

An Explicit Divergence-Free Upwinding Method for the MHD-Equations

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Abstract: Many flows, particularly astrophysical flows, are electrically conducting, and the electromagnetic forces can be of the same order as the hydrodynamic forces. The governing equations of Magnetohydrodynamics (MHD) basically merges the Euler equations of gas dynamics with the Maxwell equations of electromagnetic. A feature of the MHD-equation, in contrast to the Euler system, is the additional constrain $\operatorname{div} B = 0$ on the magnetic field. Based on the Method of Transport, which will be explained briefly, we will present an explicit multi-dimensional upwind scheme for the MHD-equations, which conserves $\operatorname{div} B$ according to a numerical divergence-operator and whose timestep is fully local.

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