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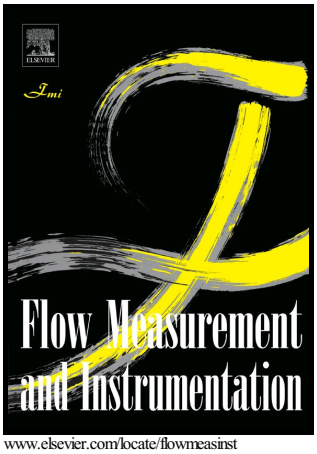

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Control of Flow around a Square Cylinder at Incidence by Using a Splitter Plate

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Abstract

Passive control of vortex shedding behind a square cylinder at incidence has been conducted experimentally by using a stationary splitter plate for the Reynolds numbers of 3.0×10^4. The splitter plate was located at the center of the rear face of the square cylinder in tandem. The width of the cylinder and the plate were both chosen to be 30 mm and the incidence angle of the square cylinder was rotated between 0 to 45 deg. In this study, the combined effects of the splitter plate and angle of incidence on the pressure distributions and vortex-shedding phenomenon were investigated. Vortex shedding frequency was obtained from velocity measurements and aerodynamic force coefficients acted on the cylinder were calculated from pressure distributions. Characteristics of the vortex formation region and location of the flow attachments, reattachments and separation were observed by using the smoke–wire flow visualization technique. For the case with the plate, there is a sudden jump in the Strouhal number in the vicinity of 13 deg which corresponds to a minimum value of the drag coefficient. At zero angle of incidence, Strouhal number and a drag coefficient of the square cylinder decreased about 20% by means of the splitter plate. Drag reduction was minimum at about 13 deg and reached its maximum value at about 20 deg.

Keywords: Square cylinder; vortex shedding; pressure distribution; splitter plate; Strouhal number; drag reduction.

Nomenclature

C_D' drag coefficient of square cylinder based on H'