

A Unified Computing Method for Compressible and Incompressible Flows Applied to Hydrodynamic Cavitation

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Abstract: The homogeneous equilibrium model for flows with cavitation gives rise to a nonconvex hyperbolic system. In applications of this model the effective Mach number M varies enormously (typically $0.001 < M < 25$). Therefore computing methods must have Mach-uniform accuracy and efficiency. The approach taken is to generalize the classical staggered Marker-and-Cell scheme, originally designed for incompressible flows, to compressible flows and to general coordinates. Issues related to accuracy of staggered schemes on rough curvilinear grids are discussed. Use of the pressure-correction method ensures efficiency for $M \ll 1$. Good performance for intermediate and large Mach numbers is demonstrated, and application to flows with cavitation is shown. This is joint work with Duncan van der Heul.