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Self-similar streak instability in the logarithmic region of turbulent channel[1] MATTEO DE GIOVANETTI, ANDREA CASSINELLI, YONGYUN HWANG, Imperial College London — In the present study, we report our findings on the instability of the elongated streaky motions in the logarithmic layer, and its role in the generation of vortical structures in the logarithmic layer. We perform an LES-based numerical experiment, up to $Re_\tau \approx 2000$, in which a streamwise-uniform streaky motion is driven by means of an optimal forcing profile, obtained from linear theory. The spanwise spacing of the forced streaks ranges from $\lambda_z/h = 0.3$ to $\lambda_z/h = 1$. For a large enough amplification, turbulent statistics show characteristics consistent with a sinuous-mode instability of the streak. Furthermore, additional energy is now carried by the cross-streamwise velocity components, at a streamwise wavelength similar to the length scale of the streak instability, i.e. $\lambda_x = 1 \sim 2\lambda_z$, where λ_z is the spanwise spacing of the streak. Dynamic mode decomposition shows that these two structures, i.e. the streak and the vortices, both belong to the most energetic eigenstructure. The statistical description of the vortical structures resembles the characteristics of the quasi-streamwise vortices in the logarithmic layer.

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