EXPERIMENTAL STUDY OF FLOW CHARACTERISTIC PASSING THROUGH FOUR I-TYPE SLICED CYLINDERS 53° WITH IN-LINED ARRANGEMENT AND IN-LINED DISTANCE L/D=4 NEAR SIDE WALL ”Case Study for Gap Ratio Cylinder To Side Wall (0≤ G/D ≤0.2)”

Name of Student : Willy Stevanus  
NRP : 2107 100 170  
Department : Mechanical Engineering FTI-ITS  
Advisor Lecturer : Prof. Dr. Ir. Triyogi Yuwono, DEA

Abstract
Different studies show that many interesting and unexpected fluid phenomena may occur when bodies are placed one beside the other, and grouping effect of bodies is a very interesting subject of fundamental research in fluid mechanics. Two circular cylinders in transversal arrangement is a simple case of an array of multiple structures. Moreover, this array of multiple circular cylinder are also often located near a flat plate, and it’s an interesting topic to be investigated. This kind of study can be applied to many engineering problems such as undersea tube in heat exchanger, etc. There are certainly the larger the number of studies on the flow around a bluff body of various shape located near a plane wall, especially for a bluff body with a special shape. For special shape of bluff body, it was proposed a I-type cylinder. The I-type cylinder is a circular cylinder which is cut at both sides in parallel with the-y axis. Hence, the aim of this study is to investigate the flow characteristics around four I-type cylinders in in-lined arrangement placed near a plane wall. This study, on the relatively simple case of four stationary I-type cylinders of equal diameters in in-lined arrangement with constant spacing are placed near a plane wall.

The experiments were carried out in a subsonic wind tunnel with test section of 660 mm height, 660 mm width, and 1780 mm length. Four I-type cylinders with cutting angle of 53°
which are made from PVC tube were used as model. The cylinder have an external diameters, D, of 60 mm. A smooth acrylic flat plate 6 mm in thickness and 1200 mm in length was installed 100 mm above the bottom surface of the test section. The leading edge of the plate was a sharp edge with an angle of 30°. The free stream velocity in the wind tunnel was constantly maintained at 14,166 m/s, corresponding to Reynolds Number of Re = 5.4 x 10^4 (based on diameter circular cylinders D and the free stream velocity). The in-lined distance between four cylinders was constantly maintained at L/D=4. The gap distance between the bottom of the cylinders and the flat plate relative to the cylinder diameter (G/D) were varied from 0 to 0.2 with increment 0.067. Pressure transducers are used to measure coefficient of pressure of sidewall and cylinders. The velocity profiles behind the cylinders was measured using a Pitot-static Tube connected to pressure transducers. Surface oil film technique were used to investigate the flow patterns on the cylinders.

The result for the gap distance ratio 0 ≤G/D≤ 0.2 shows that sidewall effect gives big effect on the flow characteristic through I-type cylinder 53° with in-lined arrangement. Bubble separation occured on second cylinder caused by sidewall effect because it gives huge blockage effect on first cylinder that exists side-by-side with second cylinder.

**Keywords:** I-type cylinder, in-lined arrangement, near a plane wall