EFFECT OF ATTACK ANGLE ON THE DRAG REDUCTION OF SQUARE PRISM BY USING A SMALL ROD

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Aerodynamic characteristics of a square prism were investigated experimentally in the Reynolds number of 2.7×10^4. To control the flow around the square prism a small rod was set upstream of the prism. The side length of the prism and the rod diameter were D = 30 mm and d = 6 mm respectively. Experiments were carried out in wind tunnel for two distances, L/D=1.5 and 2.6, between the bodies which are correspond to two flow patterns with and without vortex shedding from the rod at zero angle of attack. The square prism and rod were positioned at an angle of incidence to the free stream flow direction and turned in the range $0° \leq \alpha \leq 90°$. At different angles of α, the effects of the rod on the pressure distributions, drag and lift coefficients, and vortex-shedding from the square prism were examined.

Vortex shedding from the square prism was detected by using a constant-temperature anemometer with a hot-film probe. The Strouhal numbers for the vortex shedding from the models were determined from the frequency analysis of the velocity fluctuations. The lift and drag coefficients on the square prism were obtained through integrating the pressures on the side surfaces. A single smoke-wire was set in front of the bodies and the flow structure at the mid-span of test section was visualized.

The positions of flow attachments, separations, and reattachments on the square cylinder due to the rod and the attack angle have been clearly obtained from the pressure distributions on the square cylinder and from the flow visualization photographs. The reducing effects of the rod on the drag and lift forces were also discussed.

Keywords: Attack Angle, Drag Reduction, Control Rod, Square Prism, Flow separation