FOZ2018
PROGRAM

Warning: The abstracts of Monday (23) are available! You can see by clicking in the names.

Monday - July, 23

	Room Africa + Europe				
08:00h	FOZ 2018 - ICM Sattelite Event Opening Session				
	Room Africa + Europe				
	Chair: Clóvis Gonzaga				
08:30h	Alfredo Iusem				
09:15h	Sandra Augusta Santos				
10:00h	Coffee-Break and BRAZILOPT Poster Session				
	Room Africa + Europe			Room Oceania	
	Chair: Ernesto Birgin			Chair: José Cuminato	
10:30h	José Mario Martinez		10:30h	Felipe Pereira	
11:15h	Clóvis Caesar Gonzaga		11:15h	Jorge Lira	
12:00h	Lunch				
	Room Asia	Room Americas		Room Oceania	Room Mercosul
	Chair: Hugo Scolnik	Chair: Douglas S. Gonçalves		Chair: Justin Wan	Chair: Felipe Pereira
13:50h	Konstantin Khanin	Abel S. Siqueira	14:00h	Jiangong You	V.A. Vassiliev
14:15h	Joaquim Judice	John L. Gardenghi			
14:40h	Roberto Andreani	Graciela N. Sottosanto	14:45h	Qi-Man Shao	Weldon Lodwick
15:05h	Hugo Scolnik	Douglas S. Gonçalves			
15:30h	Coffee-Break and BRAZILOPT Poster Session				
	Room Africa + Europe			Room Oceania	Room Mercosul
	Chair: Alfredo Iusem			Chair: Pedro D. Damazio	Chair: Fernando Ávila
16:00h	Benar F. Svaiter		16:00h	Mary Durojaye	Erick Moya
			16:20h	Chao Wu	Maria Rojas
16:45h	Paulo J. S. Silva		16:40h	André Jacomel Torii	Camille Poignard
			17:00h	Akhlaq Husain	Mariana Kleina
			17:20h	Pedro D. Damazio	Fernando Ávila
	Room Oceania			Room Mercosul	
	Chair: Neela Nataraj			Chair: Weldon Lodwick	
17:45h	Alexandre Madureira		17:45h	Jacek Banasiak	

Communication Session Plenary Session Special Session Break

Warning: The abstracts of Tuesday (24) are available! You can see by clicking in the names.

Tuesday - July, 24

	Room Asia	Room Americas		Room Oceania	Room Mercosul
	Chair: Ademir A. Ribeiro	Chair: Hugo Lara Urdaneta		Chair: Messias Meneguetti	Chair: Cassio Oishi
08:20h	Damián Fernández	Gilson do N. Silva	08:20h	Mythily Ramaswamy	Ting Wei
08:45h	Ellen H. Fukuda	Mauricio Romero Sicre	08:40h	Ya-Feng Liu	Elias Gudiño
09:10h	Juliano de B. Francisco	Joao Xavier da C. Neto	09:00h	Jian-Hua Wu	Manuel Silvino
09:35h	Ademir A. Ribeiro	Hugo Lara Urdaneta	09:20h	Silas Abahia	Shuanping Du
			09:40h	Messias Meneguetti	Cassio Oishi
10:00h	Coffee-Break and Ind Math and BRICS Poster Session				
	Room Africa + Europe			Room Oceania	Room Mercosul
	Chair: Geovani Grapiglia			Chair: Ya-Xiang Yuan	Chair: Li Weigang
10:30h	Yaxiang Yuan		10:30h	Pingwen Zhang	V.I. Lotov
11:15h	Mikhail Solodov		11:15h	Qiang Du	José Alberto Cuminato
12:00h	Lunch				
	Room Asia	Room Americas		Room Oceania	Room Mercosul
	Chair: Juan Pablo Luna	Chair: Marc Lassonde		Chair: Jorge Lira	Chair: Romes A. Borges
13:50h	Shuai Liu	Fernanda Raupp	14:00h	Tiago Pereira	S. Lubbe
14:15h	Jefferson G. Melo	Felipe Lara			
14:40h	Geovani N. Grapiglia	Marc Lassonde	14:45h	Jonathan D. Evans	Domingos Alves Rade
15:05h	Juan Pablo Luna				
15:30h	Coffee-Break and Ind Math and BRICS Poster Session				
	Room Africa + Europe			Room Oceania	Room Mercosul
	Chair: Sandra A. Santos			Chair: Song Liu	Chair: XiangYun Zhang
16:00h	Philippe Toint		16:00h	Vinicius Albani	Huang Zhengda
			16:20h	Rawlilson O. Araújo	Benito Pires
16:45h	Yu-Hong Dai		16:40h	Shuqin Wang	Yu Chen
			17:00h	Carlos E. Andrade	Xiaodong Zhang
			17:20h	Song Liu	XiangYun Zhang
	Room Oceania			Room Mercosul	
	Chair: Ma To Fu			Chair: Domingos A. Rade	
17:45h	Jixiang Fu		17:45h	João Luiz Azevedo	
20:00h	Conference Dinner				

Communication Session | Plenary Session | Special Session | Break

Warning: The abstracts of Thursday (26) are available! You can see by clicking in the names.

Thursday - July, 26

	Room Asia	Room Americas		Room Oceania	Room Mercosul
	Chair: Susana Scheimberg	Chair: Roger Behling		Chair: Elizabeth W. Karas	Chair: José dos Reis
08:20h	Vahid Mohebbi	Melissa W. Mendonça	08:20h	Qiang Li	Stanley Ferreira
08:45h	Pedro Jorge S. Santos	Maicon Marques Alves	08:40h	Cong Sun	Bruno Barela
09:10h	Reinier Díaz Millán	José Yunier Bello Cruz	09:00h	Luiz Carlos Matioli	Zhaofang Bai
09:35h	Susana Scheimberg	Roger Behling	09:20h	Daniela R. Cantane	Jianlong Chen
			09:40h	Elizabeth W. Karas	José dos Reis
10:00h	Coffee-Break and Brazil-China Poster Session				
	Room Africa + Europe			Room Oceania	Room Mercosul
	Chair: Claudia Sagastizábal			Chair: Jixiang Fu	Chair: Natasa Krejic
10:30h	Mirjam Djur		10:30h	Marco Prate	Justin Wan
11:15h	Ernesto Birgin		11:15h	S. Kesavan	Luis Gustavo Nonato
12:00h	Lunch				
	Room Asia	Room Americas		Room Oceania	Room Mercosul
	Chair: María Cristina Maciel	Chair: Gabriel Haeser		Chair: Amiya Pani	Chair: Esdras P. Carvalho
13:50h	Ana Paula Chorobura	Leonardo D. Secchin	14:00h	Dipndra Prasad	Eban Mare
14:15h	Lauren K. S. Gonçalves	Luís Felipe Bueno			
14:40h	Maria de G. Mendonça	Alberto Ramos	14:45h	Ma To Fu	Mauro A. Ravagnani
15:05h	María Cristina Maciel	Gabriel Haeser			
15:30h	Coffee-Break and Brazil-China Poster Session				
	Room Africa + Europe			Room Oceania	Room Mercosul
	Chair: Paulo J. S. Silva			Chair: Roberto Ribeiro S. Jr	Chair: Aleksandr A. Shananin
16:00h	Peter Richtarik		16:00h	Nanqing Ding	Jairo Rocha de Faria
			16:20h	Paulo N. S. Huertas	Felix Sadyrbaev
16:45h	Claudia Sagastizábal		16:40h	Hengling Hong	Flaviana M. Souza
			17:00h	Thelma P. B. Vecchi	Geraldo Brito Junior
			17:20h	Roberto Ribeiro S. Jr	Aleksandr A. Shananin
	Room Oceania			Room Mercosul	
	Chair: Jacek Banasiak			Chair: Guoliang Chen	
17:45h	Andrey Vesnin		17:45h	Weiguo Wu	

Communication Session | Plenary Session | Special Session | Break

Warning: The abstracts of July, 27 are not available yet

Friday - July, 27

	Room Asia	Room Americas		Room Oceania	
	Chair: Max L. N. Gonçalves	Chair: Leandro Prudente		Chair: Paulo F. A. Mancera	
08:20h	Mael Sachine	Paulo S. M. dos Santos	08:20h	Guo-Feng Zhang	
08:45h	Luiz Rafael Santos	João C. de O. Souza	08:45h	Nader Jafari Rad	
09:10h	Thiago P. da Silveira	Romulo Castillo	09:10h	Olivier Bokanowski	
09:35h	Max L. N. Gonçalves	Leandro Prudente	09:35h	Paulo F. A. Mancera	
10:00h	Coffee-Break				
	Room Africa + Europe			Room Oceania	Room Mercosul
	Chair: Mikhail Solodov			Chair: Jonathan Evans	Chair: J. M. Martínez
10:30h	Hasnaa Zidani		10:30h	Shuhua Zhang	Natasa Krejic
11:15h	Aris Daniilidis		11:15h	Zhu Zuonong	Amiya Pani
12:00h	Lunch				
	Room Asia	Room Americas		Room Oceania	Room Mercosul
	Chair: Ovidiu Bagdasar	Chair: Orizon Pereira Ferreira		Chair: Elias Gudiño	Chair: Elias Gudiño
13:50h	Gislaine A. Periçaro	Pedro A. Soares Júnior	14:00h	Li Weigang	Neela Nataraj
14:15h	Daiana S. Viana	Adriano Delfino			
14:40h	Leonardo M. Mito	Teles Araújo Fernandes	14:45h	Hugo de la Cruz	
15:05h	Ovidiu Bagdasar	Orizon Pereira Ferreira			
15:30h	Coffee-Break				
	Room Africa + Europe				
	Chair: José Mario Martínez				
16:00h	Jinyun Yuan				
	Room Africa + Europe				
16:45h	FOZ 2018 - ICM Sattelite Event Closing Session				

Communication Session Plenary Session Special Session Break

DAY 1
BRAZIL OPTIMIZATION

On variational problems for random Lagrangian systems and KPZ universality

Konstantin Khanin[1]

We shall discuss the problem of global minimizers for random Lagrangian systems. While the situation in the compact setting is well understood by now, the case of unbounded space remains largely open We shall also discuss a connection with the problem of KPZ (Kardar-Parisi-Zhang) universality.

[1] University of Toronto, Canada;

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Standard Fractional Quadratic Programming and Eigenvalue Complementarity Problem

Joaquim Judice[1]
Alfredo Iusem[2]
Masao Fukushima[3]
Valentina Sessa[4]

In this talk, we address the computation of a Stationary Point (SP) for the Standard Fractional Quadratic Program (SFQP). It is shown that this problem is equivalent to an Eigenvalue Complementarity Problem (EiCP) with symmetric matrices. EiCP is an extension of the traditional Eigenvalue Problem. We discuss iterative algorithms for the solution of symmetric and nonsymmetric EiCPs, namely an Alternative Direction Method of Multipliers (ADMM) and a splitting algorithm. Some results concerning the convergence of these algorithms are introduced. The splitting algorithm is shown to perform well for the symmetric EiCP (SP of SFQP). ADDM is in general robust but slow for symmetric and nonsymmetric EiCP. A hybrid method combining ADMM and the semi-smooth Newton (SN) method is introduced and is shown to be efficient for solving symmetric and nonsymmetric EiCP.

[1] Instituto de Telecomunicações, Portugal;
[2] IMPA, Rio do Janeiro, Brazil;
[4] Nanzan University, Japan
[5] University of Sannio, Benevento, Italy;

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A sequential optimality condition associated to quasinormality and its algorithmic consequences

Roberto Andreani[1]
Nadia Fazzio[2]
Maria Laura Schuverdt[2]
Leonardo Secchin[3]

In the present paper, we prove that the Augmented Lagrangian method converges to KKT points under the quasinormality constraint qualication, which is associated to the external penalty theory. For this purpose, a new sequential optimality condition, called PAKKT, for smooth constrained optimization is dened. The new condition takes into account the sign of the dual sequence, constituting an adequate sequential counterpart to the (extended) Fritz-John necessary optimality conditions popularized by Bertsekas and Hestenes. We also define the appropriate strict constraint qualification associated with the PAKKT sequential optimality condition and we prove that it is strictly weaker than both quasinormality and cone continuity property constraint qualifications. This generalizes all previous theoretical convergence results for the Augmented Lagrangian method in the literature.

[1] University of Toronto, Canada;
[2] Universidad de la Plata, Argentina;
[3] Universidade Federal de Espírito Santo, Brazil;

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An approach for stabilizing simulation of stochastically perturbed systems

Hugo de la Cruz[1]

To be announced.

[1] FGV-Rio, Brazil;

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A Regularized Interior-Point Method for Constrained Nonlinear Least Squares

Abel Soares Siqueira[1]
Dominique Orban[2]

We propose an interior-point algorithm for constrained nonlinear least-squares problems based on the primal-dual regularization of Friedlander and Orban (2012). At each iteration, we solve a linear system with a symmetric quasi-definite matrix. This system can be solved via LDLT factorization or with the use of iterative methods for linear least squares. This last approach results in a factorization-free implementation, that is, one using only matrix-vector products, which is desirable for large-scale problems.

[1]UFPR - Federal University of Parana, Brazil;
[2]GERAD/Polytechnique Montreal, Canada.

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On the use of third-order derivatives in regularization methods

John L. Gardenghi[1]
Ernesto G. Birgin[2]
Jose M. Martínez[1]
Sandra A. Santos[1]

In the context of complexity analysis in nonlinear optimization, a recent interest in regularization methods had a surge in the last years. In particular, it was shown in a recent paper that worst-case evaluation complexity $O(\epsilon^{-(p+1)/p})$ may be obtained by means of algorithms that employ sequential approximate minimizations of p-th order Taylor models plus $(p+1)$-th order regularization terms. This result generalizes the case $p=2$, known since 2006 and successfully implemented afterwards. The natural question that we made was if there was a reasonable implementation for the case $p=3$, i.e., the case for which we apply third-order derivatives of the objective function and fourth-order regularization models. We present the algorithm and numerical results of such an implementation, with classic problems from the literature.

[1] IMECC-Unicamp, Brazil;
[2] IME-USP, Brazil;

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A structured SQP algorithm for solving the constrained least squares problem

Graciela Noemi Sottosanto[1]
Graciela Marta Croceri[1]
Gonzalo Pizarro[1]

In this work, we propose a method that belongs to the class of sequential quadratic programming (SQP) for solving the nonlinear least squares problem with equality and inequality constraints. In order to exploit the structure present in the problem, a structured secant approach of the Hessian matrix, belonging to the BFGS family, is used. To enlarge its convergence region, techniques of trust region methods are employed. As a merit function, an augmented Lagrangian function is used to avoid the need of calculating second order correction steps. A feasibility restoration phase is introduced if inconsistency in the subproblem occurs. During the restoration phase the trial steps are determined in two phases. First, the minimum constraint violation that can be achieved within the trust region bound is determined. Then a second subproblem is solved where the violated constraints are relaxed. The quality of a calculated trial step is evaluated by means an update scheme for the penalty parameter. The presented algorithm is implemented in Scilab. Some numerical results are given to compare the proposed algorithm with some existing methods.

[1] Universidad Nacional del Comahue, Argentina;

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Local convergence of Levenberg-Marquardt methods for nonzero-residue nonlinear least-squares problems under an error bound condition

Douglas S. Gonçalves[1]
Sandra A. Santos[2]
Roger Behling[1]

The Levenberg-Marquardt method (LMM) is widely used for solving nonlinear equations and nonlinear least-squares problems. For consistent systems of nonlinear equations or zero-residue nonlinear least-squares problems, many recent papers have proved the local convergence of LMM for suitable choices of the regularization parameter and under error bound conditions, that are weaker than non-singularity assumptions. \\ In this study, we consider the class of non-zero residue nonlinear least-squares problems and, by viewing the LM model as a Quasi-Newton model with quadratic regularization, we present a local convergence analysis for LMM under a different error bound condition.

[1] UFSC - Federal University of Santa Catarina, Brazil;
[2] UNICAMP - University of Campinas, Brazil;

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The Thermistor Problem with Hyperbolic Electrical

Mary Durojaye[1]
J.T.Agee[2]

This paper presents the steady state solution of the one-dimensional, positive temperature coefficient (PTC) thermistor equation, using the hyperbolic-tangent function as an approximation to the electrical conductivity of the device.The hyperbolic-tangent function describes the qualitative behaviour of the evolving solution of the thermistor in the entire domain.The steady state solution using the new approximation yielded a distribution of device temperature over the spatial dimension and all the phases of temperature distribution of the device without having to look for a moving boundary which has been a major problem encountered in literature.The analysis of the steady state solution and the numerical solution of the unsteady state is presented in the paper.

[1] University of Abuja, Nigeria;
[2] University of KwaZulu - Natal, South Africa;

Superconvergence of edge finite element solution for Maxwell's

Chao Wu[1]
Jinyun Yuan[2]
Yunqing Huang[3]

In this talk, we discuss the superconvergence of edge finite element solution for Maxwell's equations. First, we solve Maxwell's equations by linear edge finite element method on both uniform triangular mesh and strongly regular triangle mesh, we obtain superconvergence results at the interior edge by using the average technology. Second, we resolve Maxwell's equations by linear edge finite element method on both uniform tetrahedral mesh and strongly regular tetrahedral mesh, we obtain superconvergence results at the interior edge by using the average technology. Third, we use the second order and third order rectangular edge finite element method to solve the harmonic Maxwell's equations, we obtain the superconvergence results at Gauss point. Finally, numerical examples to testify our theories are presented.

[1] School of Mathematics and Computational Science, Hunan University of Science and Technology, China;
[2] Universidade Federal do Paraná, Brazil;
[3] Hunan Key Laboratory for Computation and Simulation in Science, China;

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Topology Optimization in the context of heat equation

André Jacomel Torii[1]
Diogo Pereira da Silva Santos[2]

In this work we address the problem of Topology Optimization in the context of the stationary heat equation. In particular, we seek the optimum distribution of material inside a design domain subject to heat generation and/or heat external flow that minimizes the norm of the temperature field, while satisfying a prescribed amount of material to be employed. The main objective of this work is to present, in the simplest manner possible, the relation between theoretical and numerical aspects of the problem. Emphasis is given to sensitivity analysis, where both the variational problem and its Finite Element Method (FEM) approximation are presented. We also describe in details the Adjoint Method. Finally, numerical examples are presented in order to illustrate the main properties of the problem under study.

[1] UNILA, Brazil;
[2] LNCC, Brazil;

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Spectral element methods for three dimensional elliptic problems with smooth interfaces

Akhlaq Husain[1]
Arbaz Khan[2]

Many problems in engineering are characterized by elliptic partial differential equations with discontinuous coefficients, steady state heat diffusion, electro static, multi-phase and porous flow problems are the few examples. An interface problem is a special case of an elliptic partial differential equation with discontinuous coefficients. Such interface problems arise in different situations, for example, in heat conduction or in elasticity problems whose domain of definitions are composed of several different materials. In this talk we propose a least-squares spectral element method for elliptic interface problems in three dimensions with smooth interface. The solution is obtained by solving the normal equations using preconditioned conjugate gradient method. The method is essentially nonconforming and a diagonal matrix is constructed as a preconditioner based on the stability estimate and separation of variables technique. We prove that the proposed method gives exponential converges with respect to the number of elements. Numerical results for a number of test problems are presented to validate the theory and our estimates of computational complexity of the proposed method.

[1] BML Munjal University Gurgaon, India;
[2] University of Manchester, United Kingdom;

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Existence and regularity of solutions of the magnetohydrodynamic system with mass diffusion

Pedro Danizete Damazio[1]
Enrique Fernández-Caras[2]
Marko A. Rojas-Medar[3]

In this talk we will present results on the existence and regularity of solutions for the model of the magnetohydrodynamic equations in presence of mass diffusion in regular enough bounded domains in 2 and 3 spatial dimension.

[1] Universidade Federal do Paraná, Brazil;
[2] Universidad de Sevilla. Spain;
[3] Universidad de Tarapacá, Chile;

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Stabilization for a Sub-quintic Wave Equation with Localized Nonlinear Damping

Maria Rosario Astudillo Rojas[1]

We consider the semilinear wave equation posed in an inhomogeneous medium with smooth boundary subject to a non linear damping distributed around a neighborhood of the boundary according to the Geometric Control Condition. We show that the energy of the wave equation goes uniformly to zero for all initial data of finite energy phase-space. We assume a nonlinearity which is subcritical in the sense that it grows as a power of at most $p < 5$ in three dimensions. The method of proof combines Strichartz's estimates, results by P. Gerard on microlocal defect measures and ideas first introduced in the literature by Lasiecka and Tataru in order to deal with the nonlinear damping term.

[1] Universidade Federal do Paraná, Brazil;

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Impacts of Structural Perturbations on the dynamics of Networks

Camille Poignard[1]
Jan Philipp Pade[2]
Tiago Pereira[1]

We study the effects of structural perturbations on the dynamics of networks. We first show how the synchronizability of a diffusive network increases (or decreases) when we add some links in its underlying graph. This is of interest in the context of power grids where people want to prevent from having blackouts, or for neural networks where Synchronization is responsible of many diseases such as Parkinson. Based on spectral properties for Laplacian matrices, we show some classification results obtained (with Tiago Pereira and Philipp Pade) with respect to the effects of these links. Then I will show how we can desynchronize (i.e induce chaos) in a stable network by adding links to it.

[1] Universidade de São Paulo, Brazil;
[2] Humboldt University, Brazil;

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A new algorithm for clustering based on kernel density estimation

Mariana Kleina[1]
Luiz Carlos Matioli[1]
Solange Regina dos Santos[2]

In this paper, we present an algorithm for clustering based on univariate kernel density estimation, named ClusterKDE. It consists of an iterative procedure that in each step a new cluster is obtained by minimizing a smooth kernel function. Although in our applications we have used the univariate Gaussian kernel, any smooth kernel function can be used. The proposed algorithm has the advantage of not requiring a priori the number of cluster. Furthermore, the ClusterKDE algorithm is very simple, easy to implement, well-defined and stops in a finite number of steps, namely, it always converges independently of the initial point. We also illustrate our findings by numerical experiments which are obtained when our algorithm is implemented in the software Matlab and applied to practical applications. The results indicate that the ClusterKDE algorithm is competitive and fast when compared with the well-known Clusterdata and K-means algorithms, used by Matlab to clustering data.

[1] Universidade Federal do Paraná, Brazil;
[2] Universidade Estadual do Paraná, Brazil;

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Global Hypoellipticity on Manifolds and Fourier Expansion of Elliptic Operators

Fernando de Ávila Silva[1]
Alexandre Kirilov[1]

To be announced.

[1] Universidade Federal do Paraná, Brazil;

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DAY 2
IND MATH AND BRICS

A quasi-Newton modified linear-programming-Newton method

Damián Fernández[1]
María Martínez[1]

In this work we consider a method to solve constrained system of nonlinear equations based on a modification of the Linear-Programming-Newton method and replacing the first order information with a quasi-Newton secant update, providing a computationally simple method. The proposed strategy combines good properties of two methods: the least change secant update for unconstrained system of nonlinear equations with isolated solutions and the Linear-Programming-Newton for constrained nonlinear system of equations with possible nonisolated solutions. We analyze the local convergence of the proposed method under suitable conditions proving its linear/superlinear convergence to possible nonisolated solutions.

[1] UFSC - Federal University of Santa Catarina, Brazil;
[2] FaMAF, Universidad Nacional de Córdoba, Argentina;

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Nonlinear symmetric cones problems: optimality conditions and an augmented Lagrangian method

Ellen H. Fukuda[1]
Bruno F. Lourenço[1]
Masao Fukushima

Nonlinear symmetric cone problems (NSCP) generalize nonlinear semidefinite programming, nonlinear second-order cone programming and nonlinear programming (NLP) problems. In this work, we discuss the reformulation of NSCPs as NLP problems, using squared slack variables. With this, we prove a criterion for membership in a symmetric cone, and discuss the equivalence between Karush-Kuhn-Tucker points of the original and the reformulated problems. As the main result, we observe that the reformulation allows us to obtain second-order optimality conditions for NSCPs in a easy manner. We also show that by employing the slack variables approach, we can use the results for NLP to prove convergence results of a simple augmented Lagrangian function for NSCPs.

[1] Kyoto University, Japan;
[2] Nanzan University, Japan

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Non-monotone inexact restoration method for minimization with orthogonality constraints

Juliano de Bem Francisco[1]
D . G. Gonçalves[1]
L. E. T. Paredes[1]
F. S. Viloche-Bazán[1]

In this work we consider the problem of minimizing a differentiable functional restricted to the set of matrices (of order nxp) with orthogonal columns. This problem arises from different fields of applications, such as, statistical, signal processing, global positioning system, machine learning, physics, chemistry and others. The numerical framework behind our approach is a non-monotone variation of the inexact restoration method. We give a simple characterization of the set of tangent directions (with respect to the orthogonal constraints) in order to handle with the tangent phase. For the restoration phase we use the well-known Cayley transformation for bring the computed point (at the tangent phase) back to the feasible set (i.e., the restoration phase is exact). We prove that all limit points of the generated sequence is stationary and we compare numerically our method with a well established algorithm for solving this optimization problem.

[1] Federal University of Santa Catarina, Brazil;
[2]

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Accelerated primal-dual fixed point algorithms for ridge regression problems

Ademir Alves Ribeiro[1]
Peter Richtárik[2]
Tatiane Cazarin da Silva[3]
Gislaine Aparecida Periçaro[4]

In this work we study the primal and dual formulations of the regularized least squares problem, in the special norm L_2, named Ridge Regression. We observe that the optimality conditions describing the primal and dual optimal solutions can be formulated in several different but equivalent ways. The optimality conditions we identify form a linear system involving a structured matrix depending on a single relaxation parameter which we introduce for regularization purposes. This leads to the idea of studying and comparing, in theory and practice, the performance of the fixed point method applied to these reformulations. We compute the optimal relaxation parameters and uncover interesting connections between the complexity bounds of the variants of the fixed point scheme we consider. These connections follow from a close link between the spectral properties of the associated matrices. For instance, some reformulations involve purely imaginary eigenvalues; some involve real eigenvalues and others have all eigenvalues on the complex circle.We show that our main method - which is a special case of the randomized dual coordinate ascent method with arbitrary sampling developed by Qu, Richtárik and Zhang - achieves the best rate in theory and in numerical experiments among the fixed point methods we study. Remarkably, the method achieves an accelerated convergence rate. We also establish the convergence of a gradient memory-like strategy. Numerical experiments indicate that our main algorithm is competitive with the conjugate gradient method.

[1]UFPR - Federal University of Parana, Brazil;
[2]University of Edinburgh, Scotland;
[3]UTFPR - Federal University of Tecnology of Parana, Brazil;
[4]State University of Parana, Brazil.

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Non-monotone inexact restoration method for minimization with orthogonality constraints

Gilson do Nascimento Silva[1]
Ioannis Konstantinos Argyros[2]

In this work we consider the problem of minimizing a differentiable functional restricted to the set of matrices (of order nxp) with orthogonal columns. This problem arises from different fields of applications, such as, statistical, signal processing, global positioning system, machine learning, physics, chemistry and others. The numerical framework behind our approach is a non-monotone variation of the inexact restoration method. We give a simple characterization of the set of tangent directions (with respect to the orthogonal constraints) in order to handle with the tangent phase. For the restoration phase we use the well-known Cayley transformation for bring the computed point (at the tangent phase) back to the feasible set (i.e., the restoration phase is exact). We prove that all limit points of the generated sequence is stationary and we compare numerically our method with a well established algorithm for solving this optimization problem.

[1] Universidade Federal do Oeste da Bahia, Brazil;
[2] Cameron University, United States;

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On the complexity of an hybrid proximal extragradiente projection method for solving monotone inclusion problems

Mauricio Romero Sicre[1]

In this work we establish the iteration complexity of an under-relaxed Hybrid Proximal Extragradient Projection method (HPEP) for finding a zero of a maximal monotone operator. These results extend the complexity analysis of the Hybrid Proximal Extragradient method (HPE), due to Svaiter and Monteiro, to a more general framework.

[1] Universidade Federal da Bahia, Brazil;

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Solving Convex Feasibility Problems in Hadamard Manifolds

Joao Xavier da Cruz Neto[1]
Italo Dowel Lira[1]
Paulo Alexandre Sousa[1]
João Carlos Souza[1]

In this talk, we study the convergence issue of the gradient method for solving a convex feasibility problem in Hadamard manifolds. Clearly, our results extend the corresponding ones in Euclidean spaces and solve the open problem proposed by Bento and Melo [J. Optimization. Theory Application., 152 (2012), pp. 773-785] which was partially solved by Wang et al. [J. Optimization. Theory Application., 164 (2015), pp. 202-217].

[1] Universidade Federal do Piauí, Brazil;

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On Riemannian Conjugate Gradient and non monotone linear search algorithm with mixed direction on Stiefel

Hugo José Lara Urdaneta[1]
Harry Oviedo Leon[2]
Oscar Dalmau[2]
João Carlos Souza[1]

In this talk, we study the convergence issue of the gradient method for solving a convex feasibility problem in Hadamard manifolds. Clearly, our results extend the corresponding ones in Euclidean spaces and solve the open problem proposed by Bento and Melo [J. Optimization. Theory Application., 152 (2012), pp. 773-785] which was partially solved by Wang et al. [J. Optimization. Theory Application., 164 (2015), pp. 202-217].

[1] Universidade Federal de Santa Catarina, Brazil;
[2] CIMAT, Mexico;

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Local stabilization of time periodic evolution equations

Mythily Ramaswamy[1]

Local stabilization at a prescribed rate around a periodic trajectory of parabolic systems, using boundary control is an interesting problem. The main motivating example is the incompressible Navier-Stokes system. I will discuss this example and the general framework and indicate some results in this direction.

[1] TIFR-B, India;

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A New and Enhanced Semidefinite Relaxation for a Class of Nonconvex Complex Quadratic Problems with Applications in Wireless Communications

Ya-Feng Liu[1]

In this talk, we shall consider a special class of nonconvex Complex Quadratic Problems (CQP), which finds many important and interesting applications in wireless communications. In this talk, we shall first develop a new and Enhanced Complex SemiDefinite Program, called ECSDP, for the considered CQP and then apply the ECSDP to MIMO detection, a fundamental problem in modern wireless communications. As our main result, we show the tightness of the ECSDP for MIMO detection under an easily checkable condition. This result answers an open question posed by So in 2010. Based on the ECSDP, we can also develop a branch-and-bound algorithm for globally solving the MIMO detection problem (even though the above condition does not hold true).

[1] CAS, China;

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Title and Abstract to be announced

Jian-Hua Wu [1]

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[1] Shaanxi Normal University, China;

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Silas Abahia Ihedioha[1]

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Title and Abstract to be announced

Messias Meneguette

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Title and Abstract to be announced

Ting Wei[1]

TBA

[1] Lanzhou University, China;

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Modeling of non-Fickian diffusion and dissolution from a thin polymeric coating: An application to drug-eluting stents

Elias Gudiño[1]
C. M. Oishi[2]
A. Sequeira[3]

In this talk, we present a general model for non-Fickian diffusion and drug dissolution from a controlled drug delivery device coated with a thin polymeric layer. We propose an approach to reduced the computational cost of performing numerical simulations in complex 3-dimensional geometries. The model for mass transport by a coronary drug-eluting stent is coupled with a non-Newtonian blood model flow. In order to show the effectiveness of the method, numerical experiments and a model validation with experimental data are also included. In particular, we investigate the influence of the non-Newtonian flow regime on the drug deposition in the arterial wall.

[1] Universidade Federal do Paraná, Brazil;
[2] UNESP, Brazil;
[3] IST Lisboa, Portugal;

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Title and Abstract to be announced

Manoel Silvino Batalha de Araujo[1]
C. Fernandes[2]
L.L. Ferrás[2]
J. Miguel Nóbrega[2]

TBA

[1] Universidade Federal do Paraná, Brazil;
[2] Institute for Polymers and Composites/i3N, University of Minho, Portugal;

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Title and Abstract to be announced

Shuanping Du[1]

TBA

[1] School of Mathematical Sciences, Xiamen University, China;

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Computational simulation of non-Newtonian drop impact

Cassio M. Oishi[1]

To be announced.

[1] UNESP, Brazil;

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An epsilon-VU algorithm with superlinear convergence

Shuai Liu[1]
Claudia A. Sagastizábal[1]
Mikhail V. Solodov[2]

The theories of \(\mathcal{VU}\)-space decomposition and \(\mathcal{U}\)-Lagrangian have been applied to develop algorithms for solving problems with structural properties. We introduce an algorithm based on the \(\varepsilon\)-\(\mathcal{VU}\)-space decomposition, where the \(\mathcal{V}_{\varepsilon}\)-subspace is defined by the span of some enlargement of the subdifferential. \\ The algorithm has two steps: the \(\mathcal{V}\)-step, which we show can be replaced by an exact prox-step, and the \(\mathcal{U}\)-step, a quasi-Newton step in the \(\mathcal{U}_{\varepsilon}\)-subspace. The \(\mathcal{U}\)-step requires a basis matrix of the \(\mathcal{U}_{\varepsilon}\)-subspace and a matrix containing second order information of the objective function in the \(\mathcal{U}_{\varepsilon}\)-subspace. If \(\varepsilon\) is suitably driven to zero, the superlinear convergence of the algorithm can be proven if the Dennis-More condition holds in our context. We give an application of our algorithm on minimizing a function whose proximal point can be easily calculated.

[1] IMECC/UNICAMP, Brazil;
[2] IMPA, Brazil;

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An adaptive accelerated proximal point method for solving non-convex optimization problems

Jefferson G. Melo[1]
Weiwei Kong[2]
Renato DC Monteiro[2]

In this talk, we present an adaptive accelerated proximal point type method for solving non-convex optimization problems. We discuss how to compute approximate solutions of the subproblems accepting some relative error criteria. Iteration-complexity bounds for the proposed method is analyzed and some numerical experiments are presented.

[1] Universidade Federal de Goiás, Brazil;
[2] Georgia Tech, United States;

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Accelerated Regularized Newton Methods for Minimizing Composite Convex Functions

Geovani Nunes Grapiglia[1]
Yurii Nesterov[2]

In this talk, we present accelerated Regularized Newton Methods for minimizing objectives formed as a sum of two functions: one is convex and twice differentiable with H\"{o}lder-continuous Hessian, and the other is a simple closed convex function. For the case in which the H\"{o}lder parameter $\nu\in[0,1]$ is known we propose methods that take at most $\mathcal{O}\left(\dfrac{1}{\epsilon^{1/(2+\nu)}}\right)$ iterations to reduce the functional residual below a given precision $\epsilon>0$. For the general case, in which the ν is not known, we propose a universal method that ensures the same precision in at most $\mathcal{O}\left(\dfrac{1}{\epsilon^{2/3(1+\nu)}}\right)$

[1] UFPR - Federal University of Parana, Brazil
[2] CORE

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Analysis of EPEC Models for Power Markets

Juan Pablo Luna[1]
J. Filiberti[2]
S.A. Gabriel[2]
C. Sagastizábal[3]
M. Solodov[4]

A usual equilibrium model in power markets is to consider a leader-follower problem in which the top level involves multiplier power producers bidding prices and generation levels. At the bottom level, common to each producer, there is an independent system operator (ISO) that takes all the bids from producers and minimizes the total operation costs, subject to capacity and other bounds on production. As such, the system being modeled in an equilibrium problem with equilibrium constraints (EPEC). We show that already in their simplest instances, such models suffer from two serious drawbacks, related to: the existence of many equilibria, which harm the algorithmic solution (cycles); and equilibrium prices that can take values above the bids, even for the most expensive dispatched producer. To address these issues, we propose a dual regularization for the ISO problem, that has an enlightening interpretation in economical terms.

[1] UFRJ, Brazil;
[2] University of Maryland, College Park, Maryland, United States;
[3] UNICAMP, Brazil;
4 IMPA, Brazil;

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An algorithm for projecting a point onto a level set of a quadratic function

Fernanda Raupp[1]
Wilfredo Sosa[2]

We propose an iterative algorithm to project a point onto a level set of a quadratic function, based on the spectral decomposition of the Hessian, which is performed in a unique iteration. The proposed algorithm was tested on instances with distinct Hessian matrices and shows great potential in applications, such as in computer graphics

[1] LNCC, Brazil;
[2] UCB, Brazil;

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A new quasiconvex asymptotic function with applications in optimization

Felipe Lara[1]
N. Hadjisavvas[2]
J. E. Martínez-Legaz[3]

We introduce a new asymptotic function which is mainly adapted to quasiconvex functions. We establish several properties and calculus rules for this concept and compare it to previous notions of generalized asymptotic functions. Finally, we apply our new definition to quasiconvex optimization problems: we characterize the boundedness of the function, the nonemptiness and compactness of the set of minimizers, and we provide a sufficient condition for the closedness of the image of a nonempty closed convex set via a vector-valued function.

[1] IMPA - National Institute of Pure and Applied Mathematics, Brazil;
[2] University of the Aegean, Greece;
[3] Universidad Autónoma de Barcelona, Spain;

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Limits of sequences of maximal monotone operators

Marc Lassonde[1]
Yboon García[2]

We consider a sequence (T_n) of maximal monotone operators on a reflexive Banach space. In general, the (Kuratowski) lower limit $\liminf T_n$ of such a sequence is not a maximal monotone operator. So, what can be said? In the first part of the talk, we show that $\liminf T_n$ is a representable monotone operator while its Mosco limit M-$\lim T_n$, when it exists, is a maximal monotone operator. As an application of the former result, we obtain that the variational sum of two maximal monotone operators is a representable monotone operator. In the second part of the talk, we consider a sequence (f_n) of representative functions of (T_n). We show that if (f_n) epi-converges to a function f, then $\liminf T_n$ is representable by f; moreover if (f_n) Mosco-converges to f, then $\liminf T_n$ is maximal monotone. As an application, we recover Attouch's result: if a sequence of convex lower semicontinuous functions (f_n) Mosco-converges to f, then $\partial f=\liminf \partial f_n$.

[1] Antilles University, Guadeloupe, and LIMOS, Clermont-Ferrand, France;
[2] Universidad del Pacífico, Lima, Perú;

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On the simulation and calibration of jump-diffusion models in finance

Vinicius Albani[1]

We apply a splitting strategy to identify simultaneously the local volatility surface and the jump-size distribution of a jump-diffusion driven asset from quoted European option prices. This is done by means of a Tikhonov-type regularization technique. Proofs of the convergence of the corresponding algorithm as well as the stability of the solution are provided. We also presente numerical examples with synthetic, as well as, real data illustrating the robustness of this method.

[1] UFSC, Brazil;

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Pullback dynamics of a non-autonomous Bresse system

Rawlilson de Oliveira Araújo[1]

The Bresse system is a model for vibrations of a circular arched beam. Here we discuss the existence of pullback attractors for a weakly dissipative non-autonomous semilinear Bresse.

[1] UNESP, Brazil;

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Title and Abstract to be announced (TBA)

Shuqin Wang[1]

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[1] Northwest Polytecnical University, China;

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Title and Abstract to be announced (TBA)

Carlos Eduardo Andrades[1]
Débora Aline Kotz[1]
Rafael Berkenbrock[1]
Enio Roberto Galli[1]
Paulo Marcos Flores[1]
Luiz Antônio Rasia[1]
Antonio Carlos Valdiero[1]

TBA

[1] Universidade do Noroeste do Estado do Rio Grande do Sul – UNIJUÍ, Brazil;

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Title and Abstract to be announced (TBA)

Song Liu[1]

TBA

[1] Xi'an Jiaotong University, China;

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On an SSOR-like method with four parameters for saddle point problems

Huang Zhengda[1]
Huidi Wang

Since 2001 when several SOR-like methods for the saddle point problems was proposed by Golub, G. H., Wu, X. and Yuan, J.-Y., many papers have been appeared to consider the generalized SOR, AOR and SSOR-like methods based on the different splitting ways of the coefficient matrix and accompanied by different number of parameters. This talk is an short report on an SSOR-like method with four parameters, which is one of our works for the saddle point problem. To our best knowledge, it can't be written in the same classical forms used by the existed SSOR-like methods. A condition to guarantee the convergence and the optimal convergence factor are obtained, and comparisons with other SSOR-like methods are discussed. This work is coauthored with Dr. Huidi Wang.

[1] School of Mathematical Sciences, China;

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Title and Abstract to be annouced (TBA)

Benito Pires[1]

TBA

[1] USP, Brazil;

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Title and Abstract to be annouced (TBA)

Yu Chen

TBA

Not informed

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Title and Abstract to be annouced (TBA)

Xiaodong Zhang[1]

TBA

[1] Shangai Jiao Tong University, China;

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Shifted Gradient Method for Computing Tensor Eigenpairs

Xiangyun Zhang[1]
Hao Liang[2]
Guoliang Chen[2]

In this talk, we propose a shifted gradient method (S-GM) to calculate the Z-eigenpairs of the symmetric tensor. S-GM can be viewed as a generalization of shifted symmetric higher-order power method (SS-HOPM). The convergence analysis and the fixed-point analysis of this algorithm are given. Numerical examples show that S-GM needs fewer iterations than SS-HOPM when the appropriate parameters were selected.

[1] East China Normal University, China;
[2] School of Mathematical Sciences, East China Normal University, Shanghai, P.R. China;

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DAY 3
IND MATH AND BRICS

Weak and strong convergence theorems for equilibrium problems in Banach Spaces

Vahid Mohebbi[1]

In this talk, we introduce and analyze some convergence methods for solving equilibrium problems in Banach spaces. We prove weak convergence of the generated sequence to a solution of the equilibrium problem, under standard assumptions on the bifunction. Then, we propose a regularization procedure which ensures strong convergence of the generated sequence to a solution of the problem.

[1] IMPA, Brazil;

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A Newton-type method for Quasi-Equilibrium Problems and applications

Pedro Jorge Sousa dos Santos[1]
Susana Scheimberg[2]
Paulo Sérgio Marques dos Santos[1]

We present a local fast convergence method for solving Quasi-Equilibrium Problems (QEPs). Applications to generalized Nash equilibrium problems (GNEPs) and multiobjective optimization problems (MPOs) are considered. In the case of jointly convex GNEP, our algorithm allows finding any solutions of the problem, not only the normalized equilibrium solutions. Some numerical results are reported showing the performance of the algorithm.

[1] Universidade Federal do Piauí, Brazil;
[2] Universidade Federal do Rio de Janeiro, Brazil;

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Douglas-Rachford Method: a View from Strongly Quasi-Nonexpansive Operators

Reinier Díaz Millán[1]
Scott Lindstrom[2]
Vera Roshchina[3]

We focus on the convergence analysis of Douglas-Rachford method for convex feasibility problems in the context of inexact projections. Standard convergence analysis of Douglas-Rachford algorithms is based on the firm nonexpansivity property of the relevant operator. However, if the true projections are replaced by cutters (projections onto separating hyperplanes), the firm nonexpansivity is lost. We provide a proof of convergence of the method under reasonable assumptions, foregoing the usual operator theory scaffolding and relying on a simple geometric argument. This allows us to clarify fine details related to the allowable choice of the relaxation parameters, highlighting the distinction between the exact (firmly nonexpansive) and approximate (strongly quasi-nonexpansive) settings. We provide illustrative examples and discuss practical implementations of the method.

[1] Federal Institute of Goiás, Brazil;
[2] University of Newcastle, Australia;
[3] RMIT University, Australia;

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An existence result for quasi-equilibrium problems

Susana Scheimberg[1]
Paulo S. M. Santos[2]
Leonardo A. Santos[1]

In this work we study the existence of solutions for quasi-equilibrium problems in Banach spaces in the setting of generalized KKM theory. As a particular case, we provide the existence of solutions of generalized Nash equilibrium problems.

[1] UFRJ/ COPPE/PESC, Brazil;
[2] UFPI/ Campus Ministro Reis Velloso, Brazil;

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A discussion of new implementation strategies for solving the Weighted Orthogonal Procrustes Problem

Melissa Weber Mendonça[1]
Juliano de Bem Francisco[1]

In this work, we discuss new refinements and implementation strategies for the solution of the large-scale Weighted Orthogonal Procrustes Problem (WOPP). Although the so called balanced Orthogonal Procrustes Problem has a closed form solution using the singular value decomposition, the unbalanced or Weighted Problem requires the application of iterative methods, which can be costly due to the presence of several local minima. Most existing methods for the solution of this problem involve solving a balanced subproblem at each iteration. In our case, we have previously proposed a block Lanczos bidiagonalization strategy for reducing the cost of the overall iteration by solving increasing-sized problems and, hopefully, converging to a solution to the WOPP before solving the full-sized subproblem. Here we propose a new stopping criteria for these iterations, which can improve convergence by avoiding unnecessary iterations in earlier stages of the block Lanczos iterations. Furthermore, we present improvements on the implementation, including an application of the Polar Decomposition algorithm for the computation of the solution of the subproblem and some preconditioning strategies for solving ill-conditioned problems. We present the theoretical and computational aspects of these developments, including numerical tests that show the competitiveness of this new approach against previously presented methods and implementations.

[1] Universidade Federal de Santa Catarina, Brazil;

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A parallel forward-backward splitting method for multiterm composite convex optimization

Maicon Marques Alves[1]
Samara C. Lima[1]

We propose and study the iteration complexity of a parallel version of the forward-backward (proximal gradient) splitting method for minimizing a (possibly) large sum of convex functions with many smooth and nonsmooth terms. We obtain pointwise (nonergodic) as well as ergodic nonasymptotic convergence rates by embedding the proposed method within the framewoks of the partial inverse of Spingarn and the HPE method of Solodov and Svaiter.

[1] Universidade Federal de Santa Catarina, Brazil;

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On the Q-linear convergence of the forward-backward splitting method and uniqueness of optimal solution to Lasso

José Yunier Bello Cruz[1]

In this talk, by using tools of second-order variational analysis, we present the popular forward-backward splitting method with Beck-Teboulle's line search for solving convex optimization problem where the objective function can be split into the sum of a differentiable function and a possible nonsmooth function. We first establish that this method exhibits global convergence to an optimal solution of problem (if it exists) without the usual assumption that the gradient of the differentiable function involved is global Lipschitz continuous. We also obtain the $o(k^{−1})$ complexity for the function value sequence when this usual assumption is weakened from globally Lipschitz continuity to locally Lipschitz continuity; improving the existing $O(k^{−1})$ complexity result. We then derive the local and global Q-linear convergence of the method in terms of both the function value sequence and the iterative sequence, under a general metric subregularity assumption which is automatically satisfied for convex piecewise-quadratic optimization problems. In particular, we provide verifiable sufficient conditions for metric subregularity assumptions, and so, local and global Q-linear convergence of the proposed method for broad structured optimization problems arise in machine learning and signal processing including the partly smooth optimization problems as well as the ℓ_1-regularized optimization problems. Our results complement the current literature by providing Q-linear convergence result to the forward-backward splitting method under weaker assumptions. Moreover, via this approach, we obtain several full characterizations for the uniqueness of the optimal solution to Lasso problem, which covers some recent results in this direction.

[1] Northern Illinois University, United States;

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On the linear convergence of the circumcentered-reflection method

Roger Behling[1]
Luiz Rafael dos Santos[1]
José Yunier Bello Cruz[2]

In order to accelerate the Douglas-Rachford method we recently developed the circumcentered-reflection method, which provides the closest iterate to the solution among all points relying on successive reflections, for the best approximation problem related to two affine subspaces. We now prove that this is still the case when considering a family of finitely many affine subspaces. This property yields linear convergence and incites embedding of circumcenters within classical reflection and projection based methods for more general feasibility problems.

[1] Universidade Federal de Santa Catarina, Brazil;
[2] Northern Illinois University, United States;

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Macroscopic and mesoscopic numerical model of melt filling and gas penetration processes in complex mold cavity

Qiang Li[1]
Jinyun Yuan[2]

To be announced.

[1] School of Mathematics and Information Science, Henan Polytechnic University, Jiaozuo, China;
[2] Universidade Federal do Paraná, Brazil;

On a special robust optimization problem

Cong Sun[1]

We consider a robust optimization problem arising from wireless communications. In a relay-aided wiretap network, we minimize the total relay transmit power, while requiring that the achieved rate at the supported users are above some thresholds, and that at the eavesdropper is below a standard. This problem is modeled as an optimization problem with one robust constraint. We propose an algorithm to solve the problem iteratively while preserving the feasibility during the iteration. The problem with tightened worst case constraint is solved as the algorithm initialization. We apply the linesearch technique to update the feasible iterative point. All the subproblems are solved optimally and the convergence of the objective function is proved. The optimality condition of the robust optimization problem is analyzed. Simulation results show that our algorithm outperforms the state of the art, and has little loss compared to the result with perfect channel state information.

[1] Bejing University of Post and Telecommunications

Algorithms based on augmented Lagrangian methods for equilibrium problems

Luiz Carlos Matioli[1]
Elvis Manuel Rodrigues Torrealba[1]
Romulo Alberto Castillo Cardenas[2]

Augmented Lagrangian methods have been shown to be very efficient in solving problems of mathematical.

[1] Universidade Federal do Paraná, Brazil;
[2] UFSC/Joinville, Brazil;

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Optimization Model Applied to Radiotherapy Planning Problem with Dose Intensity and Beam Choice

Daniela Renata Cantane[1]
Juliana Campos de Freitas[1]
Helenice de Oliveira Florentino[1]

A radiotherapy planning consists in choose the right dose amount to be delivered in the tumor tissue. This tissue is surrounded by health tissue and tissues at risk, which have to be preserved. Is important to consider these tissues during the planning because high dose delivered into it can cause cell mutation, what can become a malign tumor (cancer) in future. To prevent future cancer disease developed by a radiation treatment, the planning has to be precise considering the beam disposal and certain dose amount. Optimization models have been developed and improved to facilitate and assure the radiotherapy planning. Such type of model can approach three different problems: dose intensity, beam choice and blades opening. However, is common to find only one or two problems in the model. In the current work we propose a optimization model which treats the dose intensity problem and the beam choice problem. In the new model the best beam set is selected by solving the model through matheuristics. A matheuristic consists in solve the beam choice by metaheuristics, applying in this case Tabu Search and Variable Neighborhood Search, coupled with an exact method, such as Interior Point Method and Simplex Method to solve the model.

[1] UNESP, Brazil;

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Multiobjective programming via bundle methods

Elizabeth Wegner Karas[1]
Claudia A. Sagastizábal[2]
Hasnaa Zidani[3]

We present a method solving multiobjective optimization problems that combines achievement and improvement functions. The algorithm exploits the specific structure of the achievement function from a nonsmooth optimization perspective based on bundle methods that it is specially tailored for efficiently building the Pareto front. This is done by parsing attainable points for the objective functions, in a manner that allows for warm starts of the succesive nonsmooth problems solved by the bundle algorithm. The methodology is illustrated with several examples that show the interest of the approach.

[1] Universidade Federal do Paraná, Brazil;
[2] UNICAMP, Brazil;
[3] Paris Tech, France;

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Damage Identification of Vehicle Brake Disks by the Use of Impedance-Based SHM and K-Means Method

Stanley Washington Ferreira de Rezende[1]
Bruno Pereira Barella[1]
João Paulo Moreira Bento[1]
José dos Reis Vieira de Moura Júnior[1]

The maximum operational efficiency has been a continuous search by the automotive engineering in the last decades, aiming at obtaining greater performance and safety of its mechanical systems at low production and maintenance costs. In this context, emerge some predictive studies related to suffered damage or that may occur over the lifetime of structures. Therefore, focusing on analyzing and avoiding failures, new structural health monitoring methodologies have been developed and electromechanical impedance-based SHM method is one of them. The impedance-based technique uses the dielectric and mechanical properties of piezoelectric materials, inspecting any extension of a structure, and calculating an index among impedance signatures and then detecting the damage. Brake system is one of the most important mechanical systems in a passenger vehicle and it is composed by brake pads and brake disc. This system was designed to promote wear in brake pads which are exchanged periodically while the brake discs continue to have a useful life. Thus, in this contribution a common vehicle brake disc is studied in order to evaluate the sensitivity of the impedance-based SHM application to identify mechanical changes and propose a method of checking the integrity of the brake discs. The proposed experimental damage was the mass addition attached to the system in different positions (3 cubic magnets with 10mm). The frequency range of monitoring used was from 20.5 kHz to 30 kHz. A set of 30 signals of each state of the structure, baseline and damage conditions, were acquired by the acquisition system. Then, it was implemented the algorithm of K-Means for the damage identification (cluster analysis for grouping). Finally, in order to validate the proposed damage identification method, it was performed the construction of a linear regression model with the RMSD damage metrics of the different damage sets. Results show the applicability of the method in the identification of damages.

[1] Universidade Federal de Goiás, Brazil;

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Data Acquisition Reduction in Impedance-based SHM Method

Bruno Pereira Barella[1]
Stanley Washington Ferreira de Rezende[1]
João Paulo Moreira Bento[1]
José dos Reis Vieira de Moura Júnior[1]

The main purpose of the electromechanical impedance-based SHM method is to identify incipient damages in structures. This method can prevent failures in critical mechanical systems such as the aerospace and naval industry or in large structures such as bridges and buildings. The electromechanical impedance-based SHM method usually uses a piezoelectric transducer as sensor/actuator to excite/gather the dynamic response of the mechanical structure under investigation in order to find incipient damages. In SHM methods, many samples of the signature is gathered and recorded in order to perform analysis of the system. Then, the present contribution proposes a method to generate signatures based on some measured ones. The signature generator is based on the Monte Carlo method. Thus, this approach proposes to reduce the number of measured/recorded samples in a SHM system. The system under investigation was an aluminum beam and was applied four levels of damage (mass addition). It was measured 5 impedance signatures for each level of damage. Then, it was used the Monte Carlo Method to generate 200 more virtual signatures. Finally, these generated signatures were compared with the acquired signatures in order to measure the error when generating signatures from this method. Concluding, this contribution can illustrate the efficiency to use only part of the signatures (properties of the signatures) instead of the big amount of data recorded. Then, it is possible to check when it is necessary to record more data in order to classify damages or there is no need of additional signatures. Once neural network techniques need a big amount of data and the previous step is able to check the need of new measurements.

[1] Universidade Federal de Goiás, Brazil;

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Title and Abstract to be announced (TBA)

Zhaofang Bai[1]

TBA

[1] School of Mathematical Sciences, Xiamen University, China;

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Title and Abstract to be announced (TBA)

Jianlong Chen[1]

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[1] Southeast University, China;

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Markov Chains and Impedance-based SHM Method for Failure Prediction

Jose dos Reis Vieira de Moura Junior[1]
Joao Paulo Moreira Bento[1]
Bruno Pereira Barella[1]
Stanley Washington Ferreira Rezende[1]

In the last years it has been developed methods to monitor the structural health of systems as such as electromechanical impedance-based SHM (Structural Health Monitoring). Also, several statistical techniques as such as the Markov chains have become more familiar in engineering applications. The purpose of this contribution is to present a case study that aims to apply the concepts of electromechanical impedance-based SHM, optimization and Markov Chains to the monitoring of the structural integrity of a system. It was used a low cost impedance analyser (Eval - AD5933EBZ) in the experiment to measure the impedance signatures of a simple system with small parts. The monitoring frequency range used was 40000Hz - 52775Hz, with 511 points for analysis. Also, 100 signatures were detected in a certain period of time, which 75 of them were in pristine state and 25 for the structure in a fault state. The BCA (Bee Colony Algorithm) optimization method was used to reduce the region in the frequency domain of monitoring in order to find the most sensitive changes imposed to the system (largest difference between the signals). It was applied the RMSD damage metric to obtain a numerical value of damage and thus be able to define the states of the Markov Chain based on the respective index level. By observing the temporal sequence of the states, the transition of them was identified. Then, there are two possibilities: the system can remain in the same state or can change from one state to another (pristine or failure). The quantification of the transition matrix was performed by the relative frequency of occurrence, respecting the property of stochastic matrices and the transition probabilities were calculated. Concluding, with the case study is possible to understand the applicability of the Markov Chains associated to the electromechanical impedance-based method for monitoring and predicting future states.

[1] Federal University of Goias, Brazil;

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Pareto front characterization for finite horizon optimal control problems with two different objectives

Ana Paula Chorobura[1]
Hasnaa Zidani[2]

In this talk, we present a characterization of the weak and strong Pareto fronts for optimal control problems with two objective functions of different nature that need to be minimized simultaneously. One objective is in the classical Bolza form and the other one is defined as a maximum function. Our approach is based on the Hamilton-Jacobi-Bellman framework. First we define an auxiliary optimal control problem without state constraints and show that the weak Pareto front is a subset of the zero level set of the corresponding value function. Then with a geometrical approach we establish a characterization of the Pareto front. Some numerical examples will be considered to show the relevance of our approach.

[1] Universidade Federal do Paraná, Brazil;
[2] ENSTA ParisTech, France;

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Multiobjective Optimization Techniques applied to Fatigue Analysis of Viscoelastically Damped Systems

Lauren Karoline de Sousa Gonçalves[1]
Ulisses Lima Rosa[1]
Antônio Marcos Gonçalves de Lima[1]

In complex engineering structures, in order to reduce the risk of fatigue failure induced by mechanical vibrations, numerical optimization techniques have been used to determine the effectiveness design of viscoelastic dampers. The aim of this work is determine the optimal regions to apply the viscoelastic treatment and to evaluate the robustness from random parameters of optimal solutions through robust optimization techniques. Among these, NSGA technique (Non-Dominated Sorting Genetic Algorithm) was employed to minimize objective functions of multiobjective problem in order to increase fatigue life. After the presentation of the theoretical foundations, numerical studies were performed with a sandwich plate system incorporating viscoelastic damping. The computational implementation was developed employing the discretization of Gaussian random fields by Karhunen-Loève expansion and estimating the fatigue indexes estimated by Sines' criterion. The system robustness was evaluated considering fluctuation of design variables such as thickness and temperature, and these samples are generated by means of the well-known Latin Hypercube Sampling (LHS). Thus, based on Pareto optimal solutions, numerical results are presented in terms of frequency responses functions (FRFs), stress responses (PSDs) and fatigue indexes estimated by Sines' criterion. The obtained results highlighted the effectiveness of the optimization strategy mainly to demonstrate the importance of considering the robust solution in the fatigue analysis.

[1] UFU, Brazil;

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Nonlinear programming algorithm based on trust-region-filter method for unconstrained multiobjective optimization problem

Maria de Gracia Mendonça[1]
María Cristina Maciel[2]

In this work we consider the differentiable unconstrained multiobjective optimization problem. An algorithm will be presented that extends the scalar case of the sequential quadratic programming method using a trust region approach to guarantee global convergence to a weak Pareto optimal point. For the solution of each quadratic subproblem, a generalization of the projected spectral gradient method for scalar case will be presented. At each iteration the trial step will be first analyzed by a suitable filter and a non-monotone acceptance condition.

[1] Universidad Nacional de la Patagonia San Juan Bosco, Argentina;
[2] Universidad Nacional del Sur, Argentina;

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A SQP-Trust-Region algorithm for Nonlinear Multiobjective Optimization

María Cristina Maciel[1]
Sandra Augusta Santos[2]
Graciela Noemí Sottosanto[3]

This contribution deals with the differentiable nonlinear multiobjective optimization problem with equality constraints. An algorithm which extends the well known Sequential Quadratic Programming method for the scalar case is introduced. The trust region constraint is added to the subproblem in order to guarantee global convergence to a weak Pareto point.

[1] Department of Mathematics, Southern National University, Bahía Blanca, Argentina;
[2] Department of Applied Mathematics, State University of Campinas, Campinas, Brazil;
[3] Department of Mathematics, Comahue National University, Neuquén, Argentina;

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New sequential optimality conditions for mathematical problems with complementarity constraints and algorithmic consequences

Leonardo Delarmelina Secchin[1]
Roberto Andreani[1]
Gabriel Haeser[2]
Paulo José da Silva e Silva[1]

In recent years, the theoretical convergence of iterative methods for solving nonlinear constrained optimization problems has been addressed by means of the so-called sequential optimality conditions. These conditions are satisfied by local minimizers independently of the fulfilment of constraint qualifications, and may be used as stopping criteria of algorithms. In this sense, they provide a suitable framework for unifying and extending the convergence results of various methods. Although there is a considerable literature devoted to sequential conditions for standard nonlinear optimization problems, the same is not true for Mathematical Problems with Complementarity Constraints (MPCCs). MPCCs are difficult problems that do not satisfy the majority of the usual constraint qualifications (CQs). In this paper, we argue that, unfortunately, the established sequential optimality conditions do not provide an adequate tool for the convergence analysis of algorithms in the MPCC context. We then propose sequential optimality conditions for usual stationarity concepts for MPCC, namely, weak, Clarke and Mordukhovich stationarity. We call these conditions AW-, AC- and AM-stationarity, respectively. The weakest MPCC-tailored CQs associated with each of the new conditions are also provided. We show that some of the methods for MPCC in the literature reach AC-stationary points, extending previous theoretical convergence results. In particular, the new results include the linear case, not previously covered.

[1] IMECC/Unicamp, Brazil;
[2] IME/USP, Brazil;

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Optimality Conditions and Constraint Qualifications for Generalized Nash Equilibrium Problems and their Practical Implications

Luís Felipe Bueno[1]
Gabriel Haeser
Frank Navarro Rojas

Generalized Nash Equilibrium Problems (GNEPs) are a generalization of the classic Nash Equilibrium Problems (NEPs), where each player's strategy set depends on the choices of the other players. In this work we study constraint qualifications and optimality conditions tailored for GNEPs and we discuss their relations and implications for global convergence of algorithms. Surprisingly, differently from the case of nonlinear programming, we show that, in general, the KKT residual can not be made arbitrarily small near a solution of a GNEP. We then discuss some important practical consequences of this fact. We also prove that this phenomenon is not present in an important class of GNEPs, including NEPs. Finally, under a weak constraint qualification introduced, we prove global convergence to a KKT point of an Augmented Lagrangian algorithm for GNEPs and under the quasinormality constraint qualification for GNEPs, we prove boundedness of the dual sequence.

[1] UNIFESP, Brazil;

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Two New Weak Constraint Qualifications for Mathematical Programs with Equilibrium Constraints and Applications

Alberto Ramos[1]

We introduce two new weaker Constraint Qualifications (CQs) for mathematical programs with equilibrium (or complementarity) constraints, MPEC for short. One of them is a tailored version of the constant rank of subspace component (CRSC) and the other is a relaxed version of the MPEC No Nonzero Abnormal Multiplier Constraint Qualification (MPEC-NNAMCQ). Both have the local preservation property and imply the error bound property under mild assumption. Thus, they can be used to extend some results on perturbation analysis and sensitivity existing in the literature.

[1]UFPR - Federal University of Parana, Brazil;

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An Extension of Yuan's Lemma and its Applications in Optimization

Gabriel Haeser[1]

We prove an extension of Yuan's lemma to more than two matrices, as long as the set of matrices has rank at most 2. This is used to generalize the main result of Baccari and Trad (SIAM J Optim 15(2):394–408, 2005), where the classical necessary second-order optimality condition is proved, under the assumption that the set of Lagrange multipliers is a bounded line segment. We prove the result under the more general assumption that the Hessian of the Lagrangian, evaluated at the vertices of the Lagrange multiplier set, is a matrix set with at most rank 2. We apply the results to prove the classical second-order optimality condition to problems with quadratic constraints and without constant rank of the Jacobian matrix. Some further recent results about this conjecture will also be discussed.

[1] USP - University of São Paulo, Brazil;

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Coherent rings and absolutely pure covers

Nanqing Ding[1]

In this talk, we prove that a ring R is left coherent if and only if the class of absolutely pure left R-modules is a covering class. This talk is a report on joint work with G.C. Dai.

[1] Nanjing University, China;

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Stability of a non Fourier plate equation with variable density

Paulo Nicanor Seminario Huertas[1]

In this talk, motivated by recent literature for viscoelastic problems with variable density, we consider a model of (non Fourier) thermoelastic plates with velocity dependent density. Our main result establishes the exponential stability of the system without additional mechanical damping.

[1] ICMC - Universidade de São Paulo, Brazil;

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Title and Abstract to be announced (TBA)

Hengling Hong[1]

TBA.

[1] College of Computer Science and Technology Jilin University, China;

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Polynomial models to predict thermodynamic properties in turbulent flow

Thelma Pretel Brandão Vecchi[1]
F. A. R. Cardoso[1]
R. A. Almeida[2]
R. V. P. Rezende[2]
L. Cardozo-Filho[2]

The highlight of production of micro- and nanoparticles, from the supercritical technology in the pharmaceutical and food industry, is a process which has been proposed in the scientific literature as an alternative because of its benefits over conventional processes. The SAS method (Supercritical Antisolvent Process) has emerged as an effective alternative, since in this process the solute is dissolved in a conventional organic solvent and the solution is expanded through a capillary chamber containing a supercritical fluid. This acts as an antisolvent, leading to reduced solubility of the solute in the organic solvent causing supersaturation, which leads to the precipitation of particles. The system studied was the precipitation of β-carotene in carbon dioxide as antisolvent, using dichloromethane as the solvent in the SAS process and employed turbulence models k-β Realizable and k-β Stantard. The main difference between both models is precisely the fact that the Realizable model is showing error margins between 15 and 30% relative to the experimental data, while the Standard model ranges between 30 and 60%. Thus, so that the model k-β is always achievable, two changes from the standard model were incorporated. In this work, considering the non-ideal behavior of CO2 under supercritical conditions, the physical properties (density, thermal conductivity, viscosity and mass diffusivity) were also evaluated using polynomials adjusted based on the Peng-Robinson equation of state (EOS), on the Van der Waals mixing rule and on the methods of Chung and Riazi & Whitson, for thermodynamic properties. Simulations performed on a 90 bar pressure and a temperature of 308 K showed results where there were no marked differences when the dependent properties of p, T and composition were used, relative to the cases where the adjusted polynomials were used, indicating a good strategy to use the methodology of the polynomials adjusted to the thermodynamic properties.

[1] UTFPR, Brazil;
[1] UEM, Brazil;

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How to dive in a mathematical way?

Roberto Ribeiro Santos Junior[1]
André Nachbin[2]
Paul Milewski[3]
Marcelo Flamarion[2]

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[1] Universidade Federal do Paraná, Brazil;
[2] IMPA, Brazil;
[3] University of Bath, United Kingdon;

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Title and Abstract to be announced;

Jairo Rocha de Faria[1]
Thiago José Machado[1]
Raul Renner Martins de Sá[1]
Rômulo da Silva Lima[1]
L. Cardozo-Filho[2]

TBA

[1] UFPB, Brazil;

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Title and Abstract to be announced;

Felix Sadyrbaev[1]
Eduard Brokan[2]
Svetlana Atslega[1]

TBA

[1] Institute of Mathematics of University of Latvia, Latvia;
[2] Daugavpils University, Latvia;

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Title and Abstract to be announced;

Flaviana Moreira de Souza Amorim[1]
Magna Paulina de Souza Ferreira[1]
Márcio da Silva Arantes[2]
Claudio Fabiano Motta Toledo[1]

TBA

[1] USP/ICMC, Brazil;
[2] SENAI-SC, Brazil;

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Mathematics in the daily life of a hydropower plant engineer

Geraldo C. Brito Junior

Abstract to be announced;

Instituition not informed

Click here to see the schedule

Title and Abstract to be announced;

Aleksandr A. Shananin

TBA

No informations to show, yet.

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DAY 4

Polynomial models to predict thermodynamic properties in turbulent flow

Thelma Pretel Brandão Vecchi[1]
F. A. R. Cardoso[1]
R. A. Almeida[2]
R. V. P. Rezende[2]
L. Cardozo-Filho[2]

The highlight of production of micro- and nanoparticles, from the supercritical technology in the pharmaceutical and food industry, is a process which has been proposed in the scientific literature as an alternative because of its benefits over conventional processes. The SAS method (Supercritical Antisolvent Process) has emerged as an effective alternative, since in this process the solute is dissolved in a conventional organic solvent and the solution is expanded through a capillary chamber containing a supercritical fluid. This acts as an antisolvent, leading to reduced solubility of the solute in the organic solvent causing supersaturation, which leads to the precipitation of particles. The system studied was the precipitation of β-carotene in carbon dioxide as antisolvent, using dichloromethane as the solvent in the SAS process and employed turbulence models k-β Realizable and k-β Stantard. The main difference between both models is precisely the fact that the Realizable model is showing error margins between 15 and 30% relative to the experimental data, while the Standard model ranges between 30 and 60%. Thus, so that the model k-β is always achievable, two changes from the standard model were incorporated. In this work, considering the non-ideal behavior of CO2 under supercritical conditions, the physical properties (density, thermal conductivity, viscosity and mass diffusivity) were also evaluated using polynomials adjusted based on the Peng-Robinson equation of state (EOS), on the Van der Waals mixing rule and on the methods of Chung and Riazi & Whitson, for thermodynamic properties. Simulations performed on a 90 bar pressure and a temperature of 308 K showed results where there were no marked differences when the dependent properties of p, T and composition were used, relative to the cases where the adjusted polynomials were used, indicating a good strategy to use the methodology of the polynomials adjusted to the thermodynamic properties.

[1] UTFPR, Brazil;
[1] UEM, Brazil;

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