Annual Meeting of the DFG Priority Programme 1962

October 9-11, 2017, Brandenburg, Germany

Hotel Sommerfeld,
Beetzer Str. 1a,
D-16766 Kremmen
Brandenburg

SPP 1962

DFG Deutsche Forschungsgemeinschaft

WIAS

List of Projects

Project 1: Approximation of Monge-Kantorovich Problems

S. Bartels   Z. Wang, A. Bonito, M. Jensen, R. Nochetto

Project 2: Coupling Hyperbolic PDEs with Switched DAEs: Analysis, Numerics and Application to Blood Flow Models

R. Borsche, S. Trenn   D. Kocoglu

Project 3: Numerical Methods for Diagnosis and Therapy Design of Cerebral Palsy by Bilevel Optimal Control of Constrained Biomechanical Multi-Body Systems

H. Bock, E. Kostina   J. Schlöder, M. Sauter, M. Schlöder

Project 4: Parameter Identification in Models With Sharp Phase Transitions

C. Clason, A. Rösch   H. Vu

Project 5: Multiobjective Optimal Control of Partial Differential Equations Using Reduced-Order Modeling

M. Dellnitz, S. Volkwein   S. Banholzer, B. Gebken

Project 6: Analysis and Solution Methods for Bilevel Optimal Control Problems

S. Dempe, G. Wachsmuth   F. Harder, A. Schiela, M. Ulbrich

Project 7: Identification of Energies from Observations of Evolutions

M. Fornasier   M. Maggioni

Project 8: A Calculus for Non-Smooth Shape Optimization with Applications to Geometric Inverse Problems

R. Herzog, S. Schmidt   M. Herrmann, J. Vidal

Project 9: Optimal Control of Dissipative Solids: Viscosity Limits and Non-Smooth Algorithms

D. Knees, C. Meyer, R. Herzog   A. Stötzner, S. Thomas

Project 10: Generalized Nash Equilibrium Problems with Partial Differential Operators: Theory, Algorithms, and Risk Aversion

M. Hintermüller, T. Surowiec   D. Gahururu, S-M. Stengl

Project 11: Optimal Control of Elliptic and Parabolic Quasi-Variational Inequalities

M. Hintermüller   C. Rautenberg, A. Alphonse

Project 13: Simulation and Control of a Nonsmooth Cahn-Hilliard Navier–Stokes System with Variable Fluid Densities

M. Hintermüller, M. Hinze   C. Gräßle, T. Keil

Project 14: Algorithms for Quasi-Variational Inequalities in Infinite-Dimensional Spaces

C. Kanzow, D. Wachsmuth
V. Karl, D. Steck

Project 15: Non-smooth Methods for Complementarity Formulations of Switched Advection-Diffusion Processes

C. Kirches, S. Sager
P. Manns, S. Leyffer

Project 16: Optimal Control of Variational Inequalities of the Second Kind with Application to Yield Stress Fluids

C. Meyer, B. Schweizer, S. Turek
C. Christof, A. Fatima

Project 17: Optimizing Fracture Propagation Using a Phase-Field Approach

I. Neitzel, W. Wollner
M. Mohammadi, C. Ortner, T. Wick

Project 18: Optimal Control of Static Contact in Finite Strain Elasticity

A. Schiela
M. Stöcklein

Project 19: Shape Optimization for Maxwell's Equations Including Hysteresis Effects in the Material Laws

S. Schmidt, A. Walther
O. Ebel, A. Griewank

Project 20: Optimizing Variational Inequalities on Shape Manifolds

V. Schulz
K. Welker

Project 21: Multi-Leader-Follower Games in Function Space

A. Schwartz, S. Steffensen
A. Thünen

Project 22: Stress-Based Methods for Variational Inequalities in Solid Mechanics: Finite Element Discretization and Solution by Hierarchical Optimization

G. Starke, R. Krause
B. Kober, G. Rovi

Project 23: Optimization Methods for Mathematical Programs with Equilibrium Constraints in Function Spaces Based on Adaptive Error Control and Reduced Order or Low Rank Tensor Approximations

M. Ulbrich, S. Ulbrich
L. Hertlein, A. Rauls

Project 24: Optimization of Non-smooth Hyperbolic Maxwell's Equations in Type-II Superconductivity Based on the Bean Critical State Model

I. Yousept
L. Susu

Plenary Talks

The Inertial Proximal-Gradient Algorithm for Nonconvex Nonsmooth Optimization Problems
Radu Bot (University of Vienna)

We address the minimization of the sum of a proper and lower semicontinuous function with a possibly nonconvex smooth function, by means of a proximal-gradient algorithm with inertial and memory effects. We prove that the sequence of iterates converges to a critical point of the objective, provided that a regularization of the latter function is a so-called KL function; in other words, it satisfes the Kurdyka–Lojasiewicz inequality. To the class of KL functions belong semialgebraic, real subanalytic, uniformly convex and convex functions satisfying a growth condition. Finally, we approach the same minimization problem from a continuous perspective by assigning to it a dynamical system of proximal-gradient type. Under similar circumstances, the generated trajectory is proved to asymptotically converge to a critical point of the objective. Convergence rates for the trajectory in terms of the Lojasiewicz exponent are also derived.

Differential sensitivity in problems with rate independent hysteresis
Martin Brokate (Technische Universität München)

Problems with rate independent hysteresis are inherently nonsmooth. There arises the question whether the associated solution operators (which map the data to the solution) possess weak differentiability properties. We discuss this in particular for the notion of a Newton derivative (which is relevant for semismooth Newton methods) and of a Bouligand derivative, and relate this to optimal control problems.

On the Directional Limiting Normal Cones and Subdifferentials
Jiri Outrata (UTIA, Czech Academy of Science)

By a suitable restriction of the set of sequences generating the limiting (Mordukhovich) normal cone one arrives at the notions of directional limiting normal cone and subdifferential. They have been studied and utilized in several papers authored and coauthored by Gfrerer and proved their usefulness in numerous areas of modern variational analysis. The lecture is devoted to some new developments concerning these notions and their usage. First, we present several rules from the first- and the second-order calculus of directional limiting normal cones which mimic the corresponding rules from the generalized differential calculus of Mordukhovich. Thereafter we employ these rules, together with some stability results for implicitly defined multifunctions, to establish weak (nonrestrictive) criteria ensuring the Aubin property of solution maps to a class of constraint- and variational syatems. Finally, we show the importance of the obtained stability criteria in post-optimal analysis and in some problems with equilibrium constraints.

Mixed-Integer PDE Constrained Optimization
Sven Leyffer (Argonne National Laboratory)

Many complex science and engineering applications can be formulated as optimization problems, constrained by partial differential equations (PDEs), that involve both continuous and integer variables, resulting in a new class of problems, called mixed-integer PDE-constrained optimization (MIPDECO). We present a range of applications of MIPDECO, introduce a new test problem library, and summarize early numerical experience. We illustrate the power of this new modeling paradigm by solving a MIPDECO arising in the optimal control of gas networks, where the gas-flow is modeled as a one-dimensional wave equation, and binary variables are used to model the switching of compressor settings.

Program

All talks and meetings take place in the room 'Berlin' unless otherwise stated.

Monday, Oct 9

12:00 - 13:00		Registration and coffee
13:00 - 13:15		Welcome and opening remarks (M. Hintermüller)

Chair: M. Hintermüller

13:15 - 14:00		**Plenary Session**: Differential Sensitivity in Problems with Rate Independent Hysteresis (M. Brokate)
14:00 - 14:25	P01	Approximation of Monge–Kantorovich Problems (Z. Wang)
14:25 - 14:50	P02	Coupling Hyperbolic PDEs with Switched DAEs: Analysis, Numerics and Application to Blood Flow Models (R. Borsche)

14:50 - 15:15		Coffee break

Chair: R. Herzog

15:15 - 15:40	P03	Numerical Methods for Diagnosis and Therapy Design of Cerebral Palsy by Bilevel Optimal Control of Constrained Biomechanical Multi-Body Systems (M. Sauter, M. Schlöder)
15:40 - 16:05	P04	Parameter Identification in Models With Sharp Phase Transitions (C. Clason)
16:05 - 16:30	P10	Generalized Nash Equilibrium Problems with Partial Differential Operators: Theory, Algorithms, and Risk Aversion (D. Gahururu, S-M. Stengl)
16:30 - 16:55	P06	Analysis and Solution Methods for Bilevel Optimal Control Problems (G. Wachsmuth)

16:55 - 17:20		Coffee break

Chair: A. Schwartz

17:20 - 17:45	P07	Identification of Energies from Observations of Evolutions (M. Fornasier)
17:45 - 18:10	P08	A Calculus for Non-Smooth Shape Optimization with Applications to Geometric Inverse Problems (J. Vidal)

18:15 - 18:45		*Gender equality/women's meeting (A. Walther, A. Schwartz)*
19:00		Dinner

Tuesday, Oct 10

Chair: T. Surowiec

9:00 - 9:45		**Plenary Session**: On the Directional Limiting Normal Cones and Subdifferentials (J. Outrata)
9:45 - 9:10	P05	Multiobjective Optimal Control of Partial Differential Equations Using Reduced-Order Modeling (S. Banholzer, S. Peitz)
10:10 - 10:35	P09	Optimal Control of Dissipative Solids: Viscosity Limits and Non-Smooth Algorithms (A. Stötzner)

10:35 - 11:00		Coffee break

11:00 - 11:25	P11	Optimal Control of Elliptic and Parabolic Quasi-Variational Inequalities (C. Rautenberg, A. Alphonse)
11:25 - 11:50	P21	Multi-Leader-Follower Games in Function Space (A. Schwartz, A. Thünen)
11:50 - 12:15	P14	Generalized Nash Equilibria and their Computation via Augmented Lagrangian Methods (D. Steck)
12:15 - 13:30		Lunch

Chair: S. Schmidt

13:30 - 13:55	P15	Non-smooth Methods for Complementarity Formulations of Switched Advection-Diffusion Processes (P. Manns)
13:55 - 14:20	P16	Optimal Control of Variational Inequalities of the Second Kind with Application to Yield Stress Fluids (C. Christof)
14:20 - 14:45	P17	Optimizing Fracture Propagation Using a Phase-Field Approach (W. Wollner)
14:45 - 15:10		Coffee break

Chair: C. Kirches

15:10 - 15:35	P19	Shape Optimization for Maxwell's Equations Including Hysteresis Effects in the Material Laws (O. Ebel)
15:35 - 16:00	P23	Optimization Methods for Mathematical Programs with Equilibrium Constraints in Function Spaces based on Adaptive Error Control and Reduced Order or Low Rank Tensor Approximations (L. Hertlein, A. Rauls)
16:00 - 16:45		**Plenary Session**: Mixed-Integer PDE Constrained Optimization (S. Leyffer)
16:45 - 17:45		Parallel sessions: *PI meeting* *Young researchers' meeting* (room 'Brandenburg')
19:00		Dinner

Wednesday, Oct 11

Chair: D. Knees

9:00 - 9:25	P20	Optimizing Variational Inequalities on Shape Manifolds (V. Schulz)
9:25 - 9:50	P13	Simulation and Control of a Nonsmooth Cahn–Hilliard Navier-–Stokes System with Variable Fluid Densities (C. Gräßle, T. Keil)
9:50 - 10:15	P22	Stress-Based Methods for Variational Inequalities in Solid Mechanics: Finite Element Discretization and Solution by Hierarchical Optimization (R. Krause)
10:15 - 10:40	P18	Optimal Control of Static Contact in Finite Strain Elasticity (M. Stöcklein)
10:40 - 11:05		Coffee break

Chair: M. Ulbrich

11:05 - 11:30	P24	Optimization of Non-smooth Hyperbolic Maxwell's Equations in Type-II Superconductivity Based on the Bean Critical State Model (L. Susu)
11:30 - 12:15		**Plenary Session**: The Inertial Proximal-Gradient Algorithm for Nonconvex Nonsmooth Optimization Problems (R. Bot)
12:15 - 12:25		Closing

List of Participants

1	Alphonse, Amal	WIAS Berlin
2	Banholzer, Stefan	Universität Konstanz
3	Bartels, Sören	Albert-Ludwigs-Univ. Freiburg
4	Borsche, Raul	TU Kaiserslautern
5	Bot, Radu Ioan	Universität Wien
6	Brokate, Martin	TU München
7	Christof, Constantin	TU Dortmund
8	Clason, Christian	Universität Duisburg-Essen
9	Dellnitz, Michael	Universität Paderborn
10	Ebel, Olga	Universität Paderborn
11	Fatima, Arooj	TU Dortmund
12	Fornasier, Massimo	TU München
13	Gahururu, Deborah	Philipps-Universität Marburg
14	Gebken, Bennet	Universität Paderborn
15	Gräßle, Carmen	Universität Hamburg
16	Harder, Felix	TU Chemnitz
17	Herrmann, Marc	Universität Würzburg
18	Hertlein, Lukas	TU München
19	Herzog, Roland	TU Chemnitz
20	Hintermüller, Michael	WIAS Berlin
21	Kanzow, Christian	Universität Würzburg
22	Karl, Veronika	Universität Würzburg
23	Keil, Tobias	WIAS Berlin
24	Kirches, Christian	TU Braunschweig
25	Knees, Dorothee	Universität Kassel
26	Kober, Bernhard	Universität Duisburg-Essen
27	Kocoglu, Damla	TU Kaiserslautern
28	Kostina, Ekaterina	Universität Heidelberg
29	Krause, Rolf	U della Svizzera ital., Lugano
30	Leyffer, Sven	Argonne National Lab, Lermont
31	Löbhard, Caroline	WIAS Berlin
32	Manns, Paul	TU Braunschweig
33	Mehlitz, Patrick	TU Bergakademie Freiberg
34	Meyer, Christian	TU Dortmund
35	Mohammadi, Masoumeh	TU Darmstadt
36	Outrata, Jiří	Inst. Inf. Theory Autom., Prag

37	Peitz, Sebastian	Universität Paderborn
38	Rauls, Anne-Therese	TU Darmstadt
39	Rautenberg, Carlos	Humboldt-Universität zu Berlin
40	Rovi, Gabriele	U della Svizzera ital., Lugano
41	Sauter, Marta	Universität Heidelberg, IWR
42	Schiela, Anton	Universität Bayreuth
43	Schloeder, Matthias	Universität Heidelberg
44	Schlöder, Johannes	Universität Heidelberg, IWR
45	Schmidt, Stephan	Universität Würzburg
46	Schulz, Volker	Universität Trier
47	Schwartz, Alexandra	TU Darmstadt
48	Starke, Gerhard	Universität Duisburg-Essen
49	Steck, Daniel	Universität Würzburg
50	Stengl, Steven-Marian	WIAS Berlin
51	Stoecklein, Matthias	Universität Bayreuth
52	Stötzner, Ailyn	TU Chemnitz
53	Surowiec, Thomas	Philipps-Universität Marburg
54	Susu, Livia	Universität Duisburg-Essen
55	Thomas, Stephanie	Universität Kassel
56	Thünen, Anna	RWTH Aachen
57	Turek, Stefan	TU Dortmund
58	Ulbrich, Michael	TU München
59	Ulbrich, Stefan	TU Darmstadt
60	Vidal-Nunez, Jose	TU Chemnitz
61	Volkwein, Stefan	Universität Konstanz
62	Vu, Huu Nhu	Universität Duisburg-Essen
63	Wachsmuth, Daniel	Universität Würzburg
64	Wachsmuth, Gerd	TU Chemnitz
65	Walther, Andrea	Universität Paderborn
66	Wang, Zhangxian	Albert-Ludwigs-Univ. Freiburg
67	Winckler, Malte	Universität Duisburg-Essen
68	Wollner, Winnifried	TU Darmstadt
69	Yousept, Irwin	Universität Duisburg-Essen