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An improved method to characterise the modulation of small-scale turbulent by large-scale structures LIONEL AGOSTINI, Ohio State University, MICHAEL LESCHZINER, Imperial College London, UK, DATTA GAITONDE, Ohio State University — A key aspect of turbulent boundary layer dynamics is "modulation," which refers to degree to which the intensity of coherent large-scale structures (LS) cause an amplification or attenuation of the intensity of the small-scale structures (SS) through large-scale-linkage. In order to identify the variation of the amplitude of the SS motion, the envelope of the fluctuations needs to be determined. Mathis et al(2009) proposed to define this latter by low-pass filtering the modulus of the analytic signal built from the Hilbert transform of SS. The validity of this definition, as a basis for quantifying the modulated SS signal, is re-examined on the basis of DNS data for a channel flow. The analysis shows that the modulus of the analytic signal is very sensitive to the skewness of its PDF, which is dependent, in turn, on the sign of the LS fluctuation and thus of whether these fluctuations are associated with sweeps or ejections. The conclusion is that generating an envelope by use of a low-pass filtering step leads to an important loss of information associated with the effects of the local skewness of the PDF of the SS on the modulation process. An improved Hilbert-transform-based method is proposed to characterize the modulation of SS turbulence by LS structures

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