

P. Chaviaropoulos and K. Giannakoglou, “A Vorticity-Stream Function Formulation for Steady Incompressible Two-Dimensional Laminar Flows”, Int. Journal for Numerical Methods in Fluids, Vol 23, pp. 431-444, (1996).

Abstract

A vorticity-streamfunction formulation for incompressible planar viscous flows is presented. The standard kinematic field equations are discretized using centred finite difference schemes and solved in a coupled way via a Newton-like linearization scheme. The linearized system of partial differential equations is handled through the restarting linear GMRES algorithm, preconditioned by means of an incomplete LU approximate factorization. The proposed solution technique constitutes a fast and robust algorithm for treating laminar flows at high Reynolds numbers. The pressure field is obtained at a subsequent step by solving a convection-diffusion equation in terms of the stagnation pressure, which presents certain advantages compared with the widely used static pressure Poisson equation. Results are shown for a wide variety of applications including internal and external flows.

Keywords

Laminar Flows, Incompressible Flows, Vorticity-streamfunction Formulation, Krylov Subspace Methods, Preconditioning