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Three-Dimensional, Laminar Flow Past a Short, Surface-Mounted Cylinder ANASTASIOS LIAKOS, United States Naval Academy, NIKOLAOS MALAMATARIS, George Mason University/ATEI of Thessaloniki —

The topology and evolution of three-dimensional flow past a cylinder of slenderness ratio $SR = 1$ mounted in a wind tunnel is examined for $0.1 \leq Re \leq 325$ (based on the diameter of the cylinder) where steady-state solutions have been obtained. Direct numerical simulations were computed using an in-house parallel finite element code. Results indicate that symmetry breaking occurs at $Re = 1$, while the first prominent structure is a horseshoe vortex downstream from the cylinder. At $Re = 150$, two foci are observed, indicating the formation of two tornadolike vortices downstream. Concurrently, another horseshoe vortex is formed upstream from the cylinder. For higher Reynolds numbers, the flow downstream is segmented to upper and lower parts, whereas the topology of the flow on the solid boundaries remains unaltered. Pressure distributions show that pressure, the key physical parameter in the flow, decreases everywhere except immediately upstream from the cylinder. In addition, creation of critical points from saddle-node-type bifurcations occur when the streamwise component of the pressure gradient changes sign. Finally, at $Re = 325$, an additional horseshoe vorrtex is formed at the wake of the cylinder

Nikolaos Malamataris
George Mason University

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