Joint

APPLIED MATHEMATICS COLLOQUIUM

And

NUMERICAL METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS SEMINAR

Adaptive Space-time Multiresolution Techniques for Nonlinear PDEs

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ABSTRACT:
We present efficient fully adaptive numerical schemes for evolutionary partial differential equations based on a finite volume (FV) discretization with explicit time discretization. A multiresolution strategy allows local grid refinement while controlling the approximation error in space. The costly fluxes are evaluated on the adaptive grid only. For time discretization we use an explicit Runge-Kutta scheme of second-order with a scale-dependent time step. On the finest scale the size of the time step is imposed by the stability condition of the explicit scheme. On larger scales, the time step can be increased without violating the stability requirement of the explicit scheme. Embedded Runge-Kutta methods of second and third order are then used to choose automatically the new time step while controlling the approximation error in time. Non-admissible choices of the time step are avoided by limiting its variation.

The implementation of the multiresolution representation uses a dynamic tree data structure, which allows memory compression and CPU time reduction. This new numerical scheme is validated using different classical test problems in one, two and three space dimensions. The gain in memory and CPU time with respect to the finite volume scheme on a regular grid is reported, which demonstrates the efficiency of the new method.

This work is joint work with M. Domingues, S. Gomes and O. Roussel.

Monday October 5th 2009
4:30 PM
Building 4, Room 370

Refreshments are available in Building 2, Room 290
(Math Common Room) between 3:30 – 4:30 PM

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