NUMERICAL STUDY 2D UNSTEADY-RANS ABOUT THE INFLUENCE OF SQUARE DISTURBANCE BODY ON THE DRAG FORCE REDUCTION OF CIRCULAR CYLINDER IN A NARROW CHANNEL

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ABSTRACT

The research of knowing flow characteristics around a bluff body had undergone a great improvement through boundary layer philosophy. Because of shear layer effect, boundary layer contributes greatly in reducing the drag force around the body that are subjected to the fluid flow. This shear layer on body surfaces is affected by the pressure which occurs on body contour. Drag that was caused by the interaction between body surface and the shear layer is highly unwanted, therefore it is needed to manipulate the flow area using methods such as placing a disturbance rod in front of the main body (circular cylinder). This study aims to compare and complete the previous study about drag force reduction.

This study is done numerically in 2 dimension Unsteady-RANS using CFD software FLUENT 6.3.26 using viscous turbulence model shear stress transport (SST) k-ω in narrow channel. A circular cylinder is simulated as main bluffbody and square cylinder as disturbance body which is positioned ahead of main body according to ratios s/D 0.16 to s/D 0.107. Disturbance body is positioned variably at (α) 20, 30, 40, 50 and 60 with gap (δ = 0.4 mm). Reynolds number according to cylinder diameter is 2.32 x 10^4 and 3.12 x 10^4 for s/D 0.16 configuration; 3.48 x 10^4 and 4.68 x 10^4 for s/D 0.107 configuration.

The study result shows that positioning disturbance body on the upstream circular cylinder hasten the flow transition from laminar to turbulent boundary layer. The best drag force reduction occurs at 81% on cylinder with SDB angle 20° for s/D 0.16 configuration and 53% on cylinder SDB angle 30° for s/D 0.107 configuration.

Key words : square disturbance body, Shear-Stress-Transport (SST) k-ω, pressure drag coefficient, narrow channel, drag force, unsteady.