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Benchhmark of NIMROD kinetic electron closures with the NEO code ERIC HELD, Utah State University, SCOTT KRUGER, Tech-X Corporation, EMILY BELLI, General Atomics, JAMES CALLEN, Wisconsin, NIMROD TEAM
— The need to close the extended magnetohydrodynamic equations to include perturbed bootstrap current physics in response to magnetic island formation has long been recognized. In this work we discuss a numerical solution of the second-order[1] drift-kinetic equation (DKE) which supplies the bootstrap current closure for the perturbed Ohms Law in simulations of slowly growing, neoclassical tearing modes. Important aspects of this numerical solution include the conservative properties of the adopted Chapman-Enskog like approach as well as the fully implicit solution for the electron DKE which is staggered in time from the advancing fluid equations. The complexity of the analytic formulation and numerical implementation makes verification of this closure paramount. To this end, we compare axisymmetric NIMROD calculations with the results of NEO[2], which numerically solves the DKE in 2D geometry, and with various analytic formulas.

[1]J. Ramos, private communication
[2]E. A. Belli, J. M. Candy PPCF 50, 095010 (2008).

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