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Klein, R.; **Botta, N.**; **Schneider, T.**; **Munz, C. D.**; **Roller, S.**; **Meister, A.**; **Hoffmann, L.**; **Sonar, T.**

Asymptotic adaptive methods for multi-scale problems in fluid mechanics. (English)

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J. Eng. Math. 39, No. 1-4, 261-343 (2001).

The authors look into the reasons for the failure of standard numerical techniques in singular limit regimes, and propose some asymptotic adaptive methods which are of reality and potential. To identify an asymptotic limit regime, it is very important to define non-dimensional scalar parameters, for example, Reynolds number or Mach number. As illustrating examples, the authors consider here low-Mach-number weakly compressible flows, magnetohydrodynamics for small Mach and Alfvén numbers, and atmospheric flows in the case of equal vanishing Mach and Froude numbers, namely $\mathrm{Fr} = M$, $M \to 0$. The readers will be brought into a strict mathematical framework of the asymptotics and the corresponding numerical procedures based on the multiple-scale analysis. Numerical results reveal that the present technique is effective and convenient, and numerical methods are robust, uniformly accurate, and efficient in a wide range of relevant applications.

Reviewer: Ji-Huan He (Shanghai)

MSC:

76M45	Asymptotic methods, singular perturbations applied to problems in fluid mechanics	Cited in **55** Documents
76G25	General aerodynamics and subsonic flows	
76W05	Magnetohydrodynamics and electrohydrodynamics	

Keywords:

asymptotic adaptive methods; low-Mach-number weakly compressible flows; singular limit regimes; atmospheric flows; magnetohydrodynamics; multiple-scale analysis

Software:

HE-E1GODF

Full Text: DOI

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