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High-order energy-stable boundary treatment for finite-difference cut-cell method NEK SHARAN, PETER BRADY, DANIEL LIVESCU, Los Alamos National Lab — Cut-cell methods simplify grid generation for fluid-flow simulations over complex geometries. Construction of high-order boundary implementation for cut-cell discretization that also provably satisfies stability and conservation constraints, however, remains a challenge, especially for hyperbolic equations. Existing energy-stability proofs of finite-difference methods for initial-boundary value problems require imposing the boundary conditions weakly or by a projection approach, where the computed boundary values may not be exact. Inexact boundary values may be adequate for estimates in certain applications, but they can adversely influence turbulence/mixing statistics in a direct numerical simulation. A framework to prove energy-stability with strong boundary treatment is developed and used to obtain boundary implementation for a Cartesian cut-cell discretization. Linear and non-linear numerical tests to verify the accuracy, stability and conservation properties of the developed method will be discussed.

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