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Flow Control around Bluff Bodies by Attached Permeable Plates

Authors : Gokturk Memduh Ozkan, Huseyin Akilli

Abstract : The aim of present study is to control the unsteady flow structure downstream of a circular cylinder by use of attached permeable plates. Particle image velocimetry (PIV) technique and dye visualization experiments were performed in deep water and the flow characteristics were evaluated by means of time-averaged streamlines, Reynolds Shear Stress and Turbulent Kinetic Energy concentrations. The permeable plate was made of a chrome-nickel screen having a porosity value of β=0.6 and it was attached on the cylinder surface along its midspan. Five different angles were given to the plate (θ=0°, 15°, 30°, 45°, 60°) with respect to the centerline of the cylinder in order to examine its effect on the flow control. It was shown that the permeable plate is effective on elongating the vortex formation length and reducing the fluctuations in the wake region. Compared to the plain cylinder, the reductions in the values of maximum Reynolds shear stress and Turbulent Kinetic Energy were evaluated as 72.5% and 66%, respectively for the plate angles of θ=45° and 60° which were also found to be suggested for applications concerning the vortex shedding and consequent Vortex-Induced Vibrations.

Keywords : bluff body, flow control, permeable plate, PIV, VIV, vortex shedding
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