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FOI-PERFECT code: 3D relaxation MHD modeling and Applications[1] GANG-HUA WANG, SHU-CHAO DUAN, Institute of Fluid Physics, COMUTATIONAL PHYSICS TEAM TEAM — One of the challenges in numerical simulations of electromagnetically driven high energy density (HED) systems is the existence of vacuum region. FOI-PERFECT code adopts a full relaxation magnetohydrodynamic (MHD) model. The electromagnetic part of the conventional model adopts the magnetic diffusion approximation. The vacuum region is approximated by artificially increasing the resistivity. On one hand the phase/group velocity is superluminal and hence non-physical in the vacuum region, on the other hand a diffusion equation with large diffusion coefficient can only be solved by implicit scheme which is difficult to be parallelized and converge. A better alternative is to solve the full electromagnetic equations. Maxwell's equations coupled with the constitutive equation, generalized Ohm's law, constitute a relaxation model. The dispersion relation is given to show its transition from electromagnetic propagation in vacuum to resistive MHD in plasma in a natural way. The phase and group velocities are finite for this system. A better time stepping is adopted to give a 3rd full order convergence in time domain without the stiff relaxation term restriction. Therefore it is convenient for explicit & parallel computations. Some numerical results of FOI-PERFECT code are also given.

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