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Influence of a Localized Roughness Element on Disturbance Amplification in a Laminar Boundary Layer at Ma=4.8 OLAF MARXEN, GIANLUCA IACCARINO, ERIC SHAQFEH, Stanford University — Knowledge of heat load on the surface of vehicles (re-)entering a planetary atmosphere is important for heat-shield design. Prediction of laminar-turbulent transition is a key factor for the design. We carry out numerical simulations of a flat-plate boundary layer with and without localized roughness element (small hump). The compressible Navier-Stokes equations are solved for a calorically perfect gas. Small perturbations at a fixed frequency are triggered at the wall. Their downstream convective amplification is compared between flat-plate and hump case. The roughness element leads to increased disturbance amplification. Peak amplitude levels are reached in the vicinity of the hump. The effect of the roughness element seems similar to the effect of a shock impinging on a wall. The present study shall be extended to include high-temperature gas effects as well as three-dimensional disturbances (oblique waves).

Olaf Marxen
Stanford University

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