

Abstract Submitted
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DNS of Viscoelastic Turbulent Channel Flow at High Drag Reduction ANTONY BERIS, University of Delaware, KOSTAS HOUSIADAS, Aegian University, Greece, LUO WANG, University of Delaware — A new method has been developed to enable Direct Numerical Simulations (DNS) of viscoelastic turbulent channel flow with high accuracy spectral methods at high values of drag reduction (HDR), when the polymer molecules undergo high extensional deformation. To faithfully represent that we have expressed the conformation tensor, c , as the exponential of another tensor a , $c = \exp(a)$ and we solve for a instead of c . Thus, by construction, the positive definite property of c is always preserved. In addition, a stabilizing artificial diffusion has been added to the viscoelastic constitutive model and efficiently implemented numerically using a multigrid method. The Finite-Elasticity Non-Linear Elastic Dumbbell model with the Peterlin approximation (FENE-P) is then used to represent the effect of polymer molecules in solution. To achieve HDR we used high values of the key model parameters: (a) the maximum extensional viscosity, which for the FENE-P constitutive model is proportional to the quantity $(1-\beta)*L^2$, where β is the solvent viscosity ratio and L is the maximum extensibility parameter and (b) the friction Weissenberg number, $We\tau$.

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