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Sensitivity of shock boundary-layer interactions to weak geometric perturbations[1] JI HOON KIM, JOHN K. EATON, Stanford University — Shock-boundary layer interactions can be sensitive to small changes in the inlet flow and boundary conditions. Robust computational models must capture this sensitivity, and validation of such models requires a suitable experimental database with well-defined inlet and boundary conditions. To that end, the purpose of this experiment is to systematically document the effects of small geometric perturbations on a SBLI flow to investigate the flow physics and establish an experimental dataset tailored for CFD validation. The facility used is a Mach 2.1, continuous operation wind tunnel. The SBLI is generated using a compression wedge; the region of interest is the resulting reflected shock SBLI. The geometric perturbations, which are small spanwise rectangular prisms, are introduced ahead of the compression ramp on the opposite wall. PIV is used to study the SBLI for 40 different perturbation geometries. Results show that the dominant effect of the perturbations is a global shift of the SBLI itself. In addition, the bumps introduce weaker shocks of varying strength and angles, depending on the bump height and location. Various scalar validation metrics, including a measure of shock unsteadiness, and their uncertainties are also computed to better facilitate CFD validation.

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