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Particle-based closure relations for Neoclassical MHD Studies¹ D.

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The nonlinear dynamics of neoclassical MHD tearing modes (NTM) are significantly influenced by the variation of the local (perturbed) bootstrap current within magnetic tearing mode island regions. The bootstrap current is introduced into the MHD equations through closure relations involving the parallel component of the pressure tensor. The three-dimensional magnetic field structure within island regions, coupled with the need to retain one and possibly two velocity dimensions motivates the use of Monte Carlo methods. We have adapted the DELTA5D stellarator particle code for the calculation of such closure relations. A new delta-f partitioning has been used so that plasma flows and gradients can be held constant while viscous coefficients are calculated by the particle code. This method has been successfully tested against the DKES code for axisymmetric equilibria. Second, an improved compressed representation of the magnetic field data has been developed using principal orthogonal decomposition methods and singular value decomposition. This has been applied to data from the M3D MHD code and should lead to improved performance and a decreased memory footprint for the particle calculation.

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