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The wake dynamics leading to higher efficiency versus larger thrust for heaving and pitching panels[1] ARMAN HEMMATI, ALEXANDER J. SMITS, Princeton University — The flow around a heaving-pitching rectangular panel is examined using Immersed Boundary Method incorporated to Direct Numerical Simulations, over a range of Reynolds numbers and Strouhal numbers. This study is aimed at determining the effects of a combined heaving-pitching motion on propulsive efficiency and thrust generation of new underwater propulsors. Preliminary results indicate that high efficiency and large thrust cannot be achieved simultaneously using a combined heaving-pitching motion. In particular, the leading (LEV) and trailing edge (TEV) vortex dynamics, which lead to enhanced thrust generation on the one hand and better propulsive efficiency on the other, were dictated by the oscillation frequencies and the heaving-pitching phase difference. For example, a higher heaving frequency accelerates the formation and detachment of LEVs, which favors higher efficiency while decreasing thrust generation. A higher pitching frequency, however, enhances thrust generation by accelerating the TEV detachment with a negative impact on the efficiency.

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