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PROGRAM & ABSTRACTS BOOK

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as shock waves. We present the shifted POD which extends the classical POD by introducing coordinate transformations for describing the advection in an efficient way. Especially, we demonstrate how to use the shifted POD modes for obtaining a parametric reduced-order model while achieving an efficient offline/online decomposition. Numerical experiments illustrate the effectiveness of this new approach.

12:00-12:30

Optimal sampling for approximation in tree-based tensor format
Cécile Habertisch — CEA, DAM, DIF, F-91297 Arpajon, France
Abstract: We propose a strategy to construct approximations of high-dimensional functions in subspace-based Tucker formats. It relies on an extension of principal component analysis to multivariate functions and the use of least-squares projections of partial evaluations of the function. A boosted optimal least-squares method is presented for the projection of partial evaluations on subspaces, which allows to guarantee the stability of the projection with a number of evaluations close to the dimension of the subspace.

12:30-13:00

Randomized linear algebra for model order reduction
Oleg Balabanov — Ecole Centrale Nantes
Anthony Nouy — Centrale Nantes, LMJL UMR 6629
Abstract: We propose a methodology to construct a reduced model for parameter-dependent equations from a small, efficiently computable random object called a sketch of a reduced model, which is a set of low-dimensional random projections of the reduced approximation space and the spaces of associated residuals. Our approach can provide drastic improvement of the efficiency and numerical stability of classical Galerkin and minimal residual methods. Furthermore, it makes computationally feasible a dictionary-based approximation method.

MS ME-1-0 2 — 11:00-13:00

Recent Advances in Optimal Control Theory - Part 2
For Part 1 see: MS ME-1-0 1
For Part 3 see: MS ME-1-0 3
For Part 4 see: MS ME-1-0 4
For Part 5 see: MS ME-1-0 5
Organizer: Alexander Zaslavski — The Technion - Israel Institute of Technology
Organizer: Monica Motta — University of Padua
Organizer: Boris Mordukhovich — Wayne State University
Organizer: Nobusumi Sagara — Hosei University
Abstract: This minisimposium on new developments in optimal control theory and its applications will bring together a selected group of experts in this area. The growing importance of control and optimization has been realized in recent years. This is due not only to theoretical developments, but also because of numerous applications to engineering, economics and life sciences. The topics which will be discussed include optimal control of PDE, turnpike phenomenon, infinite horizon optimal control, necessary and sufficient optimality conditions, qualitative and quantitative aspects of optimal control and applications.

11:00-11:30

On the use of the turnpike property in Model Predictive Control
Lars Gruene — University of Bayreuth
Abstract: Model predictive control (MPC) is a method for synthesizing a control input from pieces of finite horizon optimal control sequences on moving time horizons. In many cases, the control obtained this way produces a trajectory which is approximately optimal on an infinite horizon. In this talk we show that the turnpike property from optimal control can be used in order to rigorously establish near optimality of the trajectories generated by MPC.

11:30-12:00

Infinite Horizon Optimal Control and Polynomial Approximations
Sabine Pickenhain — BTU Cottbus-Senftenberg
Abstract: We consider a class of infinite horizon variational and control problems arising from economics, quantum mechanics and stabilization. The objective is of regulator type. The problem setting implies a weighted Sobolev space as the state space. We establish necessary optimality conditions in form of a Pontryagin type maximum principle. A duality concept of convex analysis is provided and used to find sufficient optimality conditions and to motivate a dual approximation scheme.

12:00-12:30

Linear Programming Approach to the Analysis of the Value Function in Infinite Horizon Optimal Control Problems with Time Averaging and Time Discounting Criteria
Ilya Shvartsman — Pennsylvania State University - Harrisburg
Abstract: This talk is devoted to analysis of the optimal value function in infinite horizon optimal control problems with time averaging and time discounting criteria. To carry out this analysis, we introduce and study an infinite dimensional linear programming problem. We focus on the general non-ergodic case, where the optimal value functions may depend on the initial condition of the system. The talk is based on the joint work with V. Borkar and V. Gaitsgory.

MS ME-1-4 2 — 11:00-13:00

Recent advances in PDE-constrained optimization - Part 2
For Part 1 see: MS ME-1-4 1
Organizer: Irwin Yousept — University of Duisburg-Essen
Abstract: In the recent past, the theoretical and numerical analysis of PDE-constrained optimization has made substantial progress, which along with advances in scientific computing may provide powerful strategies for solving real-world problems. The goal of this minisymposium is to provide an open forum for exchanging knowledge among international leading experts and junior scientists from the emerging field of PDE-constrained optimization with real-world applications, including gas transport, electrical impedance tomography, and electromagnetic machines. The tentative speakers will give an overview of recent progresses in mathematical and numerical approaches concerning optimal control of PDEs, shape and topology optimization, isoperimetric problems, and others.

11:00-11:30

Beltrami fields, the Biot-Savart operator and the isoperimetric problem for the helicity
Alberto Valli — Università degli Studi di Trento
Abstract: A Beltrami field is parallel to its curl: an interesting example is given by the eigenvectors of the curl operator. The helicity of a vector field is given by its scalar product with the Biot--Savart operator applied to it. The helicity of a domain is computed determining the eigenvalue of maximum absolute value for a saddle-point variational formulation of the Biot--Savart operator. This opens the way for finding the domain which maximizes helicity.

11:30-12:00

A shape optimization approach for electrical impedance tomography with pointwise measurements
Antoine Laurain — University of São Paulo
Abstract: We consider the inverse problem of electrical impedance tomography with pointwise boundary measurements. The reconstruction of piecewise constant conductivities leads to a shape optimization problem. We define a cost functional measuring the misfit between experimental observations and the numerical model. The existence of a distributed expression of the shape derivative for shapes with low regularity is shown and the shape derivative is computed. Numerical results showing the relevance of the approach will be presented.

12:00-12:30

Variational inequalities in electromagnetism
Irwin Yousept — University of Duisburg-Essen
Abstract: We present recent mathematical results on the existence, uniqueness and regularity for hyperbolic Maxwell variational inequalities of the second kind.

12:30-13:00

Multimaterial Topology Optimization in Electromagnetics
Peter Gangl — TU Graz
Abstract: We present a topology optimization method for multiple materials which is based on the concept of topological derivatives. Here, the design, which consists of more than two materials, is represented in an implicit way by a vector-valued level set function. We show a sufficient optimality condition and an iterative algorithm which is based on this condition. Finally, we show numerical results obtained by applying the algorithm to the optimization of an electric motor.

MS A3-S-C2 2 — 11:00-13:00

Combinatorial scientific computing - Part 2