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Control of wake vortex street behind a square cylinder using surface travelling waves SUNIL MANOHAR DASH, Singapore University of Technology and Design, MICHAEL S TRIANTAFYLLOU, Massachusetts Institute of Technology, PABLO VALDIVIA Y ALVARADO, Singapore University of Technology and Design — A novel travelling wave (TW) flow separation control strategy is developed to suppress the adverse downstream wake effects on a square cylinder of side, L, at low Reynolds number (Re=100). Our 2D numerical simulations suggest that when the downstream cylinder surface carries appropriately designed TWs, in the presence of an incoming flow of velocity U, a series of small scale vortices are formed in the trough regions of TWs. These small vortices inhibit momentum transfer between the thin fluid layer adjacent to the wall and the freestream. Consequently, the von-Karman vortex street behind the cylinder is suppressed and more than 70% reduction in drag force and complete elimination of fluctuating lift force is observed. The optimum TW control mechanism is determined by conducting a series of numerical simulations with various wave speeds (c) and wave amplitudes (A) for a fixed wave number (N=L/λ =4, where λ is the wavelength). Total suppression of the von-Karman vortex street is achieved when c/U is greater than 5, whereas only limited suppression of wake effects is seen at lesser c/U. The effect of wave amplitude is insignificant in the range of A/L=0.02 to 0.03. Energy efficiency to generate TW is also investigated in this study.

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