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A pseudospectral method for solution of the three-dimensional incompressible Navier-Stoke equations. (English) [Zbl 0658.76027]


A new collocation spectral method is presented for solving the three-dimensional incompressible Navier-Stokes equations in primitive variables for nonperiodic boundary conditions. The functions are expanded in Chebyshev polynomials, the equations are collocated at the Chebyshev points, and Chorin’s splitting method is used for the time discretization. For the resulting pressure Poisson equation a direct fast solver is proposed which is based on eigenfunction decompositions. This greatly reduces the computer storage requirements for solving the linear systems. The method is tested on the two- and three-dimensional cavity flow problem.

Reviewer: W. Zulehner

MSC:
76D05 Navier-Stokes equations for incompressible viscous fluids
65M99 Numerical methods for partial differential equations, initial value and time-dependent initial-boundary value problems
65N35 Spectral, collocation and related methods for boundary value problems involving PDEs

Keywords:
Chebyshev pseudospectral technique; three-dimensional Navier-Stokes equations; collocation spectral method; three-dimensional incompressible Navier-Stokes equations; nonperiodic boundary conditions; Chebyshev polynomials; Chorin’s splitting method; Poisson equation; three-dimensional cavity flow problem

Full Text: DOI

References:

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