Methods to Approach Velocity Data Reduction and Their Effects on Conformation Statistics in Viscoelastic Turbulent Channel Flows
GAURAB SAMANTA, ANTONY BERIS, University of Delaware, ROBERT HANDLER, Naval Research Laboratory, KOSTAS HOUSIADAS, Aegean University, Greece — Karhunen-Loeve (KL) analysis of DNS data of viscoelastic turbulent channel flows helps us to reveal more information on the time-dependent dynamics of viscoelastic modification of turbulence [Samanta et. al., J. Turbulence (*in press*), 2008]. A selected set of KL modes can be used for a data reduction modeling of these flows. However, it is pertinent that verification be done against established DNS results. For this purpose, we did comparisons of velocity and conformations statistics and probability density functions (PDFs) of relevant quantities obtained from DNS and reconstructed fields using selected KL modes and time-dependent coefficients. While the velocity statistics show good agreement between results from DNS and KL reconstructions even with just hundreds of KL modes, tens of thousands of KL modes are required to adequately capture the trace of polymer conformation resulting from DNS. New modifications to KL method have therefore been attempted to account for the differences in conformation statistics. The applicability and impact of these new modified KL methods will be discussed in the perspective of data reduction modeling.

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