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Evolution of vortical structures in Newtonian and viscoelastic turbulent flows[1] KYOUNGYOUN KIM, Hanbat National University, Daejeon, South Korea, RADHAKRISHNA SURESHKUMAR, Syracuse University, Syracuse, NY — To study the influence of dynamical interactions between turbulent vortical structures and polymer stress on turbulent friction drag reduction, a series of simulations were performed for channel flow at Re_τ=395. The initial eddy extracted by the conditional averages for the Q2 event from fully turbulent Newtonian flow is self-consistently evolved in the presence of polymer stresses by utilizing the FENE-P model (finitely extensible nonlinear elastic-Peterlin). The initial polymer conformation fields are given by the solutions of FENE- P model equations for the Newtonian mean shear. For a relatively low Weissenberg number, defined as the ratio of fluid relxation time to the time scale of viscous diffusion, (We_τ=50) the generation of new vortices is inhibited by polymer-induced counter torques, which results in fewer vortices in the buffer layer. However, the head of primary hairpin unaffected by the polymer stress. For larger values of We_τ ($\geq$100), the hairpin head becomes weaker and vortex auto-generation and Reynolds stress growth are almost entirely suppressed.

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