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On the physical mechanism of the two-way interaction between polymers and near-wall turbulence JUNGHOON LEE, CHANGHOON LEE, Yonsei University — The two-way interaction between polymers and near-wall turbulence was investigated through direct numerical simulations (DNS) of turbulent channel flow coupled with Brownian dynamics simulations. The finitely extensible nonlinear elastic (FENE) dumbbell model was used to describe the motion of polymer molecules. The effect of polymers was included in the Navier-Stokes equations by exerting their reaction forces back on the fluid at the nearby eight grid points via a projection technique. In our simulations, the maximum extension of the FENE dumbbells does not exceed 0.6 in wall units, which is 100 times their equilibrium length. We examine how the polymer feedback forces affect the fluctuating motion of the fluid in coherent near-wall turbulent structures for various polymer relaxation times. Our results are generally consistent with previous DNS studies based on a continuum approach. We provide a more detailed picture of the physical mechanisms for turbulence modification by polymers through investigation on polymer stretch and orientation in the Lagrangian frame.

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