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Evaluation of Turbulence Closures from a DNS Database of Shock Boundary Layer Interaction MICHAEL EMORY, RENE PECNIK, GIANLUCA IACCARINO, Stanford University — Reynolds averaged closures have limited predictive capabilities when applied to the problem of shock boundary layer interaction. Several modifications to RANS models have been proposed in the literature, including compressibility corrections, limiters, and alternative forms of the turbulence production terms. Our objective is to characterize the errors introduced by the various approximations used in typical two-equation models, such as turbulence isotropy, linear stress-strain relationship, dissipation rate, etc. by isolating each contribution separately. We first solve the mean flow equations using the turbulence statistics obtained from a DNS database (Wu & Martin, 2008); we alter the Reynolds stresses by perturbing the turbulent time scale and the stress anisotropy to investigate the effect of potential modeling errors on the resulting skin friction and wall pressure. As a second step, we use the same methodology to study the effect of modeling assumptions in the turbulent transport equations. We also discuss the use of the invariant map to introduce Reynolds stress perturbations that remain realizable.

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