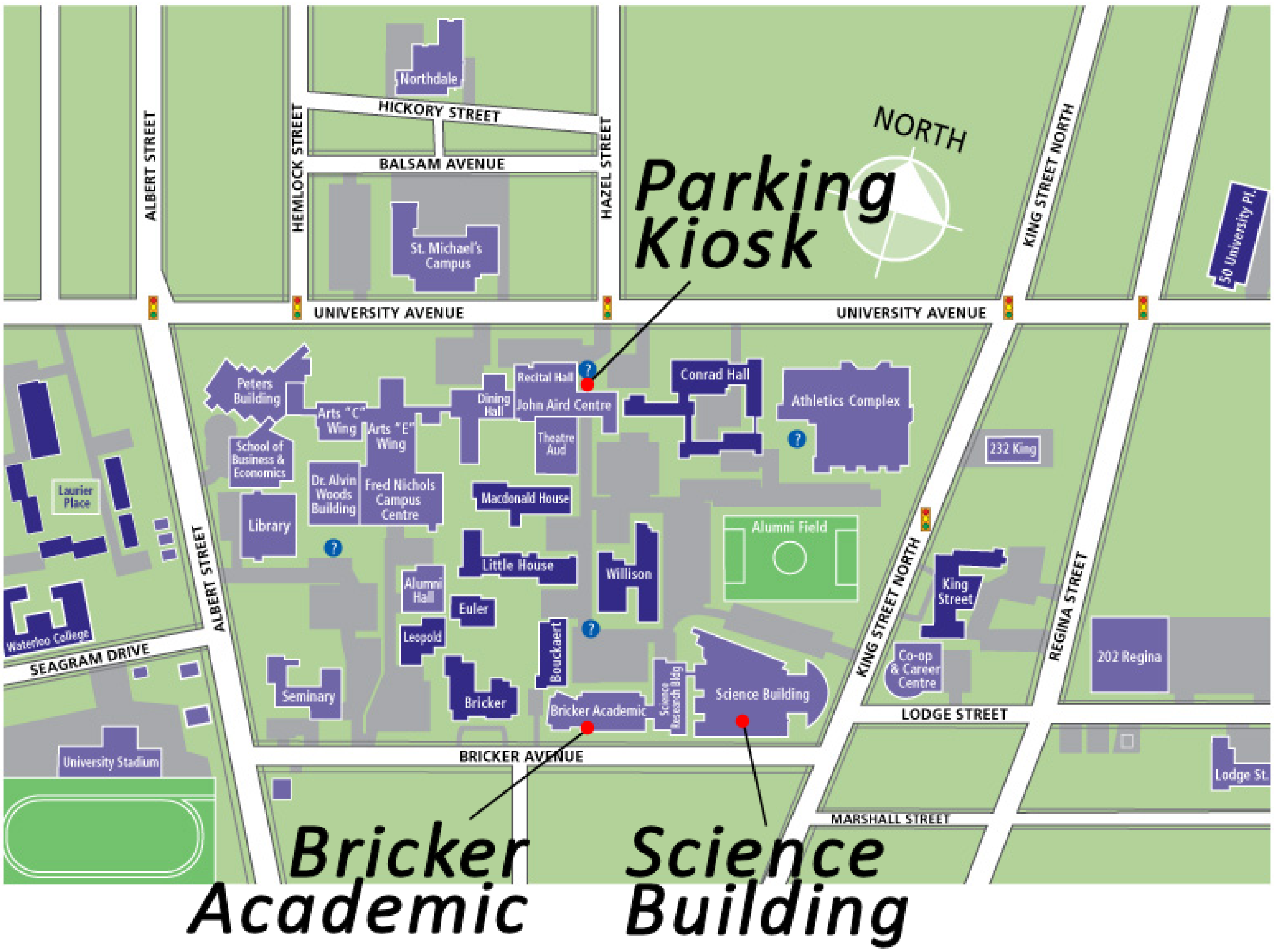


Bricker Academic Building: Third Floor

Science Building: First Floor



Wilfrid Laurier University Buildings & Parking



14. Hyperlinked Index of Speakers

15. Index of Participants with Book of Abstracts Page Numbers

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