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Using resolvent analysis for the design of separation control on a NACA 0012 airfoil[1] CHI-AN YEH, KUNIHIKO TAIRA, Florida State University — A combined effort based on large-eddy simulation and resolvent analysis on the separated flow over a NACA 0012 airfoil is conducted to design active flow control for suppression of separation. This study considers the the airfoil at 6 deg. angle-of-attack and Reynolds number of 23000. The response mode obtained from the resolvent analysis about the baseline turbulent mean flow reveals modal structures that can be categorized into three families when sweeping through the resonant frequency: (1) von Karman wake structure for low frequency; (2) Kelvin–Helmholtz structure in the separation bubble for high frequency; (3) blended structure of (1) and (2) for the intermediate frequency. Leveraging the insights from resolvent analysis, unsteady thermal actuation is introduced to the flow near the leading-edge to examine the use of the frequencies from three families for separation control in LES. As indicated by the resolvent response modes, we find that the use of intermediate frequencies are most effective in suppressing the flow separation, since the shear layer over the separation bubble and the wake are both receptive to the perturbation at the these frequencies. The resolvent-analysis-based control strategy achieves 35

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