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The viscous sublayer revisited P. HENRIK ALFREDSSON, RAMIS OERLUE, PHILIPP SCHLATTER, Linne FLOW Center, KTH Mechanics, Royal Institute of Technology — The viscous sublayer of wall bounded turbulent flows is a thin region, usually assumed to stretch out to about 5 viscous length units, where the mean velocity distribution is close to linear. Its thickness is typical of the order of one percent or less of the boundary layer thickness or channel height. Despite this fact its importance for the flow in the boundary layer cannot be overstated since the mean shear stress at the wall determines the velocity scale of the Reynolds stresses and hence the velocity scale of the turbulence itself. In this presentation we show how the variation of the flow statistics within the viscous sublayer can be understood from a simple analysis of the instantaneous velocity profile. Special emphasis is put on the near self-similarity of the probability density distribution (pdf) of the streamwise velocity in the viscous sublayer. We also describe how the pdf of the fluctuating streamwise velocity measured using hot-wire anemometry can be used to determine the wall position and the friction velocity despite the fact that such measurements are contaminated by interference effects close to the wall. We illustrate this analysis both with DNS results from turbulent boundary layers and channel flows as well as from experiments in turbulent boundary layers.

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