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Cross-code Validation for Simulations of a Planar MITL[1]
NATHANIEL HAMLIN, EVSTATI EVSTATIEV, KRISTIAN BECKWITH, Sandia National Laboratories, NM — For the planning of future pulsed-power devices such as Z-Next at Sandia National Labs, it is essential to have reliable predictive capability for modeling power-flow in the proposed designs of these devices. An important component of this predictive capability is to have results that can be closely reproduced between multiple codes for systems of progressively higher fidelity and increasing complexity. As a first step, we perform this cross-validation for the problem of power-flow along a Magnetically-Insulated Transmission Line (MITL) in planar (slab) geometry. We present a comparison of simulation results between the PERSEUS extended-MHD, EMPIRE-Fluid, and EMPIRE-PIC codes, first for the one-dimensional interaction of an electromagnetic wave with a layer of plasma, followed by an extension to a two-dimensional MITL. In this latter case, we vary the initial density of the plasma layer, seeking to identify a transition between quasi-neutral regimes that can be modeled with Hall physics, and non-quasi-neutral regimes that require space-charge-limiting in a fully two-fluid model. A close comparison between these codes provides the basis for cross-validation of power-flow simulations in more complex three-dimensional MITL geometries. SAND2019-7455 A

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