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Fully implicit moving mesh adaptive algorithm LUIS CHACON, GIOVANNI LAPENTA, LANL — In many problems of interest, the numerical modeler is faced with the challenge of dealing with multiple time and length scales. The former is best dealt with with fully implicit methods, which are able to step over fast frequencies to resolve the dynamical time scale of interest. The latter requires grid adaptivity for efficiency. Moving-mesh grid adaptive methods are attractive because they can be designed to minimize the numerical error for a given resolution. However, the required grid governing equations are typically very nonlinear and stiff, and of considerably difficult numerical treatment. Not surprisingly, fully coupled, implicit approaches where the grid and the physics equations are solved simultaneously are rare in the literature, and circumscribed to 1D geometries. In this study, we present a fully implicit algorithm for moving mesh methods that is feasible for multidimensional geometries. A crucial element is the development of an effective multilevel treatment of the grid equation.[1] We will show that such an approach is competitive vs. uniform grids both from the accuracy (due to adaptivity) and the efficiency standpoints. Results for a variety of models 1D and 2D geometries, including nonlinear diffusion, radiation-diffusion, Burgers equation, and gas dynamics will be presented.

[1]L. Chacón, G. Lapenta, A fully implicit, nonlinear adaptive grid strategy, *J. Comput. Phys.*, accepted (2005)

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