Abstract Submitted
for the GEC18 Meeting of
The American Physical Society

Embedded boundary fluid simulations of complex-geometry plasma discharges with structured adaptive mesh refinement[1] ROBERT MARSKAR, SINTEF Energy Research — I present results on the development and use of a scalable two- and three-dimensional computer code for low temperature plasma simulations in complex geometries that feature both insulators and electrodes. Our approach is based on the Chombo library, and uses embedded boundary (EB) finite volume discretizations of fluid plasma models on adaptive Cartesian grids, extended to multi-material cases that also account for charging of dielectric surfaces. I discuss cut-cell geometry generation, temporal and spatial discretizations, and implementation of these into Chombo. Our use of AMR provides a scalable platform for performing 3D fluid simulations of filamentary plasmas in realistic geometries at moderate pressures and comparatively large scale. Simulation examples that demonstrate this capability up to many thousands of CPU cores are presented. I also discuss computational bottlenecks and challenges related to large scale HPC simulations, and remark on possible optimization strategies for emergent architectures that display increasing degrees of inhomogeneity, decreasing memory-to-CPU ratios, and wider vector units.

[1]This work was supported by the Research Council of Norway through project 245422 and commercial partner ABB AS, Norway.

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Date submitted: 15 Jun 2018

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