Huser, A.; **Biringen, S.**

Calculation of two-dimensional shear-driven cavity flows at high Reynolds numbers. (English) Zbl 0753.76116

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Summary: The time-dependent Navier-Stokes equations are numerically integrated for two-dimensional incompressible viscous flow in a shear-driven square cavity. Using a time-splitting method and finite differences on a staggered mesh, the momentum and pressure equations are directly solved by a tensor product method where one finite difference direction is diagonalized by eigenvalue decomposition. The effects of increasing Reynolds number are studied and the developing boundary layer is captured by using a finely clustered mesh. At $Re = 30000$ the flow is in a continuously developing unsteady regime. Power spectrum plots indicate that the unsteady flow oscillates with one fundamental frequency and exhibits some characteristics of transition between laminar and turbulent states.

MSC:

76M20 Finite difference methods applied to problems in fluid mechanics
76D05 Navier-Stokes equations for incompressible viscous fluids

Keywords:

time-splitting method; staggered mesh; tensor product method; eigenvalue decomposition; boundary layer

Full Text: DOI

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