Abstract Submitted
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Statistical State Dynamics Based Study of the Role of Nonlinearity in the Maintenance of Turbulence in Couette Flow[1] BRIAN FARRELL, Harvard Univ, PETROS IOANNOU, MARIOS-ANDREAS NIKOLAIDIS, National and Kapodistrian University of Athens — While linear non-normality underlies the mechanism of energy transfer from the externally driven flow to the perturbation field, nonlinearity is also known to play an essential role in sustaining turbulence. We report a study based on the statistical state dynamics of Couette flow turbulence with the goal of better understanding the role of nonlinearity in sustaining turbulence. The statistical state dynamics implementations used are ensemble closures at second order in a cumulant expansion of the Navier-Stokes equations in which the averaging operator is the streamwise mean. Two fundamentally non-normal mechanisms potentially contributing to maintaining the second cumulant are identified. These are essentially parametric perturbation growth arising from interaction of the perturbations with the fluctuating mean flow and transient growth of perturbations arising from nonlinear interaction between components of the perturbation field. By the method of selectively including these mechanisms parametric growth is found to maintain the perturbation field in the turbulent state while the more commonly invoked mechanism associated with transient growth of perturbations arising from scattering by nonlinear interaction is found to suppress perturbation variance.

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