Extreme Scale Solvers for Coupled Systems

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Numerical simulation has become one of the major topics in Computational Science. To promote modelling and simulation of complex problems new strategies are needed allowing for the solution of large, complex model systems. Crucial issues for such strategies are reliability, efficiency, robustness, usability, and versatility. After discussing the needs of large-scale simulation we point out basic simulation strategies such as adaptivity, parallelism and multigrid solvers. To allow adaptive, parallel computations the load balancing problem for dynamically changing grids has to be solved efficiently by fast heuristics. These strategies are combined in the simulation system UG ("Unstructured Grids") being presented in the following. In the second part of the seminar we show the performance and efficiency of this strategy in various applications. In particular, large scale parallel computations of density-driven groundwater flow in heterogenous porous media are discussed in more detail. Load balancing and efficiency of parallel adaptive computations is discussed and the benefit of combining parallelism and adaptivity is shown.

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