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Three Magnetized Noh Problems as Verification Tests for MHD Codes[1] J.L. GIULIANI, A.L. VELIKOVICH, A. BERESNYAK, Naval Research Laboratory, S.T. ZALESAK, Berkeley Research Associates — In a recent published work [1], the cylindrical version of the classical hydrodynamic Noh problem was generalized to the magnetohydrodynamic (MHD) realm through a self-similar solution that included an azimuthal magnetic field. We have extended this class of magnetized Noh verification tests to two new self-similar solutions that include both axial and azimuthal fields. Physical constraints on the azimuthal current density at the axis limit the ratio of specific heats to $1<\gamma<3/2$ and $\gamma=2$. Several MHD codes successfully match the $\gamma=2$ case in cylindrical and 2D Cartesian coordinates. However, no MHD code tested so far has been able to reproduce the $\gamma=1.1$ case in Cartesian geometry. This indicates either a difficulty in Cartesian grid modeling of Z-pinches or that the $\gamma=1.1$ solution is physically unstable. We are investigating the stability of this MHD solution in r-phi coordinates with a numerical technique originally developed to analyze linear stability for compressible hydrodynamics [2]. Summarizing, we have developed a set of three magnetized Noh, self-similar solutions as verification tests for MHD codes. [1] Velikovich, et al., Phys. Plasmas, 19, 012707 (2012). [2] Zalesak, et al., Physics of Plasmas, 12, 056311, 2005.

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