

Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

The effect of the polymer relaxation time on the nonlinear energy cascade and dissipation of statistically steady and decaying homogeneous isotropic turbulence¹ PEDRO C. VALENTE, CARLOS B. DA SILVA, IST/Technical University of Lisbon, Mecânica I, 1o andar/LASEF, Av. Rovisco Pais, 1049-001 Lisbon, Portugal, FERNANDO T. PINHO, Faculdade de Engenharia da Universidade do Porto (FEUP), Rua Dr. Roberto Frias, s/n, 4200-465 Porto, Portugal — We report a numerical study of statistically steady and decaying turbulence of FENE-P fluids for varying polymer relaxation times ranging from the Kolmogorov dissipation time-scale to the eddy turnover time. The total turbulent kinetic energy dissipation is shown to increase with the polymer relaxation time in both steady and decaying turbulence, implying a “drag increase.” If the total power input in the statistically steady case is kept equal in the Newtonian and the viscoelastic simulations the increase in the turbulence-polymer energy transfer naturally lead to the previously reported depletion of the Newtonian, but not the overall, kinetic energy dissipation. The modifications to the nonlinear energy cascade with varying Deborah/Weissenberg numbers are quantified and their origins investigated.

¹The authors acknowledge the financial support from Fundação para a Ciência e a Tecnologia under grant PTDC/EME-MFE/113589/2009

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Date submitted: 23 Jul 2013

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