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A Taylor–Galerkin-based finite element method for turbulent flows

Chun Bo Jiang

Department of Civil Engineering, Chuo University, Tokyo 112, Japan

Mutsuto Kawahara

Department of Civil Engineering, Chuo University, Tokyo 112, Japan

Kazuo Kashiyama

Department of Civil Engineering, Chuo University, Tokyo 112, Japan

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A finite element method is applied to solve the two-dimensional turbulent channel flows. Based on the fractional step techniques, the momentum and the k–ε equations are split into convection and diffusion equations. The convection equations are solved by the second-order Taylor–Galerkin finite element method, which can overcome the spurious oscillations with minimal artificial diffusion, and the diffusion equations are solved by the fully explicit Galerkin method. Since the same order interpolation is used for the velocity, pressure and turbulent quantities, the present method is computationally efficient. The sudden expansion flow and the obstructed turbulent channel flow are studied. The results are in good agreement with experimental observations.