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Numerical Study of Flow past a Square Cylinder with an Angle of Incidence[1] DONG-HYEOG YOON, KYUNG-SOO YANG, CHOON-BUM CHOI, Inha University, Korea — A parametric study has been carried out to elucidate the characteristics of flow past a square cylinder inclined with respect to the main flow for $Re \leq 300$. Reynolds number and angle of incidence (θ) are the key parameters which determine the flow characteristics. There exist two kinds of critical Reynolds numbers; flow becomes unsteady at a lower critical Reynolds number (Re_{c1}) and the two-dimensional time-periodic wake becomes unstable to three-dimensional disturbances at an upper critical Reynolds number (Re_{c2}). We present the two critical Reynolds numbers as a function of θ by using the Stuart-Landau equation for a steady flow and a fully-resolved Floquet stability calculation for a time-periodic wake, respectively. In particular, there are two different instability modes for a time-periodic wake, namely, one (mode A) associated with a long spanwise wavelength and the other (mode B) with a short spanwise wavelength. The spanwise wave numbers of the most unstable (or least stable) wave for the critical case are presented for each θ considered. We also report flow-induced forces on the cylinder, and flow patterns past the cylinder for the range of Re considered in this investigation, and attempt to present physical explanations about them.

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