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Resistive MHD in HYDRA Using Vector Finite Elements on 3D ALE Structured Hexagonal Meshes[1] J. KONING, G. KERBEL, M. MARINAK, LLNL — The electromagnetic diffusion equations in the small Hall parameter limit are discretized using a mixed vector finite element method on 3D semistructured grids. The discretizations are based on H(grad), H(curl) and H(div) conforming finite element spaces combined with an implicit, unconditionally stable time differencing method. The electric field solve follows a formulation developed by Bochev et.al. augmented by the addition of the electron pressure gradient term from the generalized Ohm's law. The conforming finite element spaces provide an approximation to an exact De Rham complex preserving the divergence free magnetic field over all space and time. The electromagnetic field time advancement works in conjunction with HYDRA, an ALE radiation-hydrodynamics code, providing force coupling and an arbitrary divergence preserving remap of the magnetic field. A constrained transport method with good energy conservation properties utilizes the conforming finite element spaces for the remap. This development represents the first stage of an effort to develop a more complete electron Hall MHD model for electron thermal transport in HYDRA. Bochev, et al, ETNA, Vol 15 (2003).

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