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Turbulence structures and unstable periodic orbits GENTA KAWAHARA, Osaka University — Recently found unstable time-periodic solutions to the incompressible Navier-Stokes equation are reviewed to discuss their relevance to near-wall turbulence and isotropic turbulence. It is shown that the periodic motion embedded in plane Couette turbulence exhibits a regeneration cycle of near-wall coherent structures, which consists of formation and breakdown of streamwise vortices and low-velocity streaks. In phase space a turbulent state wanders around the corresponding periodic orbit for most of the time, so that the root-mean-squares of velocity fluctuations of the Couette turbulence agree very well with the temporal averages of those along the periodic orbit. The Kolmogorov universal-range energy spectrum is observed for the periodic motion embedded in high- symmetric turbulence at the Taylor-microscale Reynolds number $Re_\lambda = 67$. Spatio-temporal structures of the periodic solution in high-symmetric flow are investigated to characterize the dynamics of coherent structures which appear in the energy cascade process.

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