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Large Eddy Simulations of 2D Lattice Boltzmann MHD Turbulence CHRISTOPHER FLINT, GEORGE VAHALA, William & Mary, LINDA VAHALA, Old Dominion University, MIN SOE, Rogers State University — Dellar's LBM of 2D incompressible MHD introduced both a velocity and magnetic distribution functions. As a result div $\mathbf{B} = 0$ is automatically enforced through the trace of an antisymmetric perturbed tensor. We have extended this algorithm to 3D MHD turbulence, with excellent parallelization to many thousands of cores. In LES of MHD turbulence, only the subgrid modes are modeled for using some ad hoc closure scheme. In the Smagorinsky model, the filtered Reynolds stresses are modeled by mean field gradient terms. Recently, Ansumali et. al. have developed an LES for Navier-Stokes turbulence by filtering the underlying mesoscopic LB. The filtered LB equations are then subjected to the Chapman-Enskog expansion. A Smagorinsky LES is recovered with no ad hoc assumptions other than the subgrid terms contribute at the transport time scales. This forces a relationship between the filter width and the Knudsen number. Here we extend these ideas to MHD turbulence and achieve closures under the simple assumption that the subgrid terms affect the evolution on the transport time scale. These ideas will first be tested on the flow of 2D jets in a magnetic field. The DNS data base is being generated from a multiple relaxation time (MRT) model for both the velocity and magnetic fields.

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