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Numerical calculation of the neoclassical electron distribution function in an axisymmetric torus[1] B.C. LYONS, S.C. JARDIN, PPPL, J.J. RAMOS, MIT PSFC — We solve for a stationary, axisymmetric electron distribution function (f_e) in a torus using a drift-kinetic equation (DKE) with complete Landau collision operator. All terms are kept to gyroradius and collisionality orders relevant to high- temperature tokamaks (i.e., the neoclassical banana regime for electrons). A solubility condition on the DKE determines the non-Maxwellian pieces of f_e (called f_{NMe}) to all relevant orders. We work in a 4D phase space $(\psi, \theta, v, \lambda)$, where 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_{NMe} 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_{NMe}, Φ, and Ψ simultaneously, resulting in a neoclassical f_e for the entire torus. Our goal is to demonstrate that such a formulation can be accurately and efficiently solved numerically. Results will be compared to other codes (e.g., NCLASS, NEO) and could be used as a kinetic closure for an MHD code (e.g., M3D-C1).

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