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Physics based GMRES preconditioner for compressible and incompressible Navier-Stokes equations. (English) Zbl 0957.76032

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From the summary: This paper presents the implementation of a local physics preconditioning mass matrix for an unified approach to three-dimensional compressible and incompressible Navier-Stokes equations using an SUPG finite element formulation and GMRES implicit solver. The local feature of the preconditioner presented here means that no communication among processors is needed when working on parallel architectures. Due to these facts, we consider that this research can make some contributions towards the development of a unified fluid dynamic model with high rates of convergence for any combination of Mach and Reynolds numbers, being very suitable for massively parallel computations. Finally, it is important to remark that, while this kind of preconditioning produces stabilized results in nearly incompressible regimes, the standard version exhibits some numerical drawbacks that lead to solutions without physical meaning.

MSC:

76M10 Finite element methods applied to problems in fluid mechanics

76N15 Gas dynamics (general theory)

76D05 Navier-Stokes equations for incompressible viscous fluids

65Y05 Parallel numerical computation

Cited in **9** Documents

Keywords:

compressible Navier-Stokes equations; variational formulation; local physics preconditioning mass matrix; incompressible Navier-Stokes equations; SUPG finite element formulation; GMRES implicit solver; parallel architectures; unified fluid dynamic model; nearly incompressible regimes

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