DISCONTINUOUS GALERKIN METHOD FOR NON-EQUILIBRIUM PLASMA FLOWS

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We present a new high-order method for the two-species viscous MHD equations in two and three dimensions. The implementation is based on a discontinuous Galerkin formulation for the hyperbolic contributions combined with a mixed Galerkin formulation for the diffusive contributions. A spectral/hp element algorithms is described with standard unstructured and hybrid discretizations. The characteristics for the extended system obtained accommodate the divergence-free condition for the magnetic field. In order to model non-equilibrium plasma, two different energy equations are applied; one is for ions and the other one is for electrons. We present several results and demonstrate high-order accuracy of the method. In both two- and three-dimensions exponential accuracy is obtained. The difference between convergence results using one-species model and those using two-species model are investigated. Model problems include flow past cylinder, sphere and micro-pulsed-plasma-thruster.