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RANS simulations of a turbulent separated flow validation test-case. MADELINE SAMUELL, OWEN WILLIAMS, ANTONINO FERRANTE, University of Washington, Seattle — A new validation bump-geometry for turbulent separation has been analyzed experimentally, in our $3' \times 3'$ wind-tunnel, and computationally, by solving the Reynolds-averaged Navier-Stokes (RANS) equations using the Spalart-Allmaras model. The new bump geometry is defined by a Gaussian profile in the streamwise direction and an error function in the spanwise direction, such that the turbulent flow over the bump separates, under the adverse pressure gradient, in the downstream region of the bump. Sensitivities of skin-friction and pressure coefficients, as well as the extent of separation to various geometric and flow parameters (e.g., bump height to length ratio, distance of the bump from the top-wall to length ratio, boundary layer thickness of incoming flow on bottom and top walls) have been analyzed. The study has been performed for a range of Reynolds number varying between $0.59 \times 10^6 \leq Re_L \leq 3.5 \times 10^6$, where L is the streamwise length of the bump. The results obtained by using different turbulence models have also been compared. Initial two-dimensional RANS simulations show discrepancies between the pressure coefficients computed via RANS and the experiments.

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