EXPERIMENTAL AND NUMERICAL STUDY OF FLUID FLOW CHARACTERISTICS PASSING THROUGH CYLINDER WITH V-CAVITIES

“Case Study : The Effect of the Number of V-Cavity (n = 0, 4, 12, and 20) at Re = 50000 and 63000”

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Abstract

Research about flow around a body has been done and developed until now, for example, research about flow around a cylinder. When the fluid flows around a cylinder, the flow will separate from the cylinder wall, which produce drag force. If separated flow can be delayed, wake area will be smaller and drag force will be smaller too. Delaying flow separation can be done with several methods. One of the methods to get smaller drag coefficient in the same Reynolds number is by giving a roughness on the cylinder surface.

This research is done experimentally and numerically. Test model used in this study are cylinders with the number variation of V-cavity in the cylinder surface (n = 0, 4, 12, and 20). Those models were tested at Reynolds numbers = 50000 and 63000 based on D and U∞. For the experimental study, a test model was placed at the centerline wind tunnel. From the pressure distribution on the cylinder contour and velocity profiles behind the cylinder, fluid flow characteristic can be analyzed. In numerical analysis, a research is performed using Fluent 6.2.16, and the turbulent realizable k-ε model was used. Test model geometry was created in Gambit with boundary condition is velocity inlet at the inlet and outflow at the outlet. Fluid flow
characteristics analyzed in this study are pressure coefficient (Cp), drag coefficient (CD), velocity magnitude, pathlines, and turbulence intensity. Those parameters can be used to indicate the massive flow separation.

The result of this study is with increasing the number of the V-cavity, total drag coefficient is smaller than total drag coefficient on the circular cylinder at \( \text{Re} = 50000 \) and \( \text{Re} = 63000 \). The smallest total drag coefficient occurs on the cylinder with 20 V-cavity. Furthermore, the numerical simulation results show that the increasing number of the V-cavity on the cylinder surface, total drag coefficient is larger at both \( \text{Re} \) than on the circular cylinder.

Key word: cavity-V, pressure coefficient, drag coefficient