Matrix Computations & Scientific Computing Seminar

Organizer: James Demmel & Ming Gu

Wednesday, 11:00am–12:00pm, 380 Soda

April 27 **Frederic Gibou**, UC Santa Barbara

Numerical Solvers for Nonlinear Partial Differential Equations on Octree Adaptive Grids

Several phenomena in the physical and the life sciences can be modeled as a time dependent interface problem and nonlinear partial differential equations. Examples include the study of electro-osmotic flows, molecular beam Epitaxy, free surface flows and multiphase flows in porous media. One of the main difficulties in solving numerically these equations stems from the fact that the geometry of the problems is often arbitrary and special care is needed to correctly apply boundary conditions. Another difficulty is associated with the fact that such problems involve dissimilar length scales, with smaller scales influencing larger ones so that nontrivial pattern formation dynamics can be expected to occur at all intermediate scales. Uniform grids are limited in their ability to resolve small scales and are in such situations extremely inefficient in terms of memory storage and CPU requirements. In this talk, I will present recent advances in the numerical treatment of interface problem and describe new numerical solvers for nonlinear partial differential equations in the context of adaptive mesh refinement based on Octree grids. If time permits, I will present a second-order accurate symmetric positive definite monolithic solver for fluid/solid interactions.