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**Interaction of a Mach 2.25 turbulent boundary layer with a fluttering panel using direct numerical simulation**[1] DANIEL BODONY, CHRISTOPHER OSTOICH, PHILIPPE GEUBELLE, University of Illinois at Urbana-Champaign — The interaction between a thin metallic panel and a Mach 2.25 turbulent boundary layer is investigated using a direct numerical simulation approach for coupled fluid-structure problems. The solid solution uses a finite-strain, finite-deformation formulation, while the direct numerical simulation of the boundary layer uses a finite-difference compressible Navier-Stokes solver. The initially laminar boundary layer contains low amplitude unstable eigenmodes that grow in time and excite traveling bending waves in the panel. As the boundary layer transitions to a fully turbulent state, with $Re_\theta \approx 1200$, the panel's bending waves coalesce into a standing wave pattern exhibiting flutter with a final amplitude approximately 20 times the panel thickness. The corresponding panel deflection is roughly 25 wall units and reaches across the sonic line in the boundary layer profile. Once it reaches a limit cycle state, the panel/boundary layer system is examined in detail where it is found that turbulence statistics, especially the main Reynolds stress $-\langle u'v' \rangle$, appear to be modified by the presence of the compliant panel, the effect of which is forgotten within one integral length downstream of the panel.

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