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Advection Scheme for Phase-changing Porous Media Flow of Fluids with Large Density Ratio¹ DUAN ZHANG, JUAN PADRINO, Los Alamos National Laboratory — Many flows in a porous media involve phase changes between fluids with a large density ratio. For instance, in the water-steam phase change the density ratio is about 1000. These phase changes can be results of physical changes, or chemical reactions, such as fuel combustion in a porous media. Based on the mass conservation, the velocity ratio between the fluids is of the same order of the density ratio. As the result the controlling Courant number for the time step in a numerical simulation is determined by the high velocity and low density phase, leading to small time steps. In this work we introduce a numerical approximation to increase the time step by taking advantage of the large density ratio. We provide analytical error estimation for this approximate numerical scheme. Numerical examples show that using this approximation about 40-fold speedup can be achieved at the cost of a few percent error.

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