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Effects of traveling waves on flow separation and turbulence[1]
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Stable leading edge vortex (LEV) is observed in many flying, hovering and also some aquatic creatures. However, the LEV stability in aquatic animal, in contrast to hovering ones, is not well understood. Here, we study the flow over an inclined plate with an undulatory motion inspired from aquatic swimmers using our immersed boundary, large-eddy simulations (LES). The angle of attack is five degrees and Reynolds number (Re) is 20,000. The undulation is a traveling wave, which has a constant amplitude of 0.01 with respect to chord length and a different wavelength and Strouhal number (St=fA/U, f: frequency, A: amplitude, and U: free stream velocity) for each case. Over a fixed plate the LEV becomes unstable as it reaches the trailing edge and sheds to the wake, whereas over the undulating plate with St=0.2 the LEV becomes stable. The visualization of time average results shows there is a favorable pressure gradient along the tangential direction in cases the LEV becomes stable, which we explain analytically by showing the correlation between the average pressure gradient, St, and wavelength. Finally, the effects of undulatory moving walls of a channel flow on the turbulent statistics is shown.

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