Abstract Submitted
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Affects of spanwise heterogeneity and topographic height on Amplitude and Frequency modulation in channel flow turbulence.[1] ANKIT AWASTHI, WILLIAM ANDERSON, UT Dallas — We study the affects of spanwise heterogeneity on amplitude and frequency modulation of small-scale roughness-sublayer structures due to the passage of large-scale structures in the logarithmic region. Recent studies on amplitude and frequency modulation (Mathis et al. 2009: J. Fluid Mech., 628) have prompted the development of a predictive model for near-wall dynamics. Such a model is of great interest to large-eddy simulation (LES), since near-wall processes are, by definition, never resolved. Here, we have used LES to model flows over a series of spanwise-heterogeneous topographies, where a domain with very long streamwise extent is used to ensure that very-large-scale motions are (or, can be) resolved. We report that the secondary flows globally disrupt the turbulence from channel physics, wherein the "outer peak" is either shifted to different wavelengths or nonexistent. This spectral density redistribution is assured to alter amplitude and frequency modulation rates within the roughness sublayer, and we present correlations of the small and large scales to demonstrate precisely that (following the wavelet decomposition, as outlined by Baars et al., 2015: Exp. Fluids). Thus, spanwise heterogeneity should be regarded as a model parameter in any rough-wall-generalized prognostic wall models.

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William Anderson
UT Dallas

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