**88g Direct Numerical Simulations of Viscoelastic Turbulent Channel Flows at High Drag Reduction**

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We present the results of our most recent Direct Numerical Simulations (DNS) of turbulent viscoelastic channel flow using spectral spatial approximations and a stabilizing artificial diffusion in the viscoelastic constitutive model. The Finite-Elasticity Non-Linear Elastic Dumbbell model with the Peterlin approximation (FENE-P) is used to represent the effect of polymer molecules in solution. The key parameters to achieve the high drag reduction (HDR) or the maximum drag reduction (MDR) regimes are: (a) the maximum extensional viscosity, which for the FENE-P constitutive model is proportional to the quantity (1-β)*L^2, where β is the solvent viscosity ratio and L is the maximum extensibility parameter and (b) the friction Weissenberg number, Weτ. Both quantities can reach high values, even for dilute polymer solutions, provided that the flow viscoelasticity and the polymer molecular weight are high which results to large friction Weissenberg number and large maximum extensibility parameter, respectively. We have chosen the rheological parameters so that to get closer to the conditions corresponding to HDR/MDR: L=60 and β=0.8 are used with two different friction Weissenberg numbers (Weτ=50 and 100). We have first confirmed that the corresponding achieved drag reduction, in the range of friction Reynolds numbers used in this work (180-590), is independent on the Reynolds number (in accordance to previous work). The obtained drag reduction is at the level of 49% and 63%, for the friction Weissenberg numbers 50 and 100, respectively. The largest value is substantially higher than any of our previous simulations, performed at more moderate levels of viscoelasticity (i.e. higher viscosity ratio â and smaller extensibility parameter L values). Therefore, the maximum extensional viscosity exhibited by the modeled system and the friction Weissenberg number can still be considered as the dominant factors determining the levels of drag reduction. Based on that and the changes observed in the turbulent structure and in the most prevalent statistics, as presented in this work, we can still rationalize for an increasing extensional resistance-based drag reduction mechanism as the most prevalent mechanism for drag reduction, the same one evidenced in our previous work: As the polymer elasticity increases, so does the resistance offered to extensional deformation. That, in turn, changes the structure of the most energy-containing turbulent eddies (they become wider, more well correlated, and weaker in intensity) so that they become less efficient in transferring momentum, thus leading to drag reduction.