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Use of thermoacoustic excitation for control of turbulent flow over a wall-mounted hump[1] CHI-AN YEH, PHILLIP MUNDAY, KUNIHIKO TAIRA, Florida State University — We numerically examine the effectiveness of high-frequency acoustic excitation for drag reduction control of turbulent flow over a wall-mounted hump at a free stream Reynolds number of 500,000 and Mach number of 0.25. Actuation frequencies around Helmholtz number of 3 are considered based on the characteristics of recently developed graphene/carbon nanotube-based surface compliant loud speakers. The present study utilizes LES (CharLES) with an oscillatory heat flux boundary condition to produce high-intensity acoustic waves, which interact with the turbulent flow structures by introducing small-scale perturbations to the shear layer in the wake of the hump. With thermoacoustic control, the recirculation zone downstream of the hump becomes elongated with thinner shear layer profile compared to the uncontrolled case. This change in the flow shifts the low-pressure region of the wake further downstream and results in reduction in drag by 10% for two-dimensional and 15% for three-dimensional flows. The influence of actuation frequency and amplitude is also examined.

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