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Artificial large-scale-motion perturbation of a turbulent boundary layer I. JACOBI, B.J. MCKEON, Caltech — A zero-pressure-gradient flat-plate boundary layer is perturbed dynamically with a spatially-impulsive strip of two-dimensional roughness elements (which alternate with a flush-surface condition periodically in time). The perturbation knocks the boundary layer out of equilibrium and artificially introduces a very-large-scale, periodic structure into the flow. Large-scale- motions in the turbulent boundary layer have recently been understood as a significant source of both turbulent kinetic energy and Reynolds stress, and in addition, have been shown to take part in an apparent amplitude modulation of smaller scales in the flow. The properties of this artificially generated large- scale-motion are studied with particular emphasis on the phase relationship between it and smaller scale structures. The behavior of the artificially-introduced large-scale-motion is also compared with the natural large-scales of the unperturbed turbulent boundary layer, and the interaction between the artificial and natural large-scales is explored. This study is supported by the Air Force Office of Scientific Research under grant #FA9550-08-1-0049 (program manager John Schmisseur).

Ian Jacobi
Caltech

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