

# Multiphase Godunov-typed Smoothed Particle Hydrodynamics Method with Approximate Riemann Solvers

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**Abstract:** In this paper, we propose a Multiphase Godunov-typed Smoothed Particle Hydrodynamics (MGSPH) method for simulating multi-fluid Riemann problems. In this method, different EOSs are applied on different materials; and interfacial approximate Riemann solvers are introduced on the interfacial particle pairs to deal with the transition between different EOSs. Various combinations of five kinds of single-phase approximate Riemann solvers (LLXF, ROE, HLLE, HLLC, DUCO) and three types of interface approximation Riemann solvers (ROE, LRS, RRS) are comparatively studied in three numerical tests. It turns out that LLXF and HLLE give worse results than other approximate Riemann solvers; and pressure instabilities are observed when applying RRS on interfacial particle pairs. In general, the combinations of DUCO+ROE and DUCO+LRS may be the suitable choices for MGSPH in simulating multiphase Riemann problems.

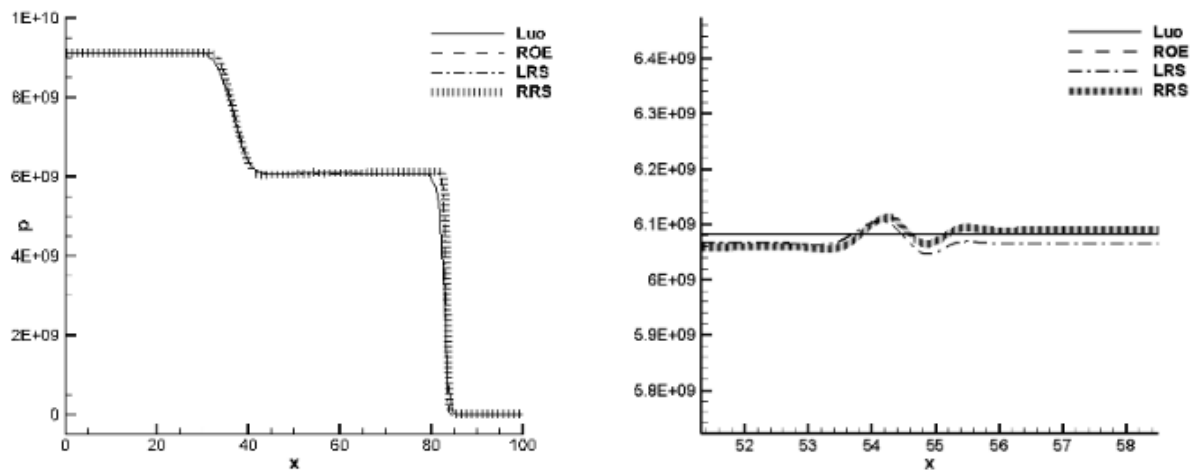


Figure 1: Gas-water shock tube problem. The solutions of  $t = 0.000156$ . Left: pressure; right: broken features