Two discrete vortex method for application to bluff body aerodynamics

Two-dimensional viscous incompressible flow past a flat plate of finite thickness and length is simulated using the discrete vortex method. Both a fixed plate and a plate undergoing a harmonic heave and pitch motion are studied. The Reynolds number is 104 and the reduced onset flow speed, $U/f_c$ is in the range 2-14. The fundamental kinematic relation between the velocity and the vorticity is used in a novel approach to determine the surface vorticity. An efficient influence matrix technique is used in a fast adaptive multipole algorithm context to obtain a mesh-free method. The numerical results are compared with the steady-state Blasius solution, and with the inviscid solution for the flow past an oscillating plate by Theodorsen.

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