AN EXACTLY CURL-FREE SCHEME FOR A HYPERBOLIC MODEL OF COMPRESSIBLE TWO-FLUID FLOWS

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Abstract. We present a structure-preserving scheme for the compressible two-velocity two-pressure two-fluid model of Romenski *et. al* [**?**, **?**] in the barotropic case. The governing equations are derived in the scope of symmetric hyperbolic thermodynamically compatible models and consist in a set of first-order hyperbolic conservation laws. In the absence of algebraic sources terms, the model is submitted to a curl-free constraint affecting the relative velocity, which nevertheless allows to recover strong hyperbolicity in multiple space dimensions. Thus, in order to preserve this structure at the numerical level, the model is solved numerically using a second-order exactly curl-free finite volume scheme. The method is based on a staggered grid discretization where the curl-bound vector is stored in the cell vertexes while all the remaining variables are stored in the cell centers. This allows to define specific discrete compatible gradient and curl operators that ensure the discrete curl errors are zero at the machine level precision. Lastly, we present a set of numerical results further emphasizing this property.

Keywords: Multiphase flows, Hyperbolic models, curl-free schemes, structure-preserving,

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