A semi-implicit collocation method: Application to thermal convection in 2D compressible fluids. (English) Zbl 0724.76069

Summary: A semi-implicit pseudo-spectral collocation method using a third-order Runge-Kutta numerical scheme for the full Navier-Stokes equations is described. The Courant-Friedrichs-Lewy condition is overcome by the implicit handling of a diffusive term, as suggested by D. S. Harned and W. Kerner [J. Comput. Phys. 60, 62-75 (1985; Zbl 0581.76057)]. All such terms are solved with an iterative scheme in the Fourier space. Simulation of thermal convection in 2D compressible fluids is made by expanding variables on a Fourier-Chebyshev basis. We give some examples of sub- and supersonic steady solutions in the case where the heat flux at the upper boundary is governed by a black body.

MSC:

76M25 Other numerical methods (fluid mechanics) (MSC2010)
76R10 Free convection
76N10 Existence, uniqueness, and regularity theory for compressible fluids and gas dynamics

Keywords:

semi-implicit pseudo-spectral collocation method; third-order Runge-Kutta numerical scheme; full Navier-Stokes equations; Courant-Friedrichs-Lewy condition

Full Text: DOI

References:


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