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Algorithm for Calculating the Time Evolution of a Neoclassical Tearing Mode Using an Electrostatic Gyrokinetic Code coupled to a 3D Equilibrium Solver[1] A. REIMAN, Princeton Plasma Physics Laboratory — We present an algorithm for calculating the time evolution of a neoclassical tearing mode as it passes through a sequence of equilibria by coupling the PIES 3D equilibrium code to an electrostatic gyrokinetic code. The key is the observation that by working in the Coulomb gauge it is possible to reduce the solution for the inductive component of the electric field to the solution of a 3D Poisson equation for the gauge function. This equation can be solved using the existing capability in the PIES code for solving the 3D Poisson equation. It is also notable that the gyrokinetic code can be used to incorporate kinetic and flow effects, as well as the effects of electrostatic turbulence, in the equilibrium solutions. This is the case because the PIES code solves the equilibrium equations in the form $\nabla\times\mathbf{B} = \mathbf{j}(\mathbf{B})$, where $\mathbf{j}(\mathbf{B})$ is a nonlinear function that determines the equilibrium current density, $\mathbf{j}$, in the presence of a given field, $\mathbf{B}$. The additional physics can be incorporated by calculating $\mathbf{j}_\perp$ directly from a pullback transformation of the drift velocities, using four-point averaging. The bootstrap current calculated by the gyrokinetic code can be self-consistently incorporated as the constant of integration for the equation determining $j_{||}$.

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Allan Reiman

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