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Towards a geometric variational discretization of compressible fluid dynamics

We present a geometric variational discretization of compressible fluid dynamics. The numerical scheme is obtained by discretizing, in a structure preserving way, the Lie group formulation of fluid dynamics on diffeomorphism groups and the associated variational principles. Our framework applies to irregular mesh discretizations in 2D and 3D. It systematically extends work previously made for incompressible fluids to the compressible case. We consider in detail the numerical scheme on 2D irregular simplicial meshes and evaluate the behavior of the scheme for the rotating shallow water equations. While our focus is fluid mechanics, our approach is potentially useful for discretizing problems involving evolution equations on diffeomorphism groups.