Conservative Front-Tracking Method for 2D Euler System and Numerical Simulation of Shock-Bubble Interactions

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Abstract: In this talk we are going to introduce a conservative front-tracking method for the 2D Euler system developed in [D. K. Mao, Towards front-tracking based on conservation in two space dimensions II, tracking discontinuities in capturing fashion, J. Comput. Phys., 226, 1550-1588(2007)] and [D. K. Mao, Towards front tracking based on conservation in two space dimensions, SIAM. J. Sci. Comput., 22, 113-151(2000)] and references cited therein. In the method, the movement of material interfaces is locally described by 1D conservation laws (CLs) derived from the Euler system, and the tracking is realized by numerically solving these 1D CLs in a conservative fashion. The method is thus conservative, good in preserving physical structures of the tracked material interfaces, and much simpler compared with other front-tracking methods. A numerical surface dissipation is designed in the method, which stabilizes the tracked interfaces and eliminates the numerical artifacts usually caused by numerical dissipation observed in many other methods. Numerical simulation of two shock-bubble interactions described in [J. F. Hass & B. Sturtevant, Interaction of weak shock waves with cylindrical and spherical gas inhomogeneities, J. Fluid Mech., 181, 41-76(1987)] is presented to show the efficiency and effectiveness of the method.

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