Effect of Longtudinal Alignment on Wake Flow Characteristics behind Side-by-Side Cylinders of Unequal Diameter at Small Gap

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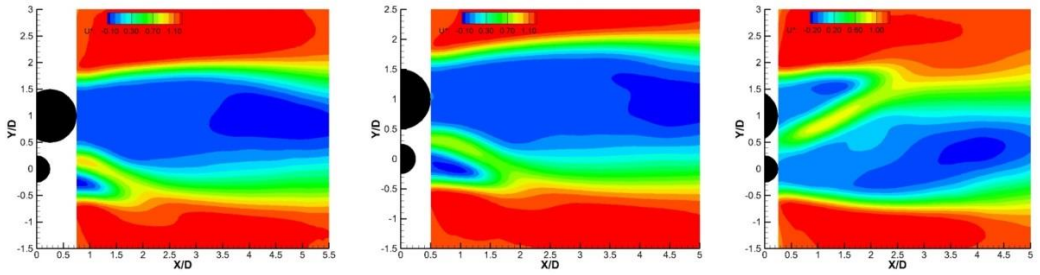
This study demonstrates the sensitivity of longitudinal spacing on the wake flow characteristics by PIV system while the side-by-side cylinders of diameter ratio two is spaced at small gap ratio (G/D=0.25). The mutual interaction, downstream evolution scenario of the gap vortices as well as distribution of fluctuating energy are investigated. The Reynolds number based on the diameter of large cylinder is 1000 and the diameter ratio of cylinders is 2.0. The staggered cylinders are arranged at three longitudinal spacings (L/D=-0.25, 0.0 and 0.25). As L/D=0.25 and 0, the gap flow biases stably toward the small cylinder in Figure 1(a) and (b). On the contrary, the gap flow biases towards the big cylinder at L/D=-0.25 (Fig. 1c). In the former cases (Fig. 2), the spatial growth rate (slope) and the magnitude of the integrated kinetic energy (Eu) for the wide wake component (Fw or vortices A and B) are smaller than those of a single large cylinder. The slope and the magnitude of the integrated kinetic energy (Eu) for the narrow wake component (Fn or vortices C and D) are about the same as those of a single small cylinder. For the latter case (Fig. 3), the spatial growth rate (slope) and the magnitude of the integrated kinetic energy (Eu) for the wide wake component (Fw or vortices C and D) are smaller than those of a single small cylinder. However, the slope and the magnitude of the integrated kinetic energy (Eu) for the narrow wake component (Fn or vortices A and B) are about the same as those of a single large cylinder. In the far wake region, the energy of the wide wake becomes predominant component because of a single wide-wake flow structure at G/D=0.25. For all the cases studied, strong mutual interaction of the wake behind side-by-side cylinders leads to a long and wide recirculation region father downstream at the expense of deterioration of the narrow wake. Slight misalignment of the longitudinal spacing may switch the bias of the gap flow at this small gap ratio.

Key Words: *Spatial growing rate, Longitudinal alignment, Integrated kinetic energy.*



(a) L/D=0.25 (b) L/D=0 (c) L/D=-0.25

Figure 1.Contours of mean streamwise velocity (U*=Ux/U) for (a) L/D=0.25 (b) L/D=0 (c) L/D=-0.25 and G/D=0.25

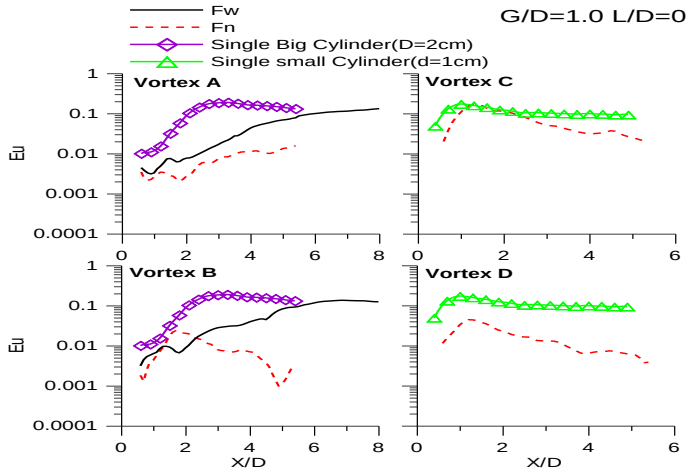


Figure 2.The integrated kinetic energy distributions (Eu) behind two side-by-side cylinders of diameter ratio D/d=2.0 at G/D=0.25 and L/D=0.0.

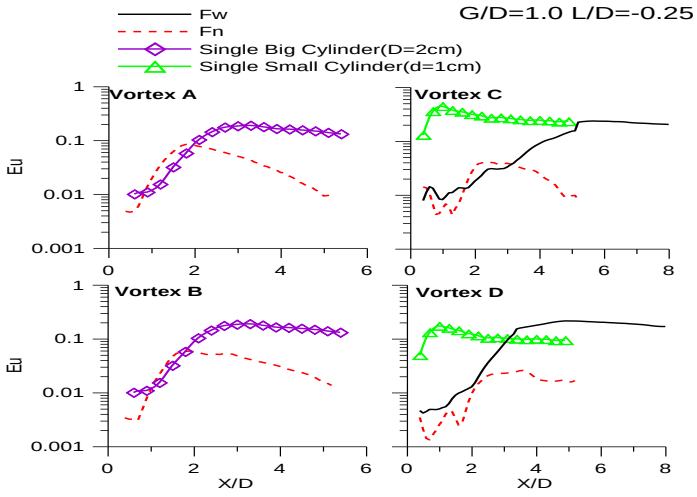


Figure 3.The integrated kinetic energy distributions (Eu) behind two side-by-side cylinders of diameter ratio D/d=2.0 at G/D=0.25 and L/D=-0.25.