XIVth EUROPT 2016 Workshop

on

ADVANCES IN CONTINUOUS OPTIMIZATION

July 1 – 2, 2016
Warsaw, Poland

PROGRAM and ABSTRACTS

Organized by:
Institute of Control and Computation Engineering
Faculty of Electronics and Information Technology
Warsaw University of Technology
EUROPT - Continuous Optimization Working Group of EURO

Supported by:
Institute of Control and Computation Engineering
Faculty of Electronics and Information Technology
Warsaw University of Technology
EUROPT - Continuous Optimization Working Group of EURO
EURO - The Association of Eurpean Operational Research Societes
NASK – Research and Academic Computer Network

SPONSORS:

Institute of Control and Computation Engineering

Faculty of Electronics and Information Technology

Warsaw University of Technology

EWG EUROPT – The Continuous Optimization Working Group of EURO

EURO – The Association of European Operational Research Societes

NASK – Research and Academic Computer Network

Programme committee

Włodzimierz Ogryczak (Warsaw University of Technology, chair)
Regina Burachik (University of South Australia)
Immanuel Bomze (University of Vienna)
Joseph Frédéric Bonnans (Inria-Saclay and CMAP, Ecole Polytechnique)
Sonia Cafieri (University of Toulouse)
Yu-hong Dai (LSEC, Institute of Computational Mathematics, Chinese Academy of Sciences)
Roger Fletcher (University of Dundee)
Jacek Gondzio (Edinburgh University)
Andreas Grothey (University of Edinburgh)
Dmitri Kvasov (University of Calabria)
Irena Lasiecka (Memphis University, USA and Systems Research Institute, PAS)
Juan Enrique Martinez-Legaz (University of Barcelona)
Panos Pardalos (University of Florida)
Roman Słowiński (Poznan University of Technology)
Oliver Stein (Karlsruhe Institute of Technology)
Tatiana Tchemisova (University of Aveiro)
Tamas Terlaky (Lehigh University)
Gerhard-Wilhelm Weber (Middle East Technical University)
Julius Zilinskas (Vilnius University)

Local Organising committee

Andrzej Stachurski (chair)
Janusz Granat
Andrzej Karbowski
Tomasz Śliwiński
Alicja Trojanowska

XIV-th EUROPT 2016 Workshop
on Advances in Continuous Optimization
1-2 July 2016
Warsaw University of Technology

General Schedule

Total time foreseen for one talk (covers presentation & discussion):
regular talk – 20 minutes,
plenary talk – 50 minutes.

Thursday

19:00 – Welcome Reception

Friday

Track	**8:30 - 8:50**	**9:00 - 9:50**	**9:50 - 10:40**	**11:10 - 12:30**	**14:00 - 15:00**
1 Room 1 (0)	FA-1: Opening	FB-1: Plenary 1	FC-1: Plenary 2	FD-1: Mixed integer optimization	FE-1: Large scale optimization
2 Room 2 (0)	FA-2:	FB-2:	FC-2:	FD-2: Interior point methods	FE-2: Derivative-free methods
3 Room 3 (0)	FA-3:	FB-3:	FC-3:	FD-3: Optimal control and variational problems I	FE-3: Optimization in energy markets
4 Room 4 (0)	FA-4:	FB-4:	FC-4:	FD-4: Non-smooth optimization I	FE-4: Robust optimization and applications

15:20 - beginning of the Warsaw tour (parking in front of the building of the Faculty of Electronics and Information Technology)

20:00 – Conference Dinner (Restaurant Wiesz co Zjesz, street Marszałkowska 45/49, Warsaw)

Saturday

Track	9:00 - 9:50	9:50 - 10:40	11:10 - 12:50	14:20 - 16:00	16:30 - 18:30
1 Room 1 (0)	SA-1: Plenary 3	SB-1: Plenary 4	SC-1: Big data optimization	SD-1: Global and nonconvex optimization I	SE-1: Global and nonconvex optimization II
2 Room 2 (0)	SA-2:	SB-2:	SC-2: Nonlinear programming I	SD-2: Nonlinear programming II	SE-2: Multi-objective optimization
3 Room 3 (0)	SA-3:	SB-3:	SC-3: Non-smooth optimization II	SD-3: Convex programming	SE-3: Optimal control and variational problems II
4 Room 4 (0)	SA-4:	SB-4:	SC-4: Linear and nonlinear optimization	SD-4: Semi-definite programming/Complementarity problems	SE-4: Optimization in industry, business and finance

Short program

SHORT PROGRAM

Friday, 8:30 - 8:50 - Room 1

Opening

Stream: Opening and Closing
Chair: Andrzej Stachurski

Friday, 9:00 - 9:50

FB-01

Friday, 9:00 - 9:50 - Room 1

Plenary 1

Stream: Plenary
Chair: Oliver Stein

1 - Optimality and convexity conditions for piecewise smooth objective functions
Andreas Griewank

Friday, 9:50 - 10:40

FC-01

Friday, 9:50 - 10:40 - Room 1

Plenary 2

Stream: Plenary
Chair: Immanuel Bomze

1 - On stability and sensitivity of constraint and variational systems
Jiri Outrata

Friday, 11:10 - 12:30

FD-01

Friday, 11:10 - 12:30 - Room 1

Mixed integer optimization

Stream: Mixed integer optimization
Chair: Dimitri Papadimitriou

1 - Space-filling visualization maps by means of Mathematical Optimization
Vanesa Guerrero, Emilio Carrizosa, Dolores Romero Morales

2 - Global Mixed Integer Nonlinear Programming Solutions by The Generalized-GRASP Method
João Lauro Faco', Ricardo Silva, Mauricio Resende

3 - On Computing Minimum Route Duration for Traveling Salesman Problem with Complex Time Constraints
Jarosław Hurkała

4 - Congested Hub-Location Routing Problem
Dimitri Papadimitriou

FD-02

Friday, 11:10 - 12:30 - Room 2

Interior point methods

Stream: Large scale optimization
Chair: Jacek Gondzio

1 - How interior point methods can help vehicle routing
Pedro Munari

2 - On unreduced KKT systems arising from Interior Point methods
Benedetta Morini, Valeria Simoncini, Mattia Tani

3 - Computing Null Space Operators in Linearly Constrained Programming
Lukas Schork, Jacek Gondzio

4 - A distributed interior point method for multistage stochastic NLPs
Marc Steinbach

Short program

FD-03

Friday, 11:10 - 12:30 - Room 3

Optimal control and variational problems I

Stream: Optimal control and applications
Chair: Thomas Weber

1 - A smoothing approximation for solving a class of variational inequalities. Application to the strategy based congested transit assignment model
Esteve Codina, Gemma Ibañez, Lídia Montero
2 - Decomposition Method for Oligopolistic Competitive Models with a Joint Emission Upper Bound
Giorgia Oggioni, Elisabetta Allevi, Adriana Gnudi, Igor Konnov
3 - Tangencity to singularity and degenerate optimization problems
Ewa Bednarczuk, Alexey Tretyakov
4 - Global Optimization on an Interval
Thomas Weber

FD-04

Friday, 11:10 - 12:30 - Room 4

Non-smooth optimization I

Stream: Convex and non-smooth optimization
Chair: Tiru Arthanari
1 - Continuous Outer Subdifferential Method for Locally Lipschitzian Functions
Martin Knossalla
2 - Chance constrained optimization in Banach Spaces
Abebe Geletu, Armin Homan, Pu Li
3 - Primal-dual proximal point algorithm with inertial effect
Krzysztof Rutkowski
4 - Lagrangean Relaxation, Hypergraphs and Symmetric Traveling Salesman Problem
Tiru Arthanari

Friday, 14:00 - 15:00

FE-01

Friday, 14:00 - 15:00 - Room 1

Large scale optimization

Stream: Large scale optimization
Chair: Massimo Roma
1 - Preconditioning Techniques for Nonlinear Conjugate Gradient Methods Based on Damped Quasi Newton Updates
Massimo Roma, Mehiddin Al-Baali, Andrea Caliciotti, Giovanni Fasano
2 - The controller of asymptotically fully damping for singularly perturbed linear autonomous systems with delay
Tsekhan Olga
3 - A new price coordination algorithm for decomposed convex optimization
Andrzej Karbowski

FE-02

Friday, 14:00 - 15:00 - Room 2

Derivative-free methods

Stream: Derivative-free optimization
Chair: Stefano Lucidi
1 - On subdivision strategies in DIRECT-type algorithms
Julius Žilinskas, Remigijus Paulavi˘cius
2 - A linesearch derivative-free method with adaptive precision function evaluations and application to bilevel minimization problems
Stefano Lucidi, Stefania Renzi
3 - Probabilistic feasible descent techniques for derivative-free linearly constrained optimization
Clément Royer, Serge Gratton, Luis Nunes Vicente, Zaikun Zhang

FE-03

Friday, 14:00 - 15:00 - Room 3

Optimization in energy markets

Stream: Optimization in industry, business and finance
Chair: Cristian Pelizzari
1 - Renewables, Allowances Markets, and Energy Mix in Energy-Only Markets
Cristian Pelizzari, Paolo Falbo, Luca Taschini

Short program

2 - Electricity market model with demand elasticity: existence of solutions and stability
Rossana Riccardi, Elisabetta Allevi, Didier Aussel, Francesca Bonenti
3 - Nash Equilibrium in Pay-as-bid Electricity Market
Miroslav Pistěk, Didier Aussel, Pascale Bendotti

FE-04
Friday, 14:00 - 15:00 - Room 4
Robust optimization and applications
Stream: Robust optimization and applications
Chair: Daniel Reem

1 - On solving an application-based completely positive program of size 3 with further results
Chee Khian Sim, Qi Fu, Chung Piaw Teo

2 - Interval global optimization using a template-based package for automatic differentiation and hull consistency enforcing
Bartlomiej Kubica

3 - Zero-convexity, perturbation resilience, and subgradient projections for feasibility-seeking methods
Daniel Reem, Yair Censor

Saturday, 9:00 - 9:50
SA-01
Saturday, 9:00 - 9:50 - Room 1
Plenary 3
Stream: Plenary
Chair: Miguel Anjos
1 - Stochastic global optimization: promises and limitations
Anatoly Zhigljavsky

Saturday, 9:50 - 10:40
SB-01
Saturday, 9:50 - 10:40 - Room 1
Plenary 4
Stream: Plenary
Chair: Julius Žilinskas
1 - Lipschitz global optimization
Yaroslav Sergeyev

Saturday, 11:10 - 12:50
SC-01
Saturday, 11:10 - 12:50 - Room 1
Big data optimization
Stream: Large scale optimization
Chair: Stephen Wright
1 - A two-stage active-set method for bound-constrained optimization problems
Andrea Cristofari, Marianna De Santis, Stefano Lucidi, Francesco Rinaldi
2 - Preconditioners for inexact Newton method in big data optimization
Jacek Gondzio
3 - Ordering in Gauss-Seidel Iterations
Weiqi Zhou
4 - smartDESC: Demand Response via Electric Water Heaters to Support the Integration of Intermittent Power Generation in a Smart Grid
Miguel Anjos
5 - Some Optimization Problems from Electrial Power Grids
Stephen Wright, Taedong Kim, Taedong Kim

Short program

SC-02

Saturday, 11:10 - 12:50 - Room 2

Nonlinear programming I

Stream: Linear and nonlinear optimization
Chair: Gerhard-Wilhelm Weber

1 - On the real Jacobian Conjecture and Newton polytopes
Tomas Bajbar, Oliver Stein
2 - On stability of nonlinear constraint systems and applications
Helmut Gfrerer
3 - Application of p-regularity theory to nonlinear optimization problems.
Ewa Szczepanik, Alexey Tretyakov
4 - Partial Order Relations for Set Optimization
Emrah Karaman, Mustafa Soyertem, ˙Ilknur Atasever Güvenç, Didem Tozkan, Mahide Kucuk, Yalcin Kucuk
5 - Optimization and Control Reenters under Stochastic Uncertainty, Jumps, Regime Switches and Paradigms Shifts
Gerhard-Wilhelm Weber, Emel Savku, Nadi Serhan Aydin

SC-03

Saturday, 11:10 - 12:50 - Room 3

Non-smooth optimization II

Stream: Convex and non-smooth optimization
Chair: Oliver Stein

1 - Lipschitz continuous positively homogeneous functions
Marina Trafimovich

2 - Semi-quasidifferentiable multiobjective optimization
Majid Soleimani-damaneh, Alireza Kabgani
3 - Solving Some of the Largest Problems of the Literature by the Accelerated Hyperbolic Smoothing Clustering Method
Adilson Elias Xavier, Vinicius Layter Xavier
4 - Linear generalized Nash equilibrium problems and nonsmooth optimization
Nathan Sudermann-Merx, Oliver Stein, Axel Dreves
5 - Solving Disjunctive Optimization Problems by Generalized Semi-infinite Optimization Techniques
Oliver Stein, Peter Kirst

SC-04

Saturday, 11:10 - 12:50 - Room 4

Linear and nonlinear optimization

Stream: Linear and nonlinear optimization
Chair: Immanuel Bomze

1 - A unified modeling approach for computing (s, S) policies with stochastic demand
Mengyuan Xiang, Roberto Rossi, Belen Martin-Barragan
2 - Generating the efficient frontier for a class of bicriteria generalized fractional programming
Riccardo Cambini, Laura Carosi, Laura Martein
3 - Weak, strong and linear convergence of a double-layer fixed point algorithm
Rafal Zalas
4 - The complexity of simple models - a study of worst and typical hard cases for the Standard Quadratic Optimization Problem
Immanuel Bomze, Werner Schachinger, Reinhard Ullrich
5 - Convergence properties of the weak subgradient algorithm in nonconvex optimization
Gulcin Dinc Yalcin, Refail Kasimbeyli

Saturday, 14:20 - 16:00

SD-01

Saturday, 14:20 - 16:00 - Room 1

Global and nonconvex optimization I

Stream: Global optimization
Chair: Anatolii Kosolap

1 - The q-asymptotic function in generalized convexity theory
Felipe Lara, Ruben Lopez
2 - A Feature Clustering Method for Large Scale Global Optimization and its Applications to Disk Packing
Francesco Bagattini, Fabio Schoen

Short program

3 - On constraint qualification conditions for abstract convex functions
Monika Syga
4 - Finding the Global Minimum of the General Quadratic Problems
Anatolii Kosolap
5 - Global Optimization Tools to Discriminate Models in Chemical Reaction Networks
M. Asuncion Jimenez-Cordero, Rafael Blanquero, Emilio Carrizosa, José Francisco Rodríguez

SD-02

Saturday, 14:20 - 16:00 - Room 2

Nonlinear programming II

Stream: Linear and nonlinear optimization
Chair: Yury Evtushenko
1 - Regularizing trust-region approaches for ill-posed nonlinear systems and nonlinear least squares
Stefania Bellavia, Benedetta Morini, Elisa Riccietti
2 - Numerical Behavior Analysis of SQP Method for Ill-posed NLPs with Multiple Precision Arithmetic
Hiroshige Dan, Yuya Matsumoto
3 - Levenberg-Morisson-Marquardt algorithms based on probabilistic models
El houcine Bergou
4 - Solving aircraft conflicts by continuous optimization
Sonia Cafieri, Andrew Conn, Marcel Mongeau
5 - Effective hull and its applications
Yury Evtushenko, Mikhail Posypkin

SD-03

Saturday, 14:20 - 16:00 - Room 3

Convex programming

Stream: Convex and non-smooth optimization
Chair: Tatiana Tchemisova
1 - On a Class of Gradient-Like Dynamical Systems with Noisy First-Order Feedback
Mathias Staudigl, Panayotis Mertikopoulos
2 - Some duality results in evenly convex programming
José Vicente-Pérez
3 - From error bounds to the complexity of
first-order descent methods for convex functions
Phong Nguyen
4 - Convergence Analysis of Douglas-Rachford Splitting Method for
Xiaoming Yuan
5 - On study of properties of special nonlinear problems arising in parametric SIP
Olga Kostyukova, Tatiana Tchemisova

SD-04

Saturday, 14:20 - 16:00 - Room 4

Semi-definite programming/Complementarity problems

Stream: Conic optimization and semi-definite programming
Chair: Jean Charles Gilbert
1 - Plea for a semidefinite optimization solver in complex numbers
Jean Charles Gilbert, Cédric Josz, Daniel Molzahn
2 - On Digital Filter Design with Semidefinite Programming
Michał Przyłuski
3 - Solutions of Complementarity Problems Monotone with Respect to Parameters
Viacheslav Kalashnikov, Nataliya Kalashnykova, Arturo García
4 - Departure time choice equilibrium with heterogeneous commuters in corridor type traffic network
Shunsuke Hayashi, Naoya Seki
5 - D-gap functions and optimization techniques for computing equilibria
Giancarlo Bigi, Mauro Passacantando

Saturday, 16:30 - 18:30

SE-01

Saturday, 16:30 - 18:30 - Room 1

Global and nonconvex optimization II

Stream: Analysis and engineering of optimization algorithms
Chair: Juan Enrique Martínez-Legaz
1 - A general nonconvex multiduality principle
Juan Enrique Martínez-Legaz, Francesca Bonenti, Rossana Riccardi

Short program

2 - On Some Methods to Find Stationary Points of Quasidifferentiable Functions with DC-Duality Approach
Didem Tozkan, Mahide Kucuk, Yalcin Kucuk
3 - A Reformulation of Sparse Optimization Problems using Complementarity-type Constraints
Alexandra Schwartz, Christian Kanzow, Oleg Burdakov
4 - A continuous DC programming approach to nonlinear mixed integer programs without integrality gaps
Takayuki Okuno, Yoshiko Ikebe

SE-02

Saturday, 16:30 - 18:30 - Room 2

Multi-objective optimization

Stream: Multi-objective optimization
Chair: Janusz Granat
1 - On Duality and Sensitivity for Vector Convex Programming in Abstract Spaces
Miguel Angel Melguizo Padial, Fernando García Castaño
2 - Scalarization and First and Second Order Optimality Conditions in Vector Optimization Problems with a Nontransitive Preference Relation
Valentin Gorokhovik
3 - Optimality conditions in convex multiobjective semi-infinite optimization
Miguel Goberna
4 - On weakly sequentially complete Banach spaces
Krzysztof Leśniewski
5 - Multiple-criteria analysis in big data mining
Janusz Granat

SE-03

Saturday, 16:30 - 18:30 - Room 3

Optimal control and variational problems II

Stream: Optimal control and applications
Chair: Andrzej Myśliński
1 - Optimal Control of Convective FitzHugh-Nagumo Equation
Tugba Kucukseyhan

2 - Structural Optimization of Variational Inequalities using Phase Field Regularization
Andrzej Myśliński
3 - A.M.Lyapunov methodology in Problems of Stability/Optimality for Complex Systems
Lyudmila Kuzmina
4 - A single-level approach to multi-leader-follower games
Simone Sagratella, Lorenzo Lampariello
5 - A bridge between bilevel programs and Nash games
Lorenzo Lampariello, Simone Sagratella

SE-04

Saturday, 16:30 - 18:30 - Room 4

Optimization in industry, business and finance

Stream: Optimization in industry, business and finance
Chair: Wlodzimierz Ogryczak
1 - Optimization Approach for Close to Reality Determination of Stresses in RC Members under Eccentric Compression
Andrzej Stachurski, Marek Lechman
2 - Randomized methods in solving contemporary traffic engineering problems in telecommunication.
Pawel Bialon
3 - Portfolio optimization for a Large Investor under Partial Information and Price Impact
Zehra Eksi
4 - Efficient optimization of the reward-risk ratio with polyhedral risk measures
Wlodzimierz Ogryczak, Tomasz Sliwinski, Michał Przyłuski
5 - Evaluating appropriate artificial neural network model for forecasting foreign exchange
Sanjeev Gupta

Friday, 8:30 - 8:50

■ FA-01

Friday, 8:30 - 8:50 - Room 1

Opening

Stream: Opening and Closing
Chair: *Andrzej Stachurski*

Friday, 9:00 - 9:50

■ FB-01

Friday, 9:00 - 9:50 - Room 1

Plenary 1

Stream: Plenary
Chair: *Oliver Stein*

1 - Optimality and convexity conditions for piecewise smooth objective functions
Andreas Griewank

In the recent book Optimization Stories edited by Martin Groetschel, Robert Mifflin and Claudia Sagastizabal [4] describe how nonsmooth optimization arose through a rare collaboration between Soviet and Western scientists in the 1960s and 1970s. In the seemingly simple case of a convex objective function there exists everywhere a nonempty set of subgradients whose shortest element provides a direction of descent. While this set is also convex it may be quite difficult to compute and epresent. On the other hand there are classical scenarios where it is quite easy to compute one of the subgradients, or in the more general Lipschitzian case, one generalized gradient. This lead to the widely accepted black-box paradigm, namely that nonsmooth optimization algorithms should be based on an evaluation oracle that provides the function value and just one generalized gradient at any point in the function domain. The resulting bundle methods were described and analyzed in great detail, for example in the classical books of Jean Baptiste Hirriart Urruty and Claude Lemarechal [3]. There exist very simple examples, where due to the codependence of intermediate quantities, such a generalized gradient cannot be computed by the application of generalized differentiation rules. Moreover, even when generalized gradients are available everywhere, the resulting descent algorithms are typically quite slow and suffer from the lack of practical stopping criteria. Ideally, these should be based on computable and reasonably sharp optimality conditions, that are satisfied approximately in a small but open neighborhood of a local minimizer. It will be shown here that this desirable situation can be achieved for objectives in the so called abs-normal form, which also yields enough information to achieve, linear, superlinear, or even quadratic convergence, by successive piecewise linearization provided certain nondegeneracy conditions are satisfied. Any piecewise smooth function that is specified by an evaluation procedure involving smooth elemental functions and piecewise linear functions like min and max can be represented in abs-normal form [1]. This is in particular true for most popular nonsmooth test functions. By an extension of algorithmic, or automatic differentiation, one can then compute certain first and second order derivative vectors and matrices that represent a local piecewise linearization and provide additional curvature information. On the basis of these quantities we characterize local optimality by first and second order necessary and sufficient conditions [2], which generalize the corresponding KKT and SSC theory for smooth problems. The key assumption is the Linear Independence Kink Qualification (LIKQ), a generalization of LICQ familiar from NLOP. It implies that the objective has locally a so-called VU decomposition [4] and renders everything tractable in terms of matrix factorizations and other simple linear algebra operations. In the smooth case local optimality conditions usually combine a stationarity condition with a convexity conditions. In contrast, nonsmooth objectives can have strongly isolated minima without having even weakly supporting hyperplanes at arbitrarily close neighboring point. Since in some applications such as multiphase equilibria, local convexity itself is necessary for single phase stability, one may also ask for convexity conditions for piecewise smooth functions in absnormal form. As it turns out this property seems to be much more difficult to verify than optimality as even the question of first order convexity, i.e. convexity of the local piecewise linear model appears to be NP hard.

Keywords: Abs-normal form, Piecewise linearization, Karush-Kuhn-Tucker, Second order optimality, Tangential stationarity, Normal growth, VU decomposition, First order convexity.

References [1] A. Griewank. On stable piecewise linearization and generalized algorithmic differentiation. Opt. Meth. and Softw., 28(6):1139-1178, 2013. [2] A. Griewank and A. Walther. First and second order optimality conditions for piecewise smooth objective functions. Opt. Meth. and Softw., accepted, 2016. [3] J.-B. Hiriart-Urruty and C. Lemarechal. Convex Analysis and Minimization Algorithms I, Springer, 1993. [4] R. Mifflin and C. Sagastizabal. A science fiction story in no nsmooth optimization originating at IIASA. Documenta Mathematica, Extra Vol.:291-300, 2012.

Short biography

1976 Diplom in Math at University of Freiburg, Germany 1980 PhD in Computer Science at Australian National University 1987 Assistant/Associate Prof Southern Methodist University Dallas 1993 (Senior) Scientist Argonne National Laboratory 2003 Prof at TU Dresden 2015 Prof at Humboldt Univ. Berlin Since October 2015 Dean of Faculty of Mathematical Sciences and Computer Engineering at Yachay Tech Ibarra.

Friday, 9:50 - 10:40

■ FC-01

Friday, 9:50 - 10:40 - Room 1

Plenary 2

Stream: Plenary
Chair: *Immanuel Bomze*

1 - On stability and sensitivity of constraint and variational systems
Jiri Outrata

In post-optimal analysis and in the treatment of the so-called equilibrium constraints one often needs to analyze local stability of the solution maps which assign some parameters (e.g. problem data) the respective solutions (optima or equilibria). One of the most important local stability notions is the Aubin (Lipschitz-like) property which ensures that the perturbed problems (i) do possess a solution, and (ii) the distance of this solution from the original (reference) solution is bounded above by a multiple of the norm of the perturbation. In the lecture, a new non-restrictive suffcient condition for the Aubin property will be presented in the general framework of implicitly defined multifunctions. In this development our main tool are generalized derivatives and coderivatives which provide a convenient description of the local behavior of nonsmooth and set-valued mappings. In particular, it is the directional limiting coderivative due to H. Gfrerer, which is tailored to fine local analysis of multifunctions along specified directions. This new condition will then be specialized to constraint and variational systems having a frequently arising structure, which requires a development of a certain calculus for the directional limiting coderivatives. We will present one rule of this new calculus generalizing a formula due to Dontchev and Rockafellar. The advantages of this new approach will be illustrated by examples. The lecture is based on a joint work with Helmut Gfrerer (Johannes Kepler Universitaet Linz).

Short biography

Jiri V. Outrata is Senior Researcher in the Institute of Information Theory and Automation of the Czech Academy of Sciences. In the period 1991-2001 he spent several years in Germany on leave with the University of Bayreuth and the University of Erlangen-Nuremberg. His technical background is optimal control but, since 1993 his main attention is devoted to mathematical programs with equilibrium constraints. In 2007 Jiri Outrata was awarded the Honorary Medal of Bernard Bolzano and since 2013 he is Adjunct Professor of the Federation University in Ballarat, Australia.

Friday, 11:10 - 12:30

■ FD-01

Friday, 11:10 - 12:30 - Room 1

Mixed integer optimization

Stream: Mixed integer optimization
Chair: *Dimitri Papadimitriou*

1 - Space-filling visualization maps by means of Mathematical Optimization
Vanesa Guerrero, Emilio Carrizosa, Dolores Romero Morales

In this talk, we propose the use of MINLP to build visualization maps for a set of individuals which have attached dissimilarities as well a statistical variable. Visualization maps are built in such a way that distances between portions resemble the dissimilarities between the individuals and the areas of the portions represent the statistical variable. To guide the location of the portions, a tailored Multidimensional Scaling is designed, which allows reducing the computational costs as well as using heuristics to handle large instances.

2 - Global Mixed Integer Nonlinear Programming Solutions by The Generalized-GRASP Method
João Lauro Faco', Ricardo Silva, Mauricio Resende

Continuous-GRASP solves efficiently general constrained global continuous optimization problems (Facó, Resende and Silva 2011, 2012, 2013, 2014, 2015) by adapting the greedy randomized adaptive search procedure (GRASP) -metaheuristic for discrete optimization- to the case of constrained continuous variables. A new version that considers also discrete variables is presented including integer variables. Generalized-GRASP does not do any relaxation as usual branch and bound methods. GRASP random search and local improvement phases use independently a discrete and a continuous set simultaneously.

3 - On Computing Minimum Route Duration for Traveling Salesman Problem with Complex Time Constraints
Jarosław Hurkała

Almost every kind of time-oriented vehicle routing, orienteering or generally traveling salesman problem has a common problem of finding the minimum route duration for a given sequence of locations. Most papers consider single time window, and constant travel and visit time. In this work we address the problem of computing minimum route duration in TSP with multiple time windows and time-dependent travel and visit time. We present a mixed-integer linear model, show results obtained from commercial optimization software, and favorably compare our novel exact algorithm against three other.

4 - Congested Hub-Location Routing Problem
Dimitri Papadimitriou

We propose a mixed integer formulation of hub-facility location routing problem where the bottom level corresponds to the customer demand points, the middle one to hubs and the upper one to facilities. Our formulation includes nonlinear proportional to the hub and facility load in the objective function to account for non-linear congestion effects. We solve this problem by means of Generalized Benders Decomposition and compare its performance with linearization methods. Using representative scenarios, we identify various tradeoffs when fixing the number of hubs vs. facilities.

■ FD-02

Friday, 11:10 - 12:30 - Room 2

Interior point methods

Stream: Large scale optimization
Chair: *Jacek Gondzio*

1 - How interior point methods can help vehicle routing
Pedro Munari

The applications of interior point methods (IPMs) have become incredibly diverse. The advantages of this clever class of methods go beyond linear and nonlinear programming. Indeed, several solution methods often used to solve combinatorial optimization problems can also take benefit from central solutions provided by IPMs. In this talk, we review the currently most successful strategies in this context and present the results of experiments with large-scale, real-life instances of vehicle routing problems, obtained from a case study developed with an oil company that operates in Brazil.

2 - On unreduced KKT systems arising from Interior Point methods
Benedetta Morini, Valeria Simoncini, Mattia Tani

The focus of this talk is on the linear systems that arise from the application of Primal-Dual Interior Point methods to convex quadratic programming problems in standard form. The block structure of the matrices allows for formulations differing in their dimensions and spectral properties. We consider the unreduced 3x3 block linear systems and their symmetric and unsymmetric formulations and provide new spectral bounds. Then we present a theoretical and experimental analysis of the iterative solution of unreduced systems in the preconditioned regime.

3 - Computing Null Space Operators in Linearly Constrained Programming
Lukas Schork, Jacek Gondzio

A method is described for finding a nonsingular submatrix of a rectangular matrix A. The method is based on LU factorization and is suitable when A is large and sparse. It uses theoretical results from rank revealing LU factorization to control the condition number of the submatrix even if A is ill conditioned. The method can be applied to obtain a stable null space operator of A or to compute constraint preconditioners for KKT systems. The numerical stability of the factors is vital in the context of interior point methods when highly ill conditioned systems are solved iteratively.

4 - A distributed interior point method for multistage stochastic NLPs
Marc Steinbach

Interior point methods are well-suited for multistage stochastic NLPs if an efficient algorithm for the huge KKT system is available. For large scenario trees with a moderate number of node variables we present a distributed algorithm with low communication overhead using a static tree partitioning. We also address structured quasi-Newton updates and inertia corrections to handle non-convexity or rank-deficiency of the KKT system. Computational results for benchmark problems from portfolio optimization and robust model predictive control demonstrate the performance of our approach.

■ FD-03

Friday, 11:10 - 12:30 - Room 3

Optimal control and variational problems I

Stream: Optimal control and applications
Chair: *Thomas Weber*

1 - A smoothing approximation for solving a class of variational inequalities. Application to the strategy based congested transit assignment model
Esteve Codina, *Gemma Ibañez*, *Lídia Montero*

This paper shows how a given class of variational inequality problems can be solved using a smoothing approximation. Particularly its application to the strategy based user equilibrium transit assignment model is illustrated. The problem can be approximated by a classical smoothing technique leading to another variational inequality model that can be solved by means of a path based method for the asymmetric traffic assignment problem. Computational tests have been carried out on several medium-large scale networks showing the viability and the applicability to large scale transit models.

2 - Decomposition Method for Oligopolistic Competitive Models with a Joint Emission Upper Bound
Giorgia Oggioni, *Elisabetta Allevi*, *Adriana Gnudi*, *Igor Konnov*

We consider the general problem of a system of firms subject to common emission upper bounds. Due to these restrictions, the problem is treated as a generalized non-cooperative. We suggest a decomposable share allocation method for attaining the corresponding generalized equilibrium state in a rather natural way. This replaces the initial problem with a sequence of usual non-cooperative games defined on Cartesian product sets. We also show that its implementation can be simplified after application of a regularized penalty method. In the case study, we consider the application of the EU-ETS.

3 - Tangencity to singularity and degenerate optimization problems
Ewa Bednarczuk, *Alexey Tretyakov*

In this talk we present description of the tangent cone in the non-regular. Comparing to the existing results we generalize the concept of p-regularity of mappings and apply this generalization to a wide class of singular problems. We describe tangent cones in these class of mappings and obtain new optimality conditions for such type of optimization problems with equality constraints.

4 - Global Optimization on an Interval
Thomas Weber

We provide semi-analytic expressions for the largest and smallest solution of a global optimization problem on an interval using an adjoint variable which represents the available one-sided improvements. The resulting optimality conditions yield two-point boundary problems as in dynamic optimization. We provide several practical examples and consider the challenges of generalizing the method to higher dimensions.

■ FD-04

Friday, 11:10 - 12:30 - Room 4

Non-smooth optimization I

Stream: Convex and non-smooth optimization
Chair: *Tiru Arthanari*

1 - Continuous Outer Subdifferential Method for Locally Lipschitzian Functions
Martin Knossalla

The theory of subdifferentials provides adequate methods and tools to put descent methods for nonsmooth optimization problems into practice. But there is often no exact information about the whole subdifferential for local Lipschitz continuous functions, e.g. for marginal functions in parametric mathematical programming. Basing on the continuous outer subdifferentials we developed, this talk presents a new strategy for optimization problems with local Lipschitzian cost functions. A descent method will be developed and its convergence will be proven.

2 - Chance constrained optimization in Banach Spaces
Abebe Geletu, *Armin Hoffman*, *Pu Li*

Chance constrained problems are in general nonconvex and non-differentiable. Therefore, nonsmooth analysis becomes the key issue in an approach to CCOPT problems. It is well-known that CCOPT problems are numerically intractable. As a result, the existing methods of finite dimensional sampling or non-smooth optimization cannot be trivially applicable. Therefore, this work proposes a smoothing method for an approximate solution of nonsmooth and nonconvex CCOPT problems on Banach spaces.

3 - Primal-dual proximal point algorithm with inertial effect

Krzysztof Rutkowski

Finding zeros of the sum of two monotone operators is of interest in image processing, optimal transportation and statistics. The main primal methods are: the forward-backward method, the Douglas-Rachford method and the forward-backward-forward method. Primal-dual methods solve the problem by generating a sequence of points converging to a point from the Kuhn-Tucker set. In this presentation we propose a primal-dual method with inertial effect, i.e. in the formula for subsequent approximate we take into account two previous aproximates.

4 - Lagrangean Relaxation, Hypergraphs and Symmetric Traveling Salesman Problem

Tiru Arthanari

Among the integer linear programming formulations of the STSP problem, the multistage-insertion formulation (MI-formulation) and the subtour elimination formulation attain the same value for their linear relaxations. Computational studies comparing different formulations indicate the superior performance of the MI-formulation. The Leontief structure of the sub-problem of the MI problem provides additional algorithmic approaches to solve the MI-relaxation problem, using Lagrangean relaxation. Also we show the problem is a minimum cost flow problem in a hypergraph, providing new algorithms.

Friday, 14:00 - 15:00

■ FE-01

Friday, 14:00 - 15:00 - Room 1

Large scale optimization

Stream: Large scale optimization
Chair: *Massimo Roma*

1 - Preconditioning Techniques for Nonlinear Conjugate Gradient Methods Based on Damped Quasi Newton Updates
Massimo Roma, Mehiddin Al-Baali, Andrea Caliciotti, Giovanni Fasano

In this paper we deal with preconditioning techniques for Nonlinear Conjugate Gradient methods in large scale unconstrained optimization. We combine information collected by the NCG scheme with specific appealing properties of quasi-Newton updates, particularly the recent damped quasi-Newton techniques. Our aim is to possibly approximate in some sense the inverse of the Hessian matrix, while still preserving information provided by the satisfaction of the secant equation or its modification. Preliminary numerical experiences described confirm the effectiveness of the proposed approach.

2 - The controller of asymptotically fully damping for singularly perturbed linear autonomous systems with delay
Tsekhan Olga

For linear autonomous singularly perturbed system with small parameter at the highest derivative of the part of variables and with delay in the slow state variables construct a dynamic composite controller, independent of the small parameter, according to the feedback principle so that for sufficiently small values of the parameter the closed-loop system was asymptotically stable by Lyapunov, and the state of the system and control's law were close to zero (order of smallness of the parameter), starting at some point of time.

3 - A new price coordination algorithm for decomposed convex optimization
Andrzej Karbowski

A separable, additive, convex optimization problem is considered. Under quite moderate assumptions, the Lagrangian decomposition, based on the relaxation of constraints, can be applied, what leads to a hierarchical, two-level scheme with the dual problem on the upper level and the decomposed primal problem on the lower level [1]. A new gradient algorithm for the upper level, using more information concerning the algorithm applied on the lower level, will be proposed.

Ref. [1] Karbowski A., Comm. on "Optimization Flow Control...", IEEE/ACM Trans. on Networking, 11(2): 338-339, 2003.

■ FE-02

Friday, 14:00 - 15:00 - Room 2

Derivative-free methods

Stream: Derivative-free optimization
Chair: *Stefano Lucidi*

1 - On subdivision strategies in DIRECT-type algorithms
Julius Žilinskas, Remigijus Paulavičius

The well known DIRECT algorithm for global optimization is based on dividing hyper-rectangles and evaluating objective function at the centers. Various modifications have been proposed including the use of simplices instead of rectangles, sampling more than one point on diagonal or vertices, etc. In order to use the sampled function value in descendant partitions a trisection is often used, but new subdivision strategies allow bisection which is preferable because of resulting shapes. In this talk we discuss and compare various sampling and subdivision strategies.

2 - A linesearch derivative-free method with adaptive precision function evaluations and application to bilevel minimization problems
Stefano Lucidi, Stefania Renzi

In this work we propose a new linesearch derivative-free algorithm for nonsmooth optimization problems with adaptive precision function evaluations. Under suitable assuptions we prove that an accumulation point of the sequence produced by the algorithm is a Clarke-stationary point of the considered problem. Then the proposed method is applied for solving a particular class of bilevel minimization problems. Finally we report the results of a preliminary numerical experience showing a possible practical interest of the proposed approach.

3 - Probabilistic feasible descent techniques for derivative-free linearly constrained optimization
Clément Royer, Serge Gratton, Luis Nunes Vicente, Zaikun Zhang

We describe a direct-search scheme for linearly constrained optimization, based on randomly generated directions that guarantee probabilistic feasible descent, in a generalization from a recent unconstrained study. By applying martingale-type arguments to assess the quality of the directions used throughout the algorithm, we establish global convergence with probability one as well as convergence rates with overwhelming probability. Such complexity bounds indicate possible interesting gains over deterministic solvers, a prospect supported by preliminary numerical experience.

■ FE-03

Friday, 14:00 - 15:00 - Room 3

Optimization in energy markets

Stream: Optimization in industry, business and finance
Chair: *Cristian Pelizzari*

1 - Renewables, Allowances Markets, and Energy Mix in Energy-Only Markets
Cristian Pelizzari, Paolo Falbo, Luca Taschini

We investigate the effect of an ETS and renewables on electricity generation investment in energy-only markets. We model the energy mix decision between conventional and renewable generation with uncertain demand. When increasing renewable capacity, a higher share of renewable production can be priced at the higher marginal cost of conventional production, yet the likelihood of achieving higher profits reduces because more demand is met by cheaper renewable generation. A numerical application shows that allowances markets supply unsatisfactory low-carbon solutions to the energy mix problem.

2 - Electricity market model with demand elasticity: existence of solutions and stability
Rossana Riccardi, Elisabetta Allevi, Didier Aussel, Francesca Bonenti

We consider a model of electricity market based on a multi-leader-common-follower approach where the producers as leaders are at the upper level and the Independent System Operator (ISO) as a common follower is at the lower level. The bids are assumed to be convex quadratic functions of the production quantity. The demand is endogenously determined. The market clearing will determine the market price in a pay-as-clear way. We present illustrative numerical examples from an electricity power market model and state some conditions for the existence of equilibria for for this market.

3 - Nash Equilibrium in Pay-as-bid Electricity Market
Miroslav Pistěk, Didier Aussel, Pascale Bendotti

The competition of producers in a pay-as-bid electricity market is modelled as an equilibrium problem with equilibrium constraints imposed by an Independent System Operator. First we find the best response of a producer given the bid functions of other producers. Then we provide a full characterization of Nash equilibria. There are two distinct classes of such equilibria corresponding to monopolistic or fully competitive market. For both situations we discuss necessary and sufficient conditions for existence of equilibrium, and we provide analytic formulae for the respective market prices.

■ FE-04

Friday, 14:00 - 15:00 - Room 4

Robust optimization and applications

Stream: Robust optimization and applications
Chair: *Daniel Reem*

1 - On solving an application-based completely positive program of size 3 with further results
Chee Khian Sim, Qi Fu, Chung Piaw Teo

We define a completely positive matrix, and introduce a completely positive program. Then we consider a distributionally robust supply chain application and relate it to a completely positive program of size 3. We solve the completely positive program completely, and using results obtained from solving this completely positive program, we provide further results on the supply chain.

2 - Interval global optimization using a template-based package for automatic differentiation and hull consistency enforcing
Bartlomiej Kubica

Interval global optimization methods often require computing derivatives of the objective function (and the constraints). This can be done using automatic differentiation techniques, but the existing software (C-XSC) has many limitations and drawbacks. The author is going to present a novel C++ template library, having the following features: *) generating the derivative functions at compile time, *) possibility of using both dense and sparse formats for Hesse matrices, *) potential possibility to computing higher derivatives, *) integration with procedures enforcing hull consistency.

3 - Zero-convexity, perturbation resilience, and subgradient projections for feasibility-seeking methods
Daniel Reem, Yair Censor

The convex feasibility problem (CFP) has applications in many areas of science. Working in a Hilbert space, we show that the sequential subgradient projection method converges weakly or strongly to a solution of the CFP despite certain perturbations. Unlike previous works, the functions which induce the feasibility problem's subsets need not be convex. Instead, they satisfy a weaker condition called zero-convexity. Zero-convex functions hold a promise to solve various optimization problems, including (approximate) minimization.

Ref: Math. Prog. (Ser. A) 152 (2015), 339-380, arXiv:1405.1501

Saturday, 9:00 - 9:50

■ SA-01

Saturday, 9:00 - 9:50 - Room 1

Plenary 3

Stream: Plenary
Chair: *Miguel Anjos*

1 - Stochastic global optimization: promises and limitations
Anatoly Zhigljavsky

Basic principles, potential and boundaries of applicability of stochastic global optimization techniques will be discussed. It will be argued that despite huge potential of stochastic methods there are also clear boundaries on the classes of problems where these methods provide reliable answers. A significant part of the talk will be concentrated on high-dimensional global optimization problems and the so-called "curse of dimensionality". We will discuss the geometry of high-dimensional balls and cubes, very slow convergence of global random search algorithms in large-dimensional problems and poor uniformity of the so-called uniformly distributed sequences of points. Different statistical and probabilistic techniques will be considered that could be used for accelerating convergence of global random search algorithms and increasing their reliability.

Short biography

Anatoly Zhigljavsky. Born in 1953. Graduated from Faculty of Mathematics, St.Petersburg State University, in 1976. PhD on applied probability in 1981. Professor of statistics at the St.Petersburg State University during 1989-1997. Since 1997: Professor, Chair in Statistics at Cardiff University. Since 2008: Director of the Centre for Optimisation and Its Applications at Cardiff University.

Author or co-author of 9 monographs on the topics of stochastic global optimization (3), time series analysis (4), optimal experimental design (1) and dynamical systems (1); editor/co-editor of 10 books or special issues of journals on the topics above, author of about 150 research papers in refereed journals, organizer of several major conferences on time series analysis, experimental design and global optimization.

Saturday, 9:50 - 10:40

■ SB-01

Saturday, 9:50 - 10:40 - Room 1

Plenary 4

Stream: Plenary
Chair: *Julius Žilinskas*

1 - Lipschitz global optimization

Yaroslav Sergeyev

Global continuous optimization is a thriving branch of applied mathematics. In this lecture, the global optimization problem of a multidimensional function satisfying the Lipschitz condition over a hyperinterval with an unknown Lipschitz constant is considered. It is supposed that the objective function can be "black box", multiextremal, and non-differentiable. It is also assumed that evaluation of the objective function at a point is a time-consuming operation.

Several adaptive partition methods and strategies for estimating the Lipschitz constant are analyzed. The main attention is dedicated to two types of algorithms. The first of them is based on using space-filling curves in global optimization. A family of derivative-free numerical algorithms applying space-filling curves to reduce the dimensionality of the global optimization problem is discussed. A number of unconventional ideas, such as adaptive strategies for estimating Lipschitz constant, balancing global and local information to accelerate the search, etc. are presented. Diagonal global optimization algorithms is the second type of methods under consideration. They have a number of attractive theoretical properties and have proved to be efficient in solving applied problem

References [1] R. G. Strongin and Ya. D. Sergeyev, Global Optimization with Non-Convex Constraints: Sequential and Parallel Algorithms, Kluwer, Dordrecht, 2000. [2] Ya. D. Sergeyev and D. E. Kvasov, Diagonal Global Optimization Methods, FizMatLit, Moscow, 2008. In Russian. [3] Ya. D. Sergeyev, R. G. Strongin, and D. Lera, Introduction to Global Optimization Exploiting Space-Filling Curves, Springer, New York, 2013.

Short biography Yaroslav D. Sergeyev is Distinguished Professor at the University of Calabria, Italy (professorship awarded by the Italian Government) and Head of Numerical Calculus Laboratory at the same university. He is also Member of the University International Council and Professor (part-time contract) at Lobachevsky Nizhniy Novgorod State University, Russia, Affiliated Researcher at the Institute of High Performance Computing and Networking of the Italian National Research Council, and Affiliated Faculty at the Center for Applied Optimization, University of Florida, Gainesville, USA. He was awarded his Ph.D. (1990) from Lobachevsky Nizhniy Novgorod State University and his D.Sc. degree (1996) from Lomonosov State University, Moscow (this degree is Habilitation for the Full Professorship in Russian universities). In 2013, he was awarded Degree of Honorary Doctor from Glushkov Institute of Cybernetics of The National Academy of Sciences of Ukraine, Kiev. His research interests include numerical analysis, global optimization (since 2016 he is Vice-President of the International Society of Global Optimization), infinity computing and calculus, philosophy of computations, set theory, number theory, fractals, parallel computing, and interval analysis. Prof. Sergeyev was awarded several research prizes (Pythagoras International Prize in Mathematics, Italy, 2010; Outstanding Achievement Award from the 2015 World Congress in Computer Science, Computer Engineering, and Applied Computing, USA; Honorary Fellowship, the highest distinction of the European Society of Computational Methods in Sciences, Engineering and Technology, 2015; The 2015 Journal of Global Optimization (Springer) Best Paper Award; Lagrange Lecture, Turin University, Italy, 2010; MAIK Prize for the best scientific monograph published in Russian, Moscow, 2008, etc.). His list of publications contains more than 200 items (among them 5 books). He is a member of editorial boards of 5 international journals and co-editor of 6 special issues. He delivered more than 50 plenary and keynote lectures at prestigious international congresses. He was Chairman of 4 international conferences and a member of Scientific Committees of more than 60 international congresses. He is Coordinator of numerous national and international research and educational projects. Software developed under his supervision is used in more than 40 countries of the world. Numerous magazines, newspapers, TV and radio channels have dedicated a lot of space to his research.

Saturday, 11:10 - 12:50

■ SC-01

Saturday, 11:10 - 12:50 - Room 1

Big data optimization

Stream: Large scale optimization
Chair: *Stephen Wright*

1 - A two-stage active-set method for bound-constrained optimization problems
Andrea Cristofari, Marianna De Santis, Stefano Lucidi, Francesco Rinaldi

We propose a two-stage active-set method for large scale problems with bound constraints. At each iteration, in the first stage we estimate the active variables and fix them to the bounds, and in the second stage we perform a line search along a projected truncated-Newton direction computed in the subset of the estimated non-active variables. The proposed algorithm embeds these two stages within a nonmonotone stabilization framework. Global convergence to stationary points is established. Promising results were obtained on some bound-constrained problems from the CUTEst collection.

2 - Preconditioners for inexact Newton method in big data optimization
Jacek Gondzio

We address efficient preconditioning techniques for the second-order methods applied to solve various sparse approximation problems arising in big data optimization. The preconditioners cleverly exploit special features of such problems and cluster the spectrum of eigenvalues around one. The inexact Newton Conjugate Gradient method excels in these conditions. Numerical results of solving L1-regularization problems of unprecedented sizes reaching a trillion of variables will be presented.

This is a joint work with Kimonas Fountoulakis.

3 - Ordering in Gauss-Seidel Iterations
Weiqi Zhou

The Gauss-Seidel iterative method is a classical way of solving linear systems with positive (semi-)definite matrices. One of its equivalent form, known as the Kaczmarz method, is still widely used in CT/signal processing. It is often observed that ordering of the equations plays a vital role for this method. We gave an explanation on why given equation orderings are often sub-optimal and how does reordering helps to improve the situation on average. These are based on understanding the spectral properties of the triangular truncation, which is an analogous operator of the Riesz projection.

4 - smartDESC: Demand Response via Electric Water Heaters to Support the Integration of Intermittent Power Generation in a Smart Grid
Miguel Anjos

The increasing penetration of wind and solar power generation requires energy storage to mitigate the intermittency of these sources. One type of storage is the distributed capacity already present on the grid. These sources (in the millions) must be coordinated for optimal system performance. We present the smartDESC project that uses mean field control and multi-stage stochastic optimization to compute the optimal day-ahead trajectory for the mean thermal energy of the heaters so as to minimize the demand peaks. Our results show that smartDESC effectively smooths the system load curve.

5 - Some Optimization Problems from Electrial Power Grids
Stephen Wright, Taedong Kim, Taedong Kim

We describe several problems in optimization and data analysis arising from electrical power grids. First, we formulate a bilevel optimization problem to identify possible vulnerabilities by finding the attack that causes maximal disruption. Second, we describe a multivariate logistic regression (MLR) approach for identifying outages in a grid from real-time sensor network data. We show that when the MLR classifier is trained to recognize the "signature" of outages under a variety of network conditions, it can identify outages correctly in the vast majority of cases. An ex

---

■ SC-02

Saturday, 11:10 - 12:50 - Room 2

Nonlinear programming I

Stream: Linear and nonlinear optimization
Chair: *Gerhard-Wilhelm Weber*

1 - On the real Jacobian Conjecture and Newton polytopes
Tomas Bajbar, Oliver Stein

We discuss the relationship between the global diffeomorphism property of polynomial maps and the non-vanishing determinant of the corresponding Jacobian matrix by analysing the coercivity property of some specific sum of squares polynomials via their Newton polytopes.

2 - On stability of nonlinear constraint systems and applications
Helmut Gfrerer

We consider a nonlinear constraint system depending on some parameter. It is well known that Robinson's CQ is sufficient for a certain stable behavior of the solution map of the constraint system when the parameter varies. In terms of modern variational analysis Robinson's CQ is equivalent to metric regularity of the multifunction associated with the constraint system at some reference parameter, whereas the implied stability property can be interpreted as some kind of uniform metric subregularity. In this talk we analyze this stability property from the viewpoint of metric subregulariy.

3 - Application of p-regularity theory to nonlinear optimization problems.
Ewa Szczepanik, *Alexey Tretyakov*

We present the main concept and results of the p-regularity theory (also known as p-factor analysis of nonlinear mappings) applied to nonlinear optimization problems. This approach is based on the construction of p-factor operator. The main result of this theory gives a detailed description of the structure of the zero set of an irregular nonlinear mappings. Applications include a new numerical methods for solving nonlinear optimization problems and p-order necessary and sufficient optimality conditions. We substantiate the rate of convergence of p-factor method.

4 - Partial Order Relations for Set Optimization
Emrah Karaman, *Mustafa Soyertem*, *İlknur Atasever Güvenç*, *Didem Tozkan*, *Mahide Kucuk*, *Yalcin Kucuk*

We define new order relations on family of sets by using Pontryagin (Minkowski) difference in order to construct a model for set optimization. Firstly, we investigate relationships between these order relations and well known upper and lower set less order relations. We obtain some properties of these order relations based on the properties of the cone. Furthermore, we show that, depending on the cone, these order relations are partial order on the family of nonempty, closed, convex and bounded sets. Also, we examine minimal and maximal sets of a family with respect to these partial orders.

5 - Optimization and Control Reenters under Stochastic Uncertainty, Jumps, Regime Switches and Paradigms Shifts
Gerhard-Wilhelm Weber, *Emel Savku*, *Nadi Serhan Aydin*

We introduce hybrid stochastic differential equations with jumps and to its optimal control. These hybrid systems allow for the representation of "random" and impulsive regime switches or paradigm shifts in economies and societies, and they are of growing importance in the areas of finance, science, development and engineering. We present special approaches to this stochastic optimal control: one is based on the finding of optimality conditions and closed-form solutions. We further discuss aspects of information asymmetries, given by delay or insider information.

■ SC-03

Saturday, 11:10 - 12:50 - Room 3

Non-smooth optimization II

Stream: Convex and non-smooth optimization
Chair: *Oliver Stein*

1 - Lipschitz continuous positively homogeneous functions
Marina Trafimovich

In the talk we endow the space of Lipschitz continuous positively homogeneous functions with the structure of the Banach space with the Lipschitz modulus as the norm. It was proved that the Lipschitz modulus norm is stronger than the uniform norm on the space of Lipschitz continuous positively homogeneous functions and weaker than the Bartels-Pallaschke norm on the space of difference-sublinear functions [1].

[1] Valentin V.Gorokhovik, Marina Trafimovich Positively Homogeneous Functions Revisited. DOI 10.1007/s10957-016-0891-4. 2016.

2 - Semi-quasidifferentiable multiobjective optimization
Majid Soleimani-damaneh, *Alireza Kabgani*

In this paper, we introduce the concept of Semi-quasidifferentiable functions motivated by the convexificator notion in nonsmooth analysis. Some properties of semi-quasidifferentials are established. Considering a multiobjective optimization problem, a characterization of the normal cone of the feasible set is provided and it is used in deriving necessary optimality conditions. We close the paper by obtaining optimality conditions in multiobjective optimization in terms of the semi-quasidifferentials. Some outcomes of the current work generalize some results existing in the literature.

3 - Solving Some of the Largest Problems of the Literature by the Accelerated Hyperbolic Smoothing Clustering Method
Adilson Elias Xavier, *Vinicius Layter Xavier*

The work considers the solution of the minimum sum-of-squares clustering problem by the Hyperbolic Smoothing method in connection with a partition scheme of observations into two non-overlapping groups: data in frontier and data in gravitational regions, which drastically simplify the computational tasks. For the purpose of illustrating both the reliability and the efficiency of the method, a set of computational experiments making use of traditional very large test problems described in the literature was performed, producing unprecedented results in the context of the clustering analysis.

4 - Linear generalized Nash equilibrium problems and nonsmooth optimization
Nathan Sudermann-Merx, *Oliver Stein*, *Axel Dreves*

We introduce linear generalized Nash equilibrium problems (LGNEPs) and study a reformulation of the LGNEP as nonsmooth nonconvex optimization problem. It is possible to characterize the nondifferentiability points of the objective function in terms of a new regularity condition, the so-called cone condition. Furthermore, we present some promising numerical results based on a simple projected subgradient method which, especially for large problems, outperforms other numerical approaches from literature.

5 - Solving Disjunctive Optimization Problems by Generalized Semi-infinite Optimization Techniques
Oliver Stein, *Peter Kirst*

We describe a new possibility to model disjunctive optimization problems as generalized semi-infinite programs. In contrast to existing methods in disjunctive programming, our approach does not expect any special formulation of the underlying logical expression. Applying existing lower level reformulations for the corresponding semi-infinite program we derive conjunctive nonlinear problems without any logical expressions, which can be locally solved by standard nonlinear solvers. Our preliminary numerical results indicate that our reformulation procedure is a reasonable.

■ SC-04

Saturday, 11:10 - 12:50 - Room 4

Linear and nonlinear optimization

Stream: Linear and nonlinear optimization
Chair: *Immanuel Bomze*

1 - A unified modeling approach for computing (s, S) policies with stochastic demand
Mengyuan Xiang, *Roberto Rossi*, *Belen Martin-Barragan*

We present mixed integer linear programming (MILP) models to compute near optimal parameters for the nonstationary stochastic lot sizing problem under the (s, S) control policy. We discuss different variants of the stochastic lot sizing problem based on piecewise linearization of first order loss functions. Our MILP models favourably compare to existing methods: they are the first MILP heuristics to approximate (s, S) policy parameters, and they work for generically distributed demand patterns. Computational experiments demonstrate the effectiveness and versatility of our models.

2 - Generating the efficient frontier for a class of bicriteria generalized fractional programming
Riccardo Cambini, *Laura Carosi*, *Laura Martein*

A bicriteria maximization problem is considered. The first component of the objective function is the ratio of powers of affine functions while the second one is linear. Under suitable assumptions the first criterium turns out to be pseudoconcave so that the connectedness of the efficient frontier is guaranteed. The theoretical properties of the problem allow to generate the whole efficient frontier by means of the solutions of suitable parametric scalar optimization problems. A solution method for generating the efficient frontier is proposed and validated by means of a computational test.

3 - Weak, strong and linear convergence of a double-layer fixed point algorithm
Rafal Zalas

In this talk we consider consistent convex feasibility problems in a real Hilbert space defined by a finite family of sets Ci. In particular, we are interested in the case where Ci=Fix Ui=z: pi(z)=0, Ui is an operator and pi is a proximity function. Moreover, we assume that the computation of pi is at most as difficult as the evaluation of Ui and this is at most as difficult as projecting onto Ci. The considered double-layer fixed point algorithm applies certain outer and inner controls.

4 - The complexity of simple models - a study of worst and typical hard cases for the Standard Quadratic Optimization Problem
Immanuel Bomze, *Werner Schachinger*, *Reinhard Ullrich*

Despite simplicity of the StQP (minimize a quadratic over the standard simplex), nonconvex instances of StQPs allow for rich patterns of coexisting local solutions. We improve known lower bounds for the number of strict local solutions by constructing rare instances. Indeed, random instances have quite sparse solutions, and their expected numbers are considerably lower than in the worst case. Here we obtain an empirical sparsity distribution of strict local solutions to the StQP by systematically searching promising instances, refining average-case analysis of this NP-hard problem class.

5 - Convergence properties of the weak subgradient algorithm in nonconvex optimization
Gulcin Dinc Yalcin, *Refail Kasimbeyli*

Weak subgradient based solution algorithm that does not require convexity conditions on neither the objective function nor the set of feasible solutions is introduced.At every iteration, to generate a new solution, the algorithm uses weak subgradients of the objective function at the point generated in the previous iteration. In this paper we introduce different step size parameters. Convergence properties of the presented algorithm are investigated for various step size parameters. The performance of the algorithm is demonstrated on test problems.

Saturday, 14:20 - 16:00

■ SD-01

Saturday, 14:20 - 16:00 - Room 1

Global and nonconvex optimization I

Stream: Global optimization
Chair: *Anatolii Kosolap*

1 - The q-asymptotic function in generalized convexity theory
Felipe Lara, Ruben Lopez

The problem to find the adequate asymptotic function in the quasiconvex case is still an open problem in generalized convexity theory. But, What we mean with "adequate"?. In what sense?. In this talk, we focus on answering these questions, as a consequence, we develop properties for the q-asymptotic function defined for dealing with quasiconvex problems. We related this function with generalized derivatives and subdifferentials, also with the Fenchel-Moreau conjugacy and with a generalized support function. The formulas from the convex analysis are particular case of these new formulas.

2 - A Feature Clustering Method for Large Scale Global Optimization and its Applications to Disk Packing
Francesco Bagattini, Fabio Schoen

Assume that for a large scale Global Optimization (GO) problem a set of features can be associated to each feasible solution. After running some time-consuming local searches of a randomized GO method, local optima are clustered in the selected features' space. Subsequent searches can then be stopped early when the current point is found to belong to a cluster, as it is likely that the resulting optimum will be very similar to one already discovered. An application to circle/disk packing proofs the validity of the approach. Many improved putative optima were discovered during the experiments.

3 - On constraint qualification conditions for abstract convex functions
Monika Syga

Within the framework of abstract convexity we establish the links between the minimax equality for lower semicontinuous functions and the minimax equality for their convexification. We provide relationships between sufficient condition for the minimax equality for abstract convex functions and constraint qualification conditions in optimization problems.

4 - Finding the Global Minimum of the General Quadratic Problems
Anatolii Kosolap

At first we consider the problem of maximizing the norm of a vector on the intersection of balls. This problem can be solved using dual method. Further, we consider general quadratic problem. This problem can be transformed in to the canonical form with positive and negative coefficients. We introduce new variables instead of quadratic variables. Further, we apply exact quadratic regularization. It transforms this problem into maximizing the norm of a vector on the intersection of balls with some prescribed tolerance. The numerical experiments have shown that new method is a very efficient.

5 - Global Optimization Tools to Discriminate Models in Chemical Reaction Networks
M. Asuncion Jimenez-Cordero, Rafael Blanquero, Emilio Carrizosa, José Francisco Rodríguez

Model inference is a challenging problem in the analysis of chemical reactions networks. In order to empirically test which model is governing a network of chemical reactions, it is fundamental to make an adequate choice of the control variables in order to have maximal separation between sets of concentrations provided by the theoretical models. In this work we illustrate how Global Optimization techniques can be used to address the problem of model separation, as a basis for model selection. Some examples illustrate the usefulness of our approach.

■ SD-02

Saturday, 14:20 - 16:00 - Room 2

Nonlinear programming II

Stream: Linear and nonlinear optimization
Chair: *Yury Evtushenko*

1 - Regularizing trust-region approaches for ill-posed nonlinear systems and nonlinear least squares
Stefania Bellavia, Benedetta Morini, Elisa Riccietti

We deal with the numerical solution of ill-posed nonlinear systems and nonlinear least-squares problems and consider procedures in the class of trust-region methods. We propose a trust-region approach that ensures regularizing properties and is so suitable to solve the above mentioned problems. We provide a trust region radius choice ensuring regularizing properties and giving rise to a procedure that has the potential to handle also the noisy case as a solution of the unperturbed problem is approached. Results of some numerical tests will be presented, too.

2 - Numerical Behavior Analysis of SQP Method for Ill-posed NLPs with Multiple Precision Arithmetic
Hiroshige Dan, Yuya Matsumoto

When we solve nonlinear programming problems (NLPs), algorithms for NLPs sometimes crash numerically and fail to find a local optimal solution, even if an appropriate constraint qualification would be satisfied at a solution. To overcome and analyze such difficulties, we have implemented an NLP solver based on the SQP method, which uses multiple precision arithmetic. This solver is equipped with automatic differentiation, then we can try to solve various NLPs easily. In this research, we analyze the detail of numerical behavior of the SQP method for some ill-posed NLPs by using our solver.

3 - Levenberg-Morisson-Marquardt algorithms based on probabilistic models
El houcine Bergou

The Levenberg-Morisson-Marquardt algorithm (LMM) is one of the most popular algorithms for the solution of nonlinear least squares problems. Motivated by the problem structure in data assimilation, we consider in this work the extension of the LMM algorithm to the scenarios where the linearized least squares subproblems are solved inexactly and/or the gradient model is noisy and accurate only within a certain probability. Under appropriate assumptions, we show that the modied algorithm converges globally and almost surely to a rst order stationary point.

4 - Solving aircraft conflicts by continuous optimization
Sonia Cafieri, Andrew Conn, Marcel Mongeau

Aircraft conflicts resolution, to avoid losses of separation between aircraft trajectories during flights, is crucial in Air Traffic Management. We propose a purely continuous optimization model relying on an exact l1-penalty function, to deal with the aircraft separation constraints. The decision levers are both aircraft speed and heading-angle changes. The removal of the infinite-dimensional feature of the separation constraints introduced in (Cafieri &Durand,2014) is exploited, and a linearization of angle-related nonlinear terms is proposed. Numerical results validate the proposed approach

5 - Effective hull and its applications
Yury Evtushenko, Mikhail Posypkin

This talk presents the concept of the effective hull of a set and the method of its approximation. The effective hull is essentially an intersection of the of Edgeworth-Pareto hulls for all possible combinations of maximization and minimization of criteria. We show that the effective hull of a set contains the set and is contained by its convex hull. We also developed a method for numerical approximation of an effective hull with the given precision. In the talk we outline an important application of the proposed approach for describing working set of robotic manipulators.

■ SD-03

Saturday, 14:20 - 16:00 - Room 3

Convex programming

Stream: Convex and non-smooth optimization
Chair: *Tatiana Tchemisova*

1 - On a Class of Gradient-Like Dynamical Systems with Noisy First-Order Feedback
Mathias Staudigl, Panayotis Mertikopoulos

In view of solving convex optimization problems with noisy feedback, we examine the convergence properties of a class of mirror descent (MD) dynamical systems with stochastically perturbed gradient input. Formulating the problem as a stochastic differential equation (SDE), we focus on the convergence of sample paths and the SDE's ergodicity properties. If the problem admits an isolated interior solution, the process admits an invariant measure which is sharply concentrated around the problem's solution; at the other end of the spectrum, corner point solutions are globally attracting (a.s.).

2 - Some duality results in evenly convex programming
José Vicente-Pérez

In this talk we present a new exact conjugation scheme for the class of extended real-valued evenly convex functions defined on general topological vector spaces which is obtained by exploiting the relationship between even convexity and even quasiconvexity. We also show a new characterization of the even convexity of a function at a given point, and establish the links between even convexity and subdifferentiability and the regularization of a given function. Finally, we derive a sufficient condition for strong duality fulfillment in convex optimization programs.

3 - From error bounds to the complexity of

first-order descent methods for convex functions
Phong Nguyen

rst-order descent methods in convex minimization. In a

first stage, this objective led us to revisit the interplay between error bounds and the Kurdyka- Lojasiewicz (KL) inequality. One can show the equivalence between the two concepts for convex functions having a moderately flat profile near the set of minimizers. In a second stage, we show how KL inequalities can in turn be employed to compute new complexity bounds for a wealth of descent methods for convex problems.

4 - Convergence Analysis of Douglas-Rachford Splitting Method for
Xiaoming Yuan

We consider the convergence of the Douglas-Rachford splitting method for minimizing the sum of a strongly convex function and a weakly convex function; a setting having various applications especially in some sparsity-driven scenarios with the purpose of avoiding biased estimates which usually occur when convex penalties are used. We prove the convergence under relatively mild assumptions and establish the non-ergodic worst-case convergence rate in term of iteration complexity; and locally linear convergence rate in asymptotical sense under some regularity conditions.

5 - On study of properties of special nonlinear problems arising in parametric SIP
Olga Kostyukova, Tatiana Tchemisova

We study parametric Semi-infinite Programming (SIP) problems with finitely representable compact index sets and investigate dependence of solutions of these problems on the parameters. We show that differential properties of solutions of the parametric SIP problems can be formulated in terms of solutions of some special auxiliary Nonlinear Programming (NLP) problems depending on a finite number of integers (parameters). We discover different properties of solutions of these NLP problems w.r.t. the values of the integers that permit us to obtain important conclusions about behavior of solution.

■ SD-04

Saturday, 14:20 - 16:00 - Room 4

Semi-definite programming/Complementarity problems

Stream: Conic optimization and semi-definite programming
Chair: *Jean Charles Gilbert*

1 - Plea for a semidefinite optimization solver in complex numbers
Jean Charles Gilbert, Cédric Josz, Daniel Molzahn

Numerical optimization in complex numbers has drawn much less attention than in real numbers. A widespread opinion is that, since a complex number is a pair of real numbers, the best strategy to solve a complex optimization problem is to transform it into real numbers and to solve the latter by a real number solver. This talk defends another point of view and presents arguments to convince the audience that skipping the transformation phase and using a complex number algorithm can be much more efficient. A speedup of two is not uncommon for interior point methods in complex SDP optimization.

2 - On Digital Filter Design with Semidefinite Programming
Michał Przyłuski

We shall consider an efficient digital filter design by means of semidefinite programming (SDP) methods. Formulations of some filter design goals as optimization problems are presented. This novel approach allows for extra requirements about the filter, such as a constant and small group delay, to be fulfilled. Numerical examples prove that employing state-of-the-art methods and solvers create new possibilities for easier design of higher-quality digital filters.

3 - Solutions of Complementarity Problems Monotone with Respect to Parameters
Viacheslav Kalashnikov, Nataliya Kalashnykova, Arturo García

In many applied problems (such as, e.g., elastohydrodynamic lubrication problem, some economic equilibrium problems, etc., one of the important question is if certain complementarity problem's solution is monotone with respect to parameters. Our paper investigates this question and provides several sufficient conditions that guarantee such a monotonicity of the solutions to linear and nonlinear complementarity problems with parameters. In the majority of cases, it is required that the principal mapping of the complementarity problem be monotone by decision variables and, vice versa, antitone.

4 - Departure time choice equilibrium with heterogeneous commuters in corridor type traffic network
Shunsuke Hayashi, Naoya Seki

The purpose of this study is to model and analyze the departure time choice equilibrium with heterogeneous commuters in corridor type traffic network. We first formulate the dynamic user equilibrium (DUE) problem as a linear complementarity problem, and then study the existence and the uniqueness of the solution in an analytic or experimental manner. We also prove that the equilibrium solution is separated into each user group. We also make a number of numerical experiments to characterize the solution. Then we observe that the flow can be different essentially from that of homogeneous one.

5 - D-gap functions and optimization techniques for computing equilibria
Giancarlo Bigi, Mauro Passacantando

A descent type algorithm for solving equilibrium problems with differentiable bifunctions is provided relying on a suitable family of D-gap functions. Its convergence is proved under assumptions not guaranteeing the equivalence between the stationary points of any D-gap function and the solutions of the equilibrium problem. Unlikely other algorithms, it does not require to set parameters according to thresholds depending on the equilibrium bifunction. Some numerical comparisons with these other algorithms are drawn relying on some extensive tests on the so-called linear equilibrium problems.

Saturday, 16:30 - 18:30

■ SE-01

Saturday, 16:30 - 18:30 - Room 1

Global and nonconvex optimization II

Stream: Analysis and engineering of optimization algorithms
Chair: *Juan Enrique Martínez-Legaz*

1 - A general nonconvex multiduality principle
Juan Enrique Martínez-Legaz, Francesca Bonenti, Rossana Riccardi

We present an arbitrary collection of mutually dual nonconvex optimization problems, as well as a characterization of their global optimal solutions. As immediate consequences of our general multiduality principle, we obtain Toland-Singer duality theorem and an analogous result involving generalized perspective functions.

2 - On Some Methods to Find Stationary Points of Quasidifferentiable Functions with DC-Duality Approach
Didem Tozkan, Mahide Kucuk, Yalcin Kucuk

In this study, we introduce some methods to find stationary points of a quasidifferentiable optimization problem (QDP), i.e., the directional derivative of the objective is a DCH-function. Firstly, we obtain some optimality conditions for DCH-functions by using DC-duality approach. As a result, we give some methods to find stationary points for (QDP) considering the problem (P') that minimizes the directional derivative of the original objective function. We present some illustrative examples about given methods.

3 - A Reformulation of Sparse Optimization Problems using Complementarity-type Constraints
Alexandra Schwartz, Christian Kanzow, Oleg Burdakov

We consider sparse optimization problems, i.e. mathematical programs where the objective is not only to minimize a given function but also the number of nonzero elements in the solution vector. Possible applications are compressed sensing, portfolio optimization and feature selection. In this talk, we present a continuous reformulation of the noncontinuous sparsity term in the objective function using a complementarity-type constraint. We discuss the relation between the original and the reformulated problem, provide suitable optimality conditions and provide preliminary numerical results.

4 - A continuous DC programming approach to nonlinear mixed integer programs without integrality gaps
Takayuki Okuno, Yoshiko Ikebe

In this talk, we consider a mixed integer nonconvex program (MINP). In particular, we restrict ourselves to the MINP whose objective function is a dc function, that is, a function that can be represented as the difference of two convex functions. Based on a new technique proposed by T. Maehara, et al.(2015), we transform the MINP to a certain equivalent continuous DC program. For solving it, we propose a proximal point type DC algorithm. Under several mild assumptions, we prove that the sequence generated by the proposed method converges to some stationary point of the MINP.

■ SE-02

Saturday, 16:30 - 18:30 - Room 2

Multi-objective optimization

Stream: Multi-objective optimization
Chair: *Janusz Granat*

1 - On Duality and Sensitivity for Vector Convex Programming in Abstract Spaces
Miguel Angel Melguizo Padial, Fernando García Castaño

The aim of this paper is to prove that the sensitivity of a vector convex optimization program can be measured in terms of the paratingent derivative by the solution of a dual program and its sensitivity. By doing so, we complete a study initiated in two previous works, showing that the aforementioned dual program becomes an useful instrument to measure sensitivity in vector convex programming through the four main notions of tangency used in set-valued analysis, namely, the contingent, adjacent, circatangent and paratingent derivatives.

2 - Scalarization and First and Second Order Optimality Conditions in Vector Optimization Problems with a Nontransitive Preference Relation
Valentin Gorokhovik

In the talk we present a unified approach to deriving first and second order local minimality conditions, both necessary and sufficient, for feasible solutions of vector optimization problems with nontransitive (more precisely, not necessarily transitive) preference relations. We employ variational methods under assumptions that the objective mapping is twice parabolic directionally differentiable, and the feasible set is approximated by first- and second-order tangent vectors.

3 - Optimality conditions in convex multiobjective semi-infinite optimization
Miguel Goberna

We present in this talk characterizations of the weak efficient solutions, efficient solutions, and isolated efficient solutions of vector optimization problem with finitely many convex objective functions and infinitely many convex constraints. These characterizations involve different data qualifications and either Karusk-Kuhn-Tucker multipliers, or an ad hoc gap function, or continuous linear functionals on the constraint space. The talk is based on joint papers with F. Guerra-Vazquez and M. I. Todorov (2016), and N. Kanzi (submitted).

4 - On weakly sequentially complete Banach spaces
Krzysztof Leśniewski

We present some properties of weakly sequentially complete Banach spaces which were investigated in number of papers, see e.g. Rosenthal, Banach. In this talk we present sufficient conditions for a Banach space Y to be weakly sequentially complete. These sufficient conditions are expressed in terms of existence of directional derivatives for cone convex mappings. There will be some discussion about normal cones and cone convex mappings.

5 - Multiple-criteria analysis in big data mining
Janusz Granat

Optimization methods are widely applied in data mining. The amount and variability of data that are generated by information systems increases considerably every year. It can be observed two main directions of development of optimization methods for mining of such data. The first direction is related to methods with huge amount of variables. The second one is focused on on-line optimization. In this paper we will show how application of multiple-criteria analysis will improve mining of big data. The on-line optimization approach that consider several criteria will be presented.

■ SE-03

Saturday, 16:30 - 18:30 - Room 3

Optimal control and variational problems II

Stream: Optimal control and applications
Chair: *Andrzej Myśliński*

1 - Optimal Control of Convective FitzHugh-Nagumo Equation
Tugba Kucukseyhan

We investigate smooth and sparse optimal control problems (ocp) for convective FitzHugh-Nagumo equation with traveling wave solutions in moving excitable media. The cost function includes distributed space-time and terminal targets. The state and adjoint equations are discretized by SIPG-backward Euler methods. Numerical results are presented to control those waves. We show the validity of the second order optimality conditions for the local solutions of ocp for vanishing Tikhonov regularization parameter. We present also results for reduced order ocp with proper orthogonal decomposition.

2 - Structural Optimization of Variational Inequalities using Phase Field Regularization
Andrzej Myśliński

The paper is concerned with the structural optimization of elastic bodies in unilateral contact with a given friction. The contact phenomenon is governed by the elliptic variational inequality. The aim of the optimization problem is to find such distribution of the material density function to minimize the normal contact stress. The phase field approach is used to analyze and solve numerically this optimization problem. The original cost functional is regularized using Ginzburg-Landau free energy functional including the surface and bulk energy terms. These terms allow to control global perim

3 - A.M.Lyapunov methodology in Problems of Stability/Optimality for Complex Systems
Lyudmila Kuzmina

The work is devoted to the problems of mathematical modelling in Engineering , Designing and Computing ,with the development of A.M.Lyapunov principle in general qualitative analysis, including stability, optimality, continuous optimization,. . . Non-linearity, high dimensionality, multi-connectivity, multi-disciplinarity of research object model are causing the impediments for obtaining exact solution by analytical and analytic-computer methods.

4 - A single-level approach to multi-leader-follower games
Simone Sagratella, Lorenzo Lampariello

Multi-Leader Common-Follower games (MLCF) are a powerful modelling tool to study complex bilevel systems arising for example in electricity markets. Leveraging the optimal value approach, we introduce a Generalized Nash Equilibrium Problem (GNEP) model based on the first order approximation of follower's value function. This single-level GNEP is closely related to the original MLCF. We show that any KKT point of (a suitably perturbed version of the) former problem is critical for (an approximate) MLCF. Moreover, we define wide classes of problems for which the vice-versa holds as well.

5 - A bridge between bilevel programs and Nash games
Lorenzo Lampariello, Simone Sagratella

We study connections between bilevel programming problems and Generalized Nash Equilibrium Problems (GNEP). We provide a complete analysis of the relationship between the vertical bilevel problem and the corresponding horizontal one-level GNEP. We define classes of problems for which solutions of the bilevel program can be computed by finding equilibria of the GNEP. We develop a simple method for the solution of our GNEP; we study how it is then possible to recover a solution of the bilevel problem from the computed equilibrium. Numerical tests show the effectiveness of our approach.

■ SE-04

Saturday, 16:30 - 18:30 - Room 4

Optimization in industry, business and finance

Stream: Optimization in industry, business and finance
Chair: *Wlodzimierz Ogryczak*

1 - Optimization Approach for Close to Reality Determination of Stresses in RC Members under Eccentric Compression
Andrzej Stachurski, Marek Lechman

A method for determining stresses in the rectangular cross-sections of RC members under eccentric compression is presented. It assumes the nonlinear physical relation for concrete in compression. The task consists of solving the set of nonlinear equations s.t. box constraints. The equations are solved by the least squares method. Modified BFGS quasi-Newton and/or Hooke-Jeeves are applied to find the starting point for the Broyden secant method. This approach is compared with Levenberg-Marquardt method variants. The model is verified on the set of data encountered in engineering practice.

2 - Randomized methods in solving contemporary traffic engineering problems in telecommunication.
Pawel Bialon

We present several mixed-integer variants of the Multicommodity Flow problem (MCF) coming from the practice of telecommunication. They account for k-splittability of the flows (sending a commodity via at most k paths), lower bound for a path flow (to satisfy a QoS demand for a single connection), reliability (at least 2 disjoint paths for a commodity), multicasting (a possibility of duplicating a flow in a node, modifies the Kirchoff law). We propose and analyze some adaptations of the Raghavan and Thompson's randomized rounding method to approximately and fast solve such variants of MCF.

3 - Portfolio optimization for a Large Investor under Partial Information and Price Impact
Zehra Eksi

We study a portfolio optimization problem for a large investor where the underlying price process is a diffusion affected by a finite-state Markov chain, representing the state of the market, and the portfolio decision of the investor. We obtain results for different impact and utility function choices. Compared to the case without price impact, we conclude that for logarithmic and power utility choices with linear impact function, the resulting value function dominates in any market regime. We extend our analysis to a partial-information setting in which the Markov chain is not observable.

4 - Efficient optimization of the reward-risk ratio with polyhedral risk measures
Wlodzimierz Ogryczak, Tomasz Sliwinski, Michał Przyłuski

In several problems of portfolio selection the reward-risk ratio criterion is optimized to search for a risky portfolio offering the maximum increase of the mean return, compared to the risk-free investment opportunities. The reward-risk ratio optimization with polyhedral risk meausures can be transformed into LP formulations. The corresponding LP models have typically both the number of constraints the number of variables proportional to the number of scenarios. This decrease dramatically their computational efficiency while dealing with real-life financial problems based on advanced simul

5 - Evaluating appropriate artificial neural network model for forecasting foreign exchange
Sanjeev Gupta

Present paper aims at forecasting exchange rate of Dollar, Pound, Euro and Japanese Yen in terms of Indian rupee. The daily data of the respective currencies will considered from 1999 own wards. For forecasting the respective variables, we will apply artificial neural network a nonlinear, non parametric and data driven modelling technique.In the study different combination of neural networks with different combinations of input nodes, one hidden node with altered combinations of hidden nodes and various activation functions will be applied to generate ex ante and ex post forecasts.

Analysis and engineering of optimization algorithms

Track(s): 1

Conic optimization and semi-definite programming

Track(s): 4

Convex and non-smooth optimization

Track(s): 3 4

Derivative-free optimization

Track(s): 2

Global optimization

Track(s): 1

Large scale optimization

Track(s): 1 2

Linear and nonlinear optimization

Track(s): 2 4

Mixed integer optimization

Track(s): 1

Multi-objective optimization

Track(s): 2

Opening and Closing

Track(s): 1

Optimal control and applications

Track(s): 3

Optimization in industry, business and finance

Track(s): 3 4

Plenary

Track(s): 1

Robust optimization and applications

Track(s): 4

Session Chair Index

Author Index

mposypkin@gmail.com
Iitp Ras, Cc Ras, Russian Federation

Przyłuski, Michał SD-04, SE-04
mikylie@gmail.com
Institute of Control and Computation Engineering, Warsaw University of Technology, Poland

Reem, Daniel FE-04
dream@tx.technion.ac.il
Math, The Technion, Haifa, Israel

Renzi, Stefania FE-02
renzi@dis.uniroma1.it
Department of Computer, Control and Management Engineering, Sapienza University of Rome, Rome, Italy

Resende, Mauricio FD-01
mresende@gmail.com
Mathematical Optimization Group, Amazon.com, Inc., Seattle, Washington, United States

Riccardi, Rossana SE-01, FE-03
rossana.riccardi@unibs.it
Economics and Management, University of Brescia, Brescia, Italy

Riccietti, Elisa SD-02
elisa.riccietti@unifi.it
Dipartimento di Matematica e Informatica Ulisse Dini, University of Florence, Italy

Rinaldi, Francesco SC-01
rinaldi@math.unipd.it
Matematica, Università di Padova, Italy

Rodríguez, José Francisco SD-01
jfrodriguezc@repsol.com
Repsol Technology Center, Madrid, Spain

Roma, Massimo FE-01
roma@dis.uniroma1.it
Dipartimento di Ingegneria Informatica, Automatica e Gestionale, SAPIENZA - Universita' di Roma, ROMA, Italy

Romero Morales, Dolores FD-01
drm.eco@cbs.dk
Copenhagen Business School, Frederiksberg, Denmark

Rossi, Roberto SC-04
robros@gmail.com
Business School, University of Edinburgh, Edinburgh, United Kingdom

Royer, Clément FE-02
clement.royer@enseeiht.fr
IRIT, University of Toulouse, Toulouse, France

Rutkowski, Krzysztof FD-04
k.rutkowski@mini.pw.edu.pl
Faculty of Mathematics and Information Science, Warsaw University of Technology, Warsaw, Poland, Poland

Sagratella, Simone SE-03
sagratella@dis.uniroma1.it
Ingegneria informatica automatica e gestionale A. Ruberti, La Sapienza Università di Roma, Roma, Italy

Savku, Emel SC-02
esavku@gmail.com
Institute of Applied Mathematics, Financial Mathematics, Middle East Technical University, Ankara, Turkey

Schachinger, Werner SC-04
werner.schachinger@univie.ac.at
Dept. of Statistics and OR, University of Vienna, Wien, Austria

Schoen, Fabio SD-01
fabio.schoen@unifi.it
Dipartimento di Ingegneria dell'Informazione, Università degli Studi di Firenze, Firenze, Italy

Schork, Lukas FD-02
L.Schork@ed.ac.uk
School of Mathematics, University of Edinburgh, United Kingdom

Schwartz, Alexandra SE-01
schwartz@gsc.tu-darmstadt.de
Graduate School CE, TU Darmstadt, Darmstadt, Germany

Seki, Naoya SD-04
n.seki@plan.civil.tohoku.ac.jp
Graduate School of Information Sciences, Tohoku University, Japan

Sergeyev, Yaroslav SB-01
yaro@dimes.unical.it
DIMES, University of Calabria, Rende (CS), Italy

Silva, Ricardo FD-01
rmas@cin.ufpe.br
Centro de Informatica, Universidade Federal de Pernambuco, Recife, Pernambuco, Brazil

Sim, Chee Khian FE-04
chee-khian.sim@port.ac.uk
Mathematics, University of Portsmouth, Portsmouth, United Kingdom

Simoncini, Valeria FD-02
valeria.simoncini@unibo.it
Universita' di Bologna, Bologna, Italy

Sliwinski, Tomasz SE-04
tsliwins@elka.pw.edu.pl
Institute of Control and Computation Engineering, Warsaw University of Technology, Warsaw, Poland

Soleimani-damaneh, Majid SC-03
soleimani@khayam.ut.ac.ir
School of Mathematics, Statistics and Computer Science, College of Science, University of Tehran & School of Mathematics, IPM., Tehran, Iran, Islamic Republic Of

Soyertem, Mustafa SC-02
mustafa.soyertem@usak.edu.tr
Mathematics, Uşak University, Uşak, Turkey

Session Index

Friday, 8:30 - 8:50

Friday, 9:00 - 9:50

Friday, 9:50 - 10:40

Friday, 11:10 - 12:30

Friday, 14:00 - 15:00

Saturday, 9:00 - 9:50

Saturday, 9:50 - 10:40

Saturday, 11:10 - 12:50

Saturday, 14:20 - 16:00

Saturday, 16:30 - 18:30