THE FLUIDS, THERMAL AND CHEMICAL PROCESSES GROUP
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Jennifer Franck
Department of Mechanical Engineering
California Institute of Technology
Pasadena, CA

Compressible Large-Eddy Simulation of Separation and Control on a Wall-Mounted Hump

Active flow control via oscillatory forcing or synthetic jets has experimentally been shown to increase aerodynamic performance of naturally separating flows. However, development of accurate computational tools for unsteady separation and control remains a challenge, especially at high Reynolds numbers. This work presents compressible large-eddy simulations (LES) over a wall-mounted hump geometry, which exhibits turbulent, unsteady separation and reattachment. Flow control via steady suction and oscillatory zero mass-flux forcing is applied just before the natural separation point. Results are compared with previous experiments for uncontrolled and controlled flows over a range of subsonic Mach numbers. Compared with the baseline flow, control shortens the separation bubble length, but is generally found to be less effective at compressible Mach numbers. The effect of forcing frequency, and a comparison between steady suction and oscillatory forcing are also presented. The LES is shown to capture the major flow physics of the large-scale shedding of vortical structures, creating a testbed for future closed-loop control developments.

TUESDAY, OCTOBER 7, 2008
3:00pm
Barus & Holley, Room 190