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**Neoclassical parallel closures in axisymmetric toroidal plasmas** M. SHARMA, J.-Y. JI, E.D. HELD, Utah State University — Neoclassical closures for the parallel conductive heat fluxes and stresses are derived. A Chapman-Enskog-like approach is adopted with time-dependent effects small compared to parallel free streaming and collisional effects. Distribution function is written as the sum of a dynamic Maxwellian and a kinetic distortion, $F$, expanded in Legendre polynomials $P_l(v_\parallel/v)$. To lowest order, the magnetic moment and total energy of the particles are conserved. For an accurate treatment of collisional effects, a moment approach is applied to the full, albeit linearized Coulomb collision operator. In contrast to previous derivations,[1] this work does not use a bounce-average to aid in the solution of the drift kinetic equation. Instead, the parallel gradient operator, which acts on $F$ as well as $v_\parallel/v$, is inverted via the Legendre-polynomial expansion and subsequent diagonalization of the differential equation system for the expansion coefficients. This approach allows for parallel acceleration as well as examination of the closures in higher regimes of collisionality i.e., the plateau and Pfirsch-Schlueter regimes. The application of these closures to NTM simulations using the NIMROD code is also discussed.

[1]E.D. Held, *et al.*, Phys. Plasmas **10**, 3933 (2003).

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