Einladung

Würzburger Mathematisches Kolloquium

Julius-Maximilians-Universität Würzburg • Institut für Mathematik

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Technische Universität Chemnitz

Preserving Structure in PDE Approximation: How and How Much? Finite Element Methods, Constrained Optimization, and Reduced Models

Dienstag, 14. Juli 2026 • 14:15 Uhr

Seminarraum SE41 • Humboldt-Bau (Emil-Fischer-Straße 41, 97074 Würzburg)

Der Vortrag wird auch als Zoom-Meeting übertragen: go.uniwue.de/ifmcolloquium-zoom

Abstract. Numerical methods for partial differential equations should not only approximate the solution accurately, but also preserve relevant structures of the underlying continuous model. Depending on the application, such structures may include conservation laws, equilibrium conditions, stability properties, stress or flux constraints, or symmetry.

This talk discusses which parts of this structure can and should be preserved at the discrete level. Starting from finite element methods for mechanical and multiphysical problems, I will focus on stress- and flux-based approaches and explain how constrained optimization and least-squares formulations provide flexible tools for enforcing or recovering structural properties, in particular for nonlinear and eigenvalue problems.

A central motivation comes from a posteriori error estimation. Equilibrated stresses and fluxes provide computable and often sharp information on the discretization error and form the basis for adaptive algorithms that refine the computational mesh where it is actually needed.

Finally, the talk will discuss what happens when such methods are integrated into reduced-order models: which structures should be preserved, how can they be preserved efficiently, and how much structure can be retained without losing the computational advantages of model reduction?

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