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Large-scale structures in turbulent Couette flow[1] JUNG HOON KIM, JAE HWA LEE, Ulsan Natl Inst of Sci Tech — Direct numerical simulation of fully developed turbulent Couette flow is performed with a large computational domain in the streamwise and spanwise directions ($40\pi h$ and $6\pi h$) to investigate streamwise-scale growth mechanism of the streamwise velocity fluctuating structures in the core region, where h is the channel half height. It is shown that long streamwise-scale structures ($>3h$) are highly energetic and they contribute to more than 80% of the turbulent kinetic energy and Reynolds shear stress, compared to previous studies in canonical Poiseuille flows. Instantaneous and statistical analysis show that negative-u' structures on the bottom wall in the Couette flow continuously grow in the streamwise direction due to mean shear, and they penetrate to the opposite moving wall. The geometric center of the log layer is observed in the centerline with a dominant outer peak in streamwise spectrum, and the maximum streamwise extent for structure is found in the centerline, similar to previous observation in turbulent Poiseuille flows at high Reynolds number. Further inspection of time-evolving instantaneous fields clearly exhibits that adjacent long structures combine to form a longer structure in the centerline.

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