Advances in Computational Mechanics

Einladung zum
Vortrag

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Efficient Fully-coupled Newton-Krylov Solution of Transport/Reaction Systems

A current challenge before the computational science and numerical mathematics community is the efficient computational solution of multiphysics systems. These systems are strongly coupled, highly nonlinear and characterized by multiple physical phenomena that span a very large range of length and time scales. The myriad of complex, interacting physical mechanisms can balance to produce steady-state behavior, nearly balance to evolve a solution on a dynamical time scale that is long relative to the component time-scales, or they can be systems that are dominated by one (or a few) process(es). These characteristics make the computational solution of these systems, over relevant dynamical time scales of interest (or to steady-state solutions), extremely challenging.

In this presentation I will overview a number of the important solution methods that our research group has applied in the large-scale parallel simulation of such systems with a focus on transport/reaction applications. The solution methods that we employ include, fully-implicit time integration, direct-to-steady-state solution methods, continuation, bifurcation, and optimization techniques. The resulting large sparse linear systems that are generated by these methods are solved by the application of parallel preconditioned Krylov methods. The preconditioners include additive Schwarz domain decomposition (DD) and multi-level preconditioners. The multi-level preconditioners are based on geometric and algebraic methods as well as approximate block factorization techniques.

To demonstrate the capability of these methods I will present simulation results for representative low heat release and high heat release transport / reaction simulations. In this context I will discuss robustness, efficiency, and the parallel and algorithmic scaling of solution methods.

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15:00 Uhr

Seminarraum LNM
MW 1237

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