Control of Separated Turbulent Flow over a Hump using RANS, DES, and LES SUBHADEEP GAN, URMILA GHIA, KARMAN GHIA, University of Cincinnati — Flow over a hump is an example of a turbulent separated flow. This flow is characterized by a simple geometry, but, nevertheless, is rich in many complex flow phenomena such as shear layer instability, separation, reattachment, and vortex interactions. The baseline case has been successfully simulated by the flow solver used in this work (Gan *et. al.*, 2007). The flow is simulated at a Reynolds number of 371,600, based on the hump chord length, C, and Mach number of 0.04. The flow control is being achieved via a slot at approximately 65% C by using steady suction, and with alternate suction/blowing. Solutions will be presented for the three-dimensional RANS SST, steady and unsteady, turbulence model and DES and LES turbulence modeling approaches. Mean-velocity contours and turbulent kinetic energy contours will be examined. Detailed comparisons will be made of mean and turbulence statistics such as the pressure coefficient, skin-friction coefficient, and Reynolds stress profiles, with experimental results. The location of the reattachment behind the hump will be compared with previously published numerical simulations and experimental results. The successful control of this turbulent separated flow will cause a reduction in the reattachment length, compared with the uncontrolled case.

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