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Evaluation of Turbulence Models Through Predictions of a Separated Flow Over a Hump. D. MADUGUNDI, J. KIEDAISCH, H. NAGIB, IIT, USA — Although a number of popular turbulence models are now commonly used to predict complex 3D separated flows, in particular for industrial applications, very limited full evaluation of their performance has been carried out using thoroughly documented experiments. Activities in this area have been recently intensified in view of the growing interest in Active Flow Control (AFC) of separation, as can be seen from the papers by Greenblatt et al. (AIAA-2005-0485) and Rumsey et al. (AIAA-2004-2217). Unlike the hump model used in these recent publications, where the point of separation is highly localized by the surface geometry, many applications develop separation over surfaces with more gradual changes in local surface curvature. A hump model generating such a separated flow has been used as a test bed for comparing results from various models including $k-\varepsilon$, Spalart-Alamaras, $k-\omega$, Menter's SST, and RSM. Our goal is a better understanding of the strengths and limitations of the various models by comparing them to each other and to experimental data recently documented on this model. The results include cases without and with AFC, applied by suction and blowing from a nearly tangential narrow slot in the vicinity of the start of separation. While very high suction and blowing rates lead to near elimination of the separation zone, the surface pressure contours reveal interesting behavior that can be used to arrive at optimum AFC parameter selection.

Hassan Nagib
IIT, Chicago, USA

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