Department of Mathematics

University of Houston

Scientific Computing Seminar

Prof. Timo Heister
Mathematical Sciences
Clemson University

Numerical Methods in the Finite Element Mantle Convection code ASPECT

Wednesday, Nov. 11, 2015
2 PM- 3 PM
Room 646 PGH

Abstract: This talk focusses on the numerical challenges involved with the simulation of large scale mantle convection problems based on the experience developing the open source, community code ASPECT (Advanced Solver for Problems in Earth ConvecTion) based on the finite element library deal.II.

We will discuss the usage of accurate finite element discretization and stabilization schemes for the underlying PDEs. Large demands on the accuracy of the solution require the combination of adaptive mesh refinement techniques and large scale, parallel computations. We developed robust, efficient, and scalable linear solvers based on block preconditioners and algebraic multigrid for the resulting linear systems. The main focus of this talk is on the successful integration of all these different numerical challenges.

Finally, we will cover some advanced applications and highlight strategies in software design we employ to develop a flexible, reusable code with an active community.

• W. Bangerth, T. Heister, L. Heltai, et al. The deal.II Library, Version 8.3 http://dealii.org

• M. Kronbichler, T. Heister, W. Bangerth: High Accuracy Mantle Convection Simulation through Modern Numerical Methods Geophysical Journal International, 2012, 191, 12-29.

• W. Bangerth, T. Heister, and others: Aspect: Advanced Solver for Problems in Earth's ConvecTion. http://aspect.dealii.org