EXPERIMENTAL STUDY OF FLUID FLOW CHARACTERISTIC PASSING THROUGH A D-53-TYPE OF SLICED CYLINDER NEAR SIDE WALL TO LIMIT CHANGES BOUNDARY LAYER THICKNESS ON SIDE WALL

"Case Study For The Effect Of Gap Ratio Cylinder To Side Wall 1,000≤G/D≤1,267"

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Abstract

There are many research efforts have been done to investigate the flow characteristic around a bluff body immersed in a boundary layer, both for academic interest and for a wide range of engineering applications. This kind of study can be applied to many engineering problems such as undersea pipelines, building constructions and tube in heat exchangers, etc. There are certainly the larger number of studies on the flow around a bluff body of various shape located near a plane wall, but is may be still of important to continue studying the flow around a bluff body near a plane wall, especially for a bluff body with a special shape. For special shape of bluff body, it was proposed a D-type cylinder. The D-type cylinder is a circular cylinder which is cut only at the front side in parallel with the-y axis. Hence, the aim of this study is to investigate the flow characteristics around single D-type cylinder placed near a plane wall compared with the circular one. It is subjected to a steady cross flow with varying gap between wall and cylinders.

The experiments where carried out in a subsonic open circuit wind tunnel with test section of 660 mm height, 660 mm width, and 1780 mm length. The cylinder circular and the D-type cylinder with cutting angle of θₛ=53° of PVC tube is used as test
model. The cylinders had external diameters, \( D \), of 60 mm and at the two ends of the cylinders spanning the wind tunnel test-section. A smooth acrylic flat plate 6 mm in thickness and 1160 mm in length was installed 100 mm above the bottom surface of the test section. The leading edge of the plate was sharp-edge with an angle of 30°. The cylinder was located at 430 mm downstream from the leading edge of the flat plate. The boundary layer were artificially thickened either by attaching a wire rod 4 mm in diameter on the plate 10 mm from the leading edge. The free stream velocity in the wind tunnel was constantly maintained at 14 m/s, corresponding to Reynolds number of \( Re=5.3\times10^4 \) (based on diameter of circular cylinder \( D \) and the free stream velocity). The gap distance between the bottom of the cylinders and the flat plate relative to the cylinder diameter (G/D) where varied from 1.000 to 1.267. An inclined kerosene manometer makes possible to measure the pressure distribution around the cylinders and the plane wall. The velocity profile behind the cylinder was measured using a pitot-static tube connected to the inclined manometer. Surface oil-film techniques were used to investigate the flow patterns on the cylinders.

The result show that the wall effect on the D-type cylinder decrease as the gap increase. This is for the both boundary layer thickness tested. Bubble separation occurs on both sides of cylinder for the entired gap ratio tested in this study. It causes massive separation delayed, so that wake behind the cylinder is narrower and it decrease the drag force.

**Key word:** D-type cylinder, cutting angle 53°, near a plane wall.