Weiss, Jonathan M.; **Smith, Wayne A.**

Preconditioning applied to variable and constant density flows. (English) Zbl 0849.76072

AIAA J. 33, No. 11, 2050-2057 (1995).

Summary: A time-derivative preconditioning of the Navier-Stokes equations, suitable for both variable and constant density fluids, is developed. The ideas of low-Mach-number preconditioning and artificial compressibility are combined into a unified approach designed to enhance convergence rates of density-based, time-marching schemes for solving flows of incompressible and variable density fluids at all speeds. The preconditioning is coupled with a dual time stepping scheme implemented within an explicit, multistage algorithm for solving time-accurate flows. The resultant time integration scheme is used in conjunction with a finite volume discretization designed for unstructured, solution-adaptive mesh topologies. This method is shown to provide accurate steady-state solutions for transonic and low-speed flow of variable density fluids. The time-accurate solution of unsteady, incompressible flow is also demonstrated.

MSC:

76M25	Other numerical methods (fluid mechanics) (MSC2010)	Cited in **1** Review
76N10	Existence, uniqueness, and regularity theory for compressible fluids and gas dynamics	Cited in **133** Documents
76D05	Navier-Stokes equations for incompressible viscous fluids	

Keywords:

artificial compressibility; dual time stepping scheme; multistage algorithm; finite volume discretization

Full Text: DOI