Berufungsvorträge „Numerik partieller Differentialgleichungen“

Der Ablauf der Berufungsvorträge für die Professur in Numerik partieller Differentialgleichungen schließt die folgenden Punkte ein:

Kurzvortrag für Studierende (30 Minuten)
Pause
Wissenschaftlicher Vortrag
Kommissionelles Hearing (C 206)

Montag, 12. November, 12.30 Uhr, C 714: **Prof. Dr. Angela Kunoth**
(Institut für Mathematik, Universität Paderborn)

12:30 Uhr: Vortrag für Studierende (30 Minuten):
„Variationsmethoden für elliptische partielle Differentialgleichungen“

13:15 Uhr: Wissenschaftlicher Vortrag:
„Adaptive Approximations for PDE-Constrained Parabolic Control Problems“

Abstract:
Optimization problems constrained by parabolic evolution PDEs (partial differential equations) are
challenging from a computational point of view, as they require to solve a system of PDEs coupled globally in time and space. For their solution, time-stepping methods quickly reach their limitations due to the
enormous demand for storage. For such a coupled PDE system, adaptive methods which aim at distributing the available degrees of freedom in an a-posteriori-fashion to capture singularities in the data or domain, with respect to both space and time, appear to be most promising.

Yet another level of challenge are control problems constrained by evolution PDEs involving stochastic or countably many infinite parametric coefficients: for each instance of the parameters, this requires the solution of the complete control problem. Even in the case of a single parameter, a corresponding Monte-Carlo simulation with \$M\$ independent draws of this parameter asks for M solutions of the control problem.

Our method of attack is based on the following theoretical results. We first show for control problems
constrained by evolution PDEs, formulated in full weak space-time form, that state and control are analytic as functions depending on these parameters. This allows for a simultaneous generalized polynomial chaos approximation of the state and the costate/control. In addition, for an adaptive approximation of the
resulting deterministic coupled PDE system with respect to space and time, we employ wavelet schemes
for which we can prove convergence and optimal complexity.

The results were obtained jointly with Christoph Schwab (ETH Zürich) and with Max Gunzburger (Florida State University).