PHYSICAL MATHEMATICS SEMINAR

NUMERICAL SOLVERS FOR NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS ON FULLY ADAPTIVE GRIDS

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ABSTRACT:

Several phenomena in the physical and the life sciences can be modeled as time dependent interface problems and nonlinear partial differential equations. Examples include the study of bacteria colonies, materials, free surface flows and multiphase flows. One of the main difficulties in solving these equations stems from the fact that they produce discontinuous solutions. Another difficulty is associated with the fact that they involve dissimilar length scales, with smaller scales influencing larger ones so that nontrivial pattern formation dynamics can be expected to occur on all intermediate scales (multiscale phenomena). Numerical simulations represent a promising avenue, but care must be taken in the treatment of interface's boundary conditions. Moreover, simulations face the limitations imposed by current computer technology. 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 since only small portions of the computational domain require fine resolutions. Since their inception, adaptive mesh refinement techniques have provided a tool to systematically concentrate the computational effort where it is most needed, allowing for efficient resolutions. In this talk, I will present recent advances in the numerical treatment of interface problems and describe new numerical solvers for nonlinear partial differential equations in the context of adaptive mesh refinement.

TUESDAY, DECEMBER 6, 2005
2:30 PM
Building 3, Room 370

Refreshments at 3:30 PM outside of Room 370

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