Abstract Submitted
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Implicit and coupled multi-scale solvers for low temperature plasma[1] ROBERT ARSLANBEKOV, VLADIMIR KOLOBOV, CFD Research Corporation, EPSCOR TEAM — We will present a new multi-fluid, multi-temperature plasma solver with adaptive Cartesian mesh based on a full-Newton (non-linear, implicit) scheme for collisional low-temperature plasma. The implicit treatment of the coupled equations allows using large time steps, and the full-Newton method enables fast non-linear convergence at each time step, offering improved efficiency of fluid plasma simulations. The new solver allows solving several problems we could not solve before with existing software: two- and three-dimensional structures of the entire DC discharges including cathode and anode regions with electric field reversals, normal cathode spot and anode ring, plasma stratification in DC and RF discharges [1]. To address the disparity of the electron and ion time scales, we also implement a modular split of the fast (electron) solvers and slow (ion) transport solvers. This split allows adding kinetic solvers for electrons to our framework. We will also report an initial development of an implicit chemistry module for additional time step increase. A few demo/validation cases will be discussed in our presentation. [1] R Arslanbekov and V Kolobov, Implicit and Coupled Multi-Fluid Solver for Collisional Low-Temperature Plasma, https://arxiv.org/abs/2003.03812

[1]NSF EPSCoR project OIA-1655280.

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