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Simulation of Mach Probes in Non-Uniform Magnetized Plasmas: the Influence of a Background Density Gradient CHRISTIAN BERNT HAAKONSEN[1], IAN H. HUTCHINSON, MIT PSFC — Mach probes can be used to measure transverse flow in magnetized plasmas, but what they actually measure in strongly non-uniform plasmas has not been definitively established. A fluid treatment in previous work has suggested that the diamagnetic drifts associated with background density and temperature gradients affect transverse flow measurements, but detailed computational study is required to validate and elaborate on those results; it is really a kinetic problem, since the probe deforms and introduces voids in the ion and electron distribution functions. A new code, the Plasma–Object Simulator with Iterated Trajectories (POSIT) has been developed to self-consistently compute the steady-state six-dimensional ion and electron distribution functions in the perturbed plasma. Particle trajectories are integrated backwards in time to the domain boundary, where arbitrary background distribution functions can be specified. This allows POSIT to compute the ion and electron density at each node of its unstructured mesh, update the potential based on those densities, and then iterate until convergence. POSIT is used to study the impact of a background density gradient on transverse Mach probe measurements, and the results compared to the previous fluid theory.

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