Abstract Submitted
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Numerical calculation of neoclassical distribution functions in an axisymmetric torus[1] B.C. LYONS, S.C. JARDIN, PPPL, J.J. RAMOS, MIT PSFC — We solve for stationary, axisymmetric distribution functions (f) in the conventional banana regime for both ions and electrons using a set of drift-kinetic equations (DKEs) with complete Landau collision operators. Solubility conditions on the DKEs determine the relevant non-Maxwellian pieces of f (called f_{NM}). We work in a 4D phase space in which ψ defines a flux surface, θ is the poloidal angle, v is the total velocity, and λ is the pitch angle parameter. We expand f_{NM} in finite elements in both v and λ. The Rosenbluth potentials, Φ and Ψ, which define the collision operator, are expanded in Legendre series in $\cos\chi$, where χ is the pitch angle, Fourier series in $\cos\theta$, and finite elements in v. At each ψ, we solve a block tridiagonal system for f_{NMi} (independent of f_e), then solve another block tridiagonal system for f_{NMe} (dependent on f_i). We demonstrate that such a formulation can be accurately and efficiently solved. Results will be benchmarked against other codes (e.g., NEO) and could be used as a kinetic closure for an MHD code (e.g., M3D-C1). Results will also include the lowest-order collisionality correction and the use of generalized Grad-Shafranov equilibria.

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