

Fourth Order Compact Difference Schemes for Unsteady 2D Incompressible Flow

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Abstract: We present applications and extensions of a compact fourth order finite difference method EC4 (E & Liu) for 2D unsteady incompressible flow in vorticity-stream function formulation utilizing local vorticity boundary conditions. The result is a highly efficient method that is especially suitable for moderate to large Reynolds number flows. As a specific example of its use we will discuss results of a detailed numerical study of an impulsively started flow past a cylinder at high Reynolds numbers. Additionally, we will outline an extension of the method to the Boussinesq equations and present benchmark simulations of a differentially-heated cavity problem, the focus of a special session at the MIT conference on Computational Fluid and Solid Mechanics in June 2001.