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TURBULENT FLOW AROUND A FINITE SURFACE-MOUNTED SQUARE CYLINDER

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Turbulent flow around a surface-mounted square cylinder is a subject receiving much attention in the fields of civil and environmental engineering. In the present study, turbulent flow around a surface-mounted square cylinder of aspect ratio h/d=7 and h/d=4 at Reynolds number of 651 are investigated. Simulations are performed using a Reynolds Stress Model (RSM) in FLUENT. The aim is to investigate the effect of aspect ratio on the flow structure around such cylinders. A large-scale vortex structure in the wake of the finite wall-mounted body is successfully reproduced in the present study, although the flow behind the square cylinder is surprisingly complex and is highly three-dimensional. The results clearly show that the wake structure depends strongly on the aspect ratio. Two different vortex structures are identified with the isosurface of Q, the instantaneous second invariant of the velocity gradient, see Figure 1. The full-loop shedding is present for the case with a higher aspect ratio (h/d=7), while the half-loop shedding is observed for the case with a lower aspect ratio (h/d=4). Although in both cases there exists a downwash near the free-end and an upwash in the base at the junction, the upwash is much stronger in the case of h/d=7. A horseshoe vortex is also observed for both aspect ratios, however the existence of a reverse flow above the top wall of the cylinder is only observed for h/d=4. The effect of the aspect ratio on the flow structure will be discussed further in the full paper.

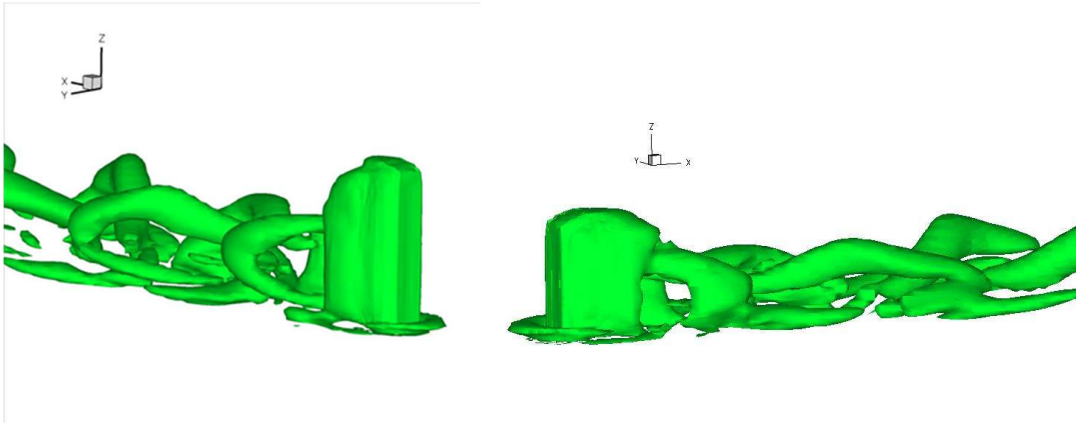

Figure1. Isosurface of instantaneous second invariant of the velocity gradient for h/d=7 (left) and h/d=4 (right).