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Interaction of Gap Flow With Flapping Dynamics of Two Side-by-Side Elastic Foils PARDHA S GURUGUBELLI, RAJEEV K JAIMAN, Natl Univ of Singapore — We present a numerical analysis on the interaction between two side-by-side elastic foils with their leading edges clamped and the gap flow between them. We perform systematic parametric direct numerical simulations as a function of nondimensional bending rigidity, $K_B \in [1 \times 10^{-4}, 3 \times 10^{-3}]$ and mass-ratio, $m^* \in [0.05, 0.2]$, for a fixed gap, $d_p = 0.2/L$, at the leading edge and Reynolds number, $Re = 1000$ to explain the underlying physical mechanism behind the in-phase and out-of-phase coupled flapping modes. The parametric simulations show that the parallel foil system exhibits predominant out-of-phase coupling for low mass-ratio $m^* \leq 0.1$ and in-phase coupling for higher mass-ratios $m^* > 0.1$. We also show that the two side-by-side elastic foils always exhibit out-of-phase coupling initially irrespective of whether the fully developed flapping show out-of-phase or in-phase coupled mode. Finally, we show that the transition from the initial out-of-phase to stable in-phase is characterized by loss of gap flow symmetric stability to undergo oscillations at the gap exit.

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