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Solvers for Coupled PDE Problems in Porous Media Science

Thursday, 2 June 2022 14:15 (15 minutes)

Developing efficient solvers for coupled PDE systems is often a non-trivial task, since one must to combine suitable schemes for time integration and linear solvers, which is suitable for HPC systems. In this study, we present a unified solver framework, which combines a linearly-implicit extrapolation scheme with a scalable multigrid solver.

The effectiveness of the approach is demonstrated for different applications in subsurface flow. These include (i) thermohaline flow, in which density depends on temperature and salt concentration, (ii) thermo-hydraulic flow, which features thawing and freezing in permafrost regions, and (iii) density-driven flow in domains with a free groundwater surface. We investigate robustness of the numerical methods, develop suitable error estimators and provide results in an HPC environment.

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Germany

References

[1] A. Vogel, S. Reiter, M. Rupp, A. Nägel and G. Wittum: "UG4: A novel flexible software system for simulating PDE based models on high performance computers", Comput. Visual Sci., 16:4 (2013), 165-179.

[2] A. Nägel, P. Deuflhard, G. Wittum: "Efficient Stiff Integration of Density Driven Flow Problems", ZIB-Report 18-54, (2018).

[3] R. Buijse, M. Parnet, A. Nägel: "Large Scale Simulations in the Software Toolbox UG4", In: Nagel W.E., Kröner D.H., Resch M.M. (eds) High Performance Computing in Science and Engineering '22. Springer, Cham (2022).

Time Block Preference

Time Block B (14:00-17:00 CET)

Participation

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