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A full-fluid model for low-temperature magnetized plasmas[1]
KENTARO HARA, ADNAN MANSOUR, Stanford University, RUPALI SAHU, Texas A&M University — A full-fluid moment model is developed to study low-temperature magnetized plasmas. The governing equations are derived by taking moments of the Boltzmann equation, and flux boundary conditions are calculated by taking moments of a shifted Maxwellian distribution. An initially quasineutral plasma is modeled between two non-emitting walls to assess the performance of the model in capturing plasma-wall interaction. Sensitivities of the boundary conditions and other physical phenomena, including ion drag and electromagnetic fields, are evaluated. Inclusion of momentum transfer collisions displayed variations in plasma sheath properties in close agreement with analytical trends. It was also observed that an inverse sheath is formed using an applied transverse magnetic field. Finally, the full-fluid moment model is employed to simulate the low-temperature plasma discharge in Hall-effect thrusters. The results are compared against a non-neutral drift-diffusion model and a quasineutral drift-diffusion model to investigate the effects of the quasineutral assumption and electron inertial terms on cross-field electron transport. Fluid shear is found to affect the cross-field electron transport.

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