

Thermodynamical Effects of the GRP Solver and its Application for Compressible Multi-fluid Flows

Jiequan Li¹, Jin Qi² and Yue Wang³

¹ Laboratory of Computational Physics, Institute of Applied Physics and Computational Mathematics, No. 6 Huayuan Road, Haidian district, Beijing, China,

li_jiequan@iapcm.ac.cn

² Institute of Applied Physics and Computational Mathematics, No. 2 Fenghao East Road, Haidian district, Beijing, China, qi_jin@iapcm.ac.cn

³ Laboratory of Computational Physics, Institute of Applied Physics and Computational Mathematics, No. 2 Fenghao East Road, Haidian district, Beijing, China,

wang_yue@iapcm.ac.cn

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One of the fundamental differences of compressible fluid flows from incompressible fluid flows is the involvement of thermodynamics. This difference should be manifested in the design of numerical methods and seems often be neglected in addition that the entropy inequality, as a conceptual derivative, is taken into account to reflect irreversible processes and verified for some first order schemes. In this talk, we refine the GRP solver to illustrate how the thermodynamical variation is integrated into the design of high resolution methods for compressible fluid flows and demonstrate numerically the importance of thermodynamic effect in the resolution of strong waves. We also rewrite the GRP solver for general equations of state. As a by-product, we show that the GRP solver works for the one dimensional multi-fluid dynamics and a two-stage fourth order temporal discretization of GRP-DG methods is developed for compressible fluid dynamics.

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