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A fully 2D electron fluid model for Hall thrusters[1] HORATIU DRAGNEA, KENTARO HARA, IAIN BOYD, Univ of Michigan - Ann Arbor — A Hall thruster is a cross-field device used for spacecraft propulsion. Recent Hall thruster developments, such as magnetic shielding and nested channels, have prompted the need to improve simulation capabilities. State-of-the-art hybrid methods such as HPHall [Fife, PhD MIT, 1998] employ a quasi-1D fluid electron model, which decouples the electron transport along and across the magnetic field lines. However, this approach cannot be used for complex magnetic field topologies, or extended computational domains. In this study, we present a fully 2D fluid electron model that directly captures the multidimensional electron transport in complex magnetic field configurations. More specifically, the plasma potential is calculated by solving a 2^{nd} order partial differential equation obtained from the generalized Ohm's law for electrons in conjunction with the charge conservation equation, and assuming a quasineutral plasma. A 9-point Cartesian stencil is used to capture the effects introduced by the cross-terms and a thruster channel test case is constructed assuming dielectric channel walls as well as an anode and cathode. We present test cases under several magnetic field configurations in comparison with previous modeling results [Geng et al, JAP, 2013], and a quasi-1D model.

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