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Adaptive Mesh Refinement for Plasma Simulations[1] VLADIMIR KOLOBOV, ROBERT ARSLANBEKOV, CFD Research Corporation — Many plasma problems are characterized by the presence of localized domains with large gradients of plasma parameters (streamers, filaments, ionization fronts, etc). The ability to dynamically adapt the local mesh resolution would substantially increase the accuracy and efficiency of simulations for such problems. In this paper, we will describe our current work to develop plasma simulation tool with Adaptive Mesh Refinement (AMR) using octree Cartesian mesh. We have already demonstrated such an approach for simulation of streamer development with a minimal plasma model (Poisson solver, drift-diffusion electron transport, immobile ions, and local field ionization). We used an explicit solver to compute the initial stage of streamer propagation at fast electron scale with 2D/3D simulations including curved electrode boundaries. Here we will describe new developments including ion drift, electron energy balance, and Immersed Boundary Method for improved treatment of boundary conditions with Cartesian mesh. We will illustrate new capabilities for several 2D/3D problems (streamers and high-pressure microplasmas) and describe code parallelization with dynamic load balancing among processors. New physics learned by using the new AMR code will be discussed.

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