

Abstract Submitted
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Non-universal k_1^{-1} laws in pressure-gradient-driven turbulent wall-bounded flows O. RAMESH, Indian Institute of Science, SHIVSAI DIXIT, MKSSS's Cummins College of Engineering for Women, Pune, India — The scaling laws for the spectra of streamwise velocity fluctuations in turbulent wall-bounded flows are reformulated with inclusion of the streamwise pressure gradient. These laws indicate that the presence of pressure gradient naturally leads to the so-called incomplete similarity of spectra irrespective of the mean flow acceleration. Interestingly however, the corresponding spectral overlap arguments still lead to the inverse-power variation of the power spectral density of streamwise velocity fluctuations i.e. the k_1^{-1} law. These are, however, the non-universal k_1^{-1} laws arising out of incomplete similarity. Experimental evidence in the literature on pipe and channel flows clearly supports this. Striking experimental evidence is presented in favour of the non-universal k_1^{-1} laws for an accelerating turbulent boundary layer flow. It is observed that the prerequisite condition of “high Reynolds number” for having substantial spectral overlap in experiments appears to be remarkably relaxed in the presence of streamwise mean flow acceleration.

O. Ramesh
Indian Institute of Science

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