A compatible finite element ALE scheme for multi-material shock hydrodynamics

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The main ideas of compatible Lagrangian hydrodynamics were originally developed in the form of a finite volume scheme by Caramana, Shashkov and Burton et al at LANL [1,2,3,4]. The compatible approach is based around two key ideas; a stronger Lagrangian assumption, where corner masses are treated as Lagrangian objects as well as the elements and the enforcement of consistency between the solution of the momentum and internal energy equations. This provides a means of improving total energy conservation and allows greater flexibility in the types of force that can be allowed in a zone for staggered grid schemes. This in turn offers significant benefits in terms of accuracy and robustness over the conventional staggered grid schemes traditionally employed in hydrocodes.

This talk will discuss a compatible finite element Arbitrary Lagrangian Eulerian (ALE) hydrodynamics method that has been developed and implemented in CORVUS [5], AWE’s 2D Arbitrary Lagrangian Eulerian (ALE) code. The talk will first describe the development of a compatible Lagrangian finite element scheme and then move on to describe the extension of this scheme to enable it to be applied as the Lagrangian step of a multi-material Arbitrary Lagrangian Eulerian code [6]. Test problems and applications will be also presented to demonstrate the benefits and performance of the scheme.

References


