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A Lagrangian code for simulating compressible large deformation multi-material MHD processes BO XIAO, HAI-BO ZHAO, JIN-SONG BAI, GANGHUA WANG, Insititute of Fluid Physics, CAEP, COMPUTATIONAL PHYSICS TEAM — A 2-dimensional Lagrangian code, named TriAngels-MHD, is made for the simulation of compressible large deformation multi-material MHD processes. The Lagrangian scheme is built on pure triangular mesh. The MHD simulation is split into a hydrodynamic step (ideal MHD step) and a magnetic diffusion step. For the hydrodynamic step, to conquer the mesh distortion problem in a Lagrangian scheme, a dynamic local remeshing algorithm is designed. And to mitigate the checkerboard oscillation problem that is typical for a triangular mesh based Lagrangian simulation, a matter flow term is introduced for each grid edge, which compensates for the non-bending of a grid edge. For the magnetic diffusion step, the Joule heat is calculated based on a formula of $\frac{\partial e_J}{\partial t} = \nabla\cdot(\frac{\eta}{\mu_0}\vec{B}\times(\nabla\times\vec{B})) - \frac{\partial}{\partial t}(\frac{1}{2\mu_0}B^2)$. This scheme insures the equality of the total Joule heat production and the total electromagnetic energy loss in the system. Typical simulations are carried out to test the performance of the Lagrangian code, including the pure hydrodynamic processes of Noh explosion test problem and triple-point problem and the MHD process of magneto-Rayleigh-Taylor instability evolution.

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