Abstract Submitted
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High order accurate finite difference schemes based on symmetry preservation ERSIN OZBENLI, PRAKASH VEDULA, U. Oklahoma, Norman — A new algorithm for development of high order accurate finite difference schemes for numerical solution of partial differential equations using Lie symmetries is presented. Considering applicable symmetry groups (such as those relevant to space/time translations, Galilean transformation, scaling, rotation and projection) of a partial differential equation, invariant numerical schemes are constructed based on the notions of moving frames and modified equations. Several strategies for construction of invariant numerical schemes with a desired order of accuracy are analyzed. Performance of the proposed algorithm is demonstrated using analysis of one-dimensional partial differential equations, such as linear advection diffusion equations inviscid Burgers equation and viscous Burgers equation, as our test cases. Through numerical simulations based on these examples, the expected improvement in accuracy of invariant numerical schemes (up to fourth order) is demonstrated. Advantages due to implementation and enhanced computational efficiency inherent in our proposed algorithm are presented. Extension of the basic framework to multidimensional partial differential equations is also discussed.

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