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Amplitude modulation by a synthetic very large-scale motion (VLSM) in the turbulent boundary layer I. JACOBI, B.J. MCKEON, Caltech — A flat-plate boundary layer is dynamically forced with a spatially-impulsive, two-dimensional roughness patch, introducing a periodic velocity disturbance. This synthetic very large-scale motion (VLSM) is isolated by a phase-locked decomposition of the velocity field, and its relationship with other scales in the flow is studied in the context of the apparent amplitude modulation of small-scale motions by large scales. The modulation effect is described as a phase-relationship between the different scales, where the phase difference is identified by cross-correlation. The extent to which the synthetic VLSM can be treated as a linear superposition on the base flow is investigated, and it is shown that the phase measurements can be used to describe the dominant large-scale motions in the unperturbed flow as well as the non-equilibrium distortion of the boundary layer by the roughness. Cospectral techniques are employed to identify the particular large-scale motions dominant in the amplitude modulation in both perturbed and unperturbed flows, and it is shown that VLSMs are significant to the modulation process, even in the unperturbed boundary layer. This study is supported by the Air Force Office of Scientific Research under grant #FA9550-09-1-0701(program manager John Schmisseur).

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