Abstract Submitted
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**Roughness induced transition on boundary layers with realistic pressure distributions**[1] CHARLES TUSA, SAIKISHAN SURYANARAYANAN, DAVID GOLDSTEIN, The University of Texas at Austin, EZEQUIEL JUSTINIANO, EDWARD WHITE, Texas A&M University — Experiments and direct numerical simulations (DNS) have provided a mechanistic understanding of the different stages of roughness induced boundary layer transition (RIT) and have suggested mitigation methods. Recent DNS (Suryanarayanan et al., TSFP11) explored the effect of pressure gradients on specific RIT mechanisms by applying pressure gradients over specified streamwise extents of the domain. To extend this fundamental understanding to technological implementation of RIT mitigation strategies, DNS of RIT on a boundary layer with an inflow and continuously varying free stream corresponding to flow over a 63(3)-418 airfoil is performed. The pressure distribution and boundary layer profiles over an appropriate extent of the airfoil are determined using wind-tunnel measurements and XFOIL simulations which serve as an input to the immersed boundary (IB) pseudo spectral DNS code. Appropriate velocities on the virtual top surface are determined and implemented in the DNS using IB forces. Following validation of the 2D laminar solution, a 3D discrete roughness element is introduced, and RIT processes are studied for a series of realistic pressure distributions obtained by varying angle of attack. The results are interpreted from a vorticity dynamics point of view.

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