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Effects of spanwise inhomogeneity on wake dynamics of a cylinder[1] CHAO JIANG, YEFEI YANG, SHUJIN LAIMA, HUI LI, Harbin Institute of Technology — The flow over a twisted cylinder at low Reynolds numbers of Re=30˜300 is investigated using direct numerical simulation based on the finite volume method. The elliptic cross-section of the cylinder is rotated along its axial direction, thus resulting in extrinsic inhomogeneity of the geometry. For comparison, the flow past a smooth and a wavy cylinder is also calculated. The twisted cylinder achieves reductions of approximately 90% both in mean drag and lift fluctuation compared with smooth and wavy cylinders. When Re>160, the time trace of drag and lift for the twisted cylinder reveals the presence of multi-frequency oscillations, resulting in harmonic behavior of the power spectra, which is different from the other two. The plot of Strouhal number vs. Reynolds number for the twisted cylinder strikingly exhibits four discontinuities, while only two for the smooth cylinder. The first discontinuity corresponding to the start point for transition of the flow, moves towards a lower critical Reynolds number. The extrinsic geometry inhomogeneity always induces the three-dimensional separation and vortical structures, even at very low Reynolds numbers. Effects of the angle of rotation are further discussed.

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