

A Godunov-type projection scheme for sound-proof models

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There is a close structural similarity between Bannon's anelastic, Durran's pseudo-incompressible, and the full compressible Euler equations when all are written in conservation form for mass, momentum, and potential temperature. Working from this observation, I am currently developing a second-order finite volume scheme that addresses these equation systems through an uniform approach. The scheme uses Godunov-type / MUSCL upwind techniques for advection and a projection approach to handle the stiff pressure terms. The current implementation also employs directional operator splitting.

Besides the overall design of the scheme we will discuss in particular

- an advection scheme that avoids the clipping of extrema induced by standard slope limiters but nevertheless maintains constant plateaus of the advected scalars well,
- the temporal discretization using ideas from auxiliary variable projection methods, and

an inf-sup-stable projection and its derivative as employed here.