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Transport timescale calculations of sawteeth and helical structures in non-circular tokamak plasmas STEPHEN JARDIN, Princeton Plasma Physics Laboratory, NATE FERRARO, General Atomics, JOSH BRESLAU, JIN CHEN, Princeton Plasma Physics Laboratory — We present results of using the implicit 3D MHD code M3D-C^1 [1,2] to perform 3D nonlinear magnetohydrodynamics calculations of the internal dynamics of a shaped cross-section tokamak plasma that span the timescales associated with ideal and resistive stability as well as parallel and perpendicular transport. We specify the transport coefficients and apply a "current controller" that adjusts the boundary loop-voltage to keep the total plasma current fixed. The 3D 2-fluid plasma model advances the magnetic field, velocities, electron and ion temperatures, and plasma density. We find that the plasma either reaches a stationary quasi-helical state in which the central safety factor is approximately unity, or it periodically undergoes either simple or compound sawtooth oscillations [3] with a period that approaches a constant value. By comparing a dee-shaped cross section with an elliptical shaped cross section, it is shown that the plasma shape has a large effect on determining the sawtooth behavior and the associated mode activity. Application to ITER shaped tokamak plasmas predict the magnitude of the 3D boundary deformation as a result of a stationary quasi-helical state forming in the interior.

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