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Transitions in the wake symmetry of side-by-side oscillating foils.
AHMET GUNGOR, ARMAN HEMMATI, University of Alberta — The unsteady hydrodynamics of two oscillating foils in side-by-side configuration is numerically examined for in-phase and out-phase oscillations at Reynolds number of $Re = 4000$ and Strouhal numbers of $St = 0.25 - 0.5$ using Direct Numerical Simulations. This study examined the effects of Strouhal number and oscillation phase difference on the propulsive performance and the wake topology. The wake symmetry was preserved throughout oscillations at lower St ($St = 0.25$) for both phase angles. In contrast, in-phase and out-of-phase oscillations display entirely opposite characteristics at higher St ($St = 0.5$). Wake of the in-phase oscillating foils at higher St, which is initially asymmetric, restores the wake symmetry in time. This restoration coincides with the enhancement of the propulsive performance of the foils. For out-of-phase oscillations, however, initial symmetry of the wake transition to asymmetry after several oscillation cycles. The collective propulsive performance of the foils stays still during the transition, even though one of the foils benefits from the absence of the wake symmetry while the other suffers from it.

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