Large CFL explicit scheme for one-dimensional shallow water equations

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Abstract

A large CFL algorithm is presented for the explicit, finite volume solution of hyperbolic systems of conservation laws, with a focus on the shallow water equations. The Riemann problems used in the flux computation are determined using averaging kernels that extend over several computational cells. The usual Courant-Friedrichs-Lewy stability constraint is replaced with a constraint involving the kernel support size. This makes the method unconditionally stable with respect to the size of the computational cells, allowing the computational mesh to be refined locally to an arbitrary degree without altering solution stability. The practical implementation of the method is detailed for the shallow water equations with topographical source term. Computational examples are provided for 1D and 2D examples.

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