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An Exact Riemann Solver for a Granular Mixture Model with Multiple Solid Components[1] MICHAEL CROCHET, KEITH GONTHIER, Louisiana State University — The solution of the two-phase Riemann problem is an essential component of finite-volume numerical methods applied to hyperbolic systems of multiphase model equations. These are typically used to study deflagration-to-detonation transition in energetic materials, and predict flow field structures associated with the dynamic compaction of gas–granular solid mixtures. A widely-used two-phase model has been extended recently to include an arbitrary number of solid components, which can be used to analyze the thermomechanical behavior of metallized explosives and mixtures containing multiple solid grain sizes. Although a solution to the two-phase Riemann problem has been formulated for gamma-law equations of state, there is currently no available solution for the N-phase analogue in the literature. Here, an extension of the exact two-phase solution to systems containing multiple solid phases is developed, where each phase is governed by general, convex equations of state. The resulting Riemann solver can be used in the verification of existing numerical schemes, and also serve as a framework for the future construction of upwind, Godunov-based numerical methods. A general overview of the solver methodology is given, and three-phase example problems are considered.

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