EXPERIMENTAL and NUMERICAL STUDY OF TURBULENT BOUNDARY LAYER CHARACTERISTICS ON A FLAT PLATE WITH SINGLE SQUARE GROOVE

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Abstract

Researches about grooved on flat plate have been done as a mean to minimize the existence of drag force on a flat plate. With development technology, efficiency of engine certainly needed. So that influence of drag force as resistance must be reduce. Researches what have been done for study this problems is through a flat plate with single groove, as have done by writer.

This experimental study is done at a subsonic wind tunnel with a Reynolds number of $Re_\theta \approx 1087$, freestream velocity of 17 m/s. The groove made on the flat plate is a square shape. Total pressure tube is used to measure the speed of fluid flow with location measurement along the horizontal every 2 mm that is four location before the groove, four location above the groove, and fourteen location after the groove. Measurement location vertical started at 0.35 mm from surface until reach the speed of freestream. Static pressure measurement is done on the groove wall using pressure taps which are placed on surface of the groove. Numerical simulation use Fluent 6.3.26. Visualization using Fluent can be performed in grid display, contour plot, and pathline plot.

It can be show decrease of total drag value on flat plate with single square groove if divided with total drag value on flat plate without single square groove. It can be analyzed from decrease skin friction of coefficient ($C_f$) on flat plate with single square groove if divided with skin coefficient of friction ($C_f$) on
flat plate without single square groove, it have value 4.28% for experiment and 0.59% for numerical simulation. Appearance of coefficient of pressure (Cp) with negative value and the value is -0.0091 for experiment and -0.0153 for numerical simulation, so that total coefficient of drag (CD) can be decrease and the value is 23.79% for experiment and 22.56% for numerical simulation. Numerical simulation can appear more values at square groove area where is experiment measurement tool can not take measurement.

Kata Kunci: turbulent boundary layer, coefficient of skin friction (Cf), coefficient of pressure (Cp), coefficient of total drag (CD), numerical simulation.