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Moving Mesh Finite Element Methods for the Adaptive Solution of Transient PDEs with Moving Boundaries

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Abstract

This talk will describe a new adaptive finite element algorithm for the solution of nonlinear diffusion equations using moving grids. The technique is particularly appropriate for problems with moving boundaries: both external boundaries, where the problem domain is time-dependent, and internal boundaries such as interfaces between phases. The approach is based upon conserving the distribution of a monitor function across the spatial domain throughout time, and this conservation principle is used to drive the velocity of the nodes in the moving mesh. A number of computational examples will be presented from a wide range of sample applications including the porous medium equation (second order nonlinear diffusion), droplet spreading problems (fourth order nonlinear diffusion) and phase-change problems. The computational accuracy and the practical efficiency of the scheme will be assessed and a number of physical properties (conservation, self-similarity, waiting times, etc.) will be discussed.

This is joint work with Mike Baines (Reading/Leeds) and Matthew Hubbard (Leeds).

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