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Discontinuous Galerkin Methods for Magnetohydrodynamics.

Standard shock-capturing numerical methods fail to give accurate solutions to the equations of magnetohydrodynamics (MHD). The essential reason for this failure is that by ignoring the divergence-free constraint on the magnetic field, these methods can be shown to be entropy unstable. In this talk we will briefly review the entropy stability theorem for discontinuous Galerkin (DG) methods. We will then present a class of constrained transport (CT) methods that we will give both stable and accurate results on several test cases. The proposed CT approach can be viewed as a predictor-corrector method, where an approximate magnetic field is first predicted by a standard DG method, and then corrected through the use of a magnetic potential. Finally, we will briefly describe efforts to extend this approach to Hall MHD and genuinely two-fluid plasma models. (Received February 01, 2010)