A U S H A N G

FREIE UNIVERSITÄT BERLIN

Fachbereich Mathematik und Informatik

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D I S P U T A T I O N

Mittwoch, 9. Juni 2021, 10:00

WebEx

Disputation über die Doktorarbeit von

Herrn Marian Philipp Moldenhauer

Thema der Dissertation:

Adaptive Algorithms in Optimization under PDE Constraints

Thema der Disputation:

Overview of Multigrid methods for optimization

Die Arbeit wurde unter der Betreuung von **Prof. Dr. R. Kornhuber** durchgeführt.

Abstract: Optimization poses an important area in mathematics and has many different applications which range from path finding, over shape optimization and image deblurring, to parameter identification, to name a few. Frequently optimization is subject to partial differential equations (PDEs) characterizing heat flow, an equilibrium of forces, or the wave propagation. With large scale problems such as weather models that include big data, or the optimization of the position of a hip implant under consideration of infinitely many motion loads, the need for fast and efficient solution methods is apparent. One of the tools that enable an accelerated solution of the optimization and/or the PDE are multigrid (MG) methods. Focusing on optimization with PDE constraints, MG methods can be used inside the optimization when solving the PDE, or outside for the optimization itself. This approach was first explored by S.G. Nash and coined MG/OPT in 2000. In the course of the presentation, the mode of operation of MG techniques is to be explored, starting first with the origin of the linear MG method in as early as the 1960s.The mode of operation include some common pre- and post-smoothers such as (damped) Jacobi, (symmetric) Gauss-Seidel, or the conjugate gradient (CG) method. With an understanding of the MG basics, the application of MG in the solution of partial differential equations and in optimization will be shown which marks the transition to MG/OPT. Here, it will be stressed how the damping of high frequency errors is advantageous, especially in combination with the aforementioned smoothers. The possibility of altering the MG method with variable metrics will be shown and results on (global) convergence for (un-) constrained optimization, but also the effect of inexact gradients will be presented. For some scenarios, the rate of convergence can be given. The presentation will conclude with the presentation of present day research and an outlook to further investigation and application.

Die Disputation besteht aus dem o. g. Vortrag, danach der Vorstellung der Dissertation einschließlich jeweils anschließenden Aussprachen.

Interessierte werden hiermit herzlich eingeladen

Der Vorsitzende der Promotionskommission
Prof. Dr. R. Kornhuber