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Comparison of M3DC1 Finite-Elements Code to Analytic Asymptotic Matching Solutions of Tearing Modes ANDREW RITCHIE, Whitworth University, THOMAS SCAFFIDI, Ecole Normale Superieure, STEPHEN JARDIN, Princeton Plasma Physics Laboratory — The M3DC1 implicit high-order two-fluid finite-element plasma-modeling code has been benchmarked in the linear resistive regime by comparison to an asymptotic matching solution for the case of a tearing mode instability in a circular cylindrical tokamak. The instability is driven by current and pressure gradients and involves reconnection of the magnetic field. The asymptotic matching technique combines the solution to the resistive magnetohydrodynamic (MHD) equations in the thin region around the mode rational surface with the solution to the ideal MHD equations beyond it. The M3DC1 and asymptotic matching results for the mode growth rate were compared over a wide range of Lundquist numbers ($10^4 < S < 10^8$) where both methods were expected to be valid. The mode growth rate calculated by M3DC1 is shown to be convergent both with decreasing time step and mesh size around the mode rational surface for a wide range of mesh adaptation parameters. Good agreement was found between the converged M3DC1 results and the asymptotic matching code, supporting the accuracy of the M3DC1 code.

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