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Worst-case amplification of disturbances in inertialess shear-driven flows of viscoelastic fluids MIHAILO JOVANOVIC, BINH LIEU, SATISH KUMAR, University of Minnesota — Amplification of deterministic disturbances in inertialess shear-driven channel flows of viscoelastic fluids is examined by analyzing the frequency responses from spatio-temporal body forces to the velocity and polymer stress fluctuations. In strongly elastic flows, we show that disturbances with large streamwise length scales may be significantly amplified even in the absence of inertia. For fluctuations without streamwise variations, we derive explicit analytical expressions for the dependence of the worst-case amplification (from different forcing to different velocity and polymer stress components) on the Weissenberg number (We), the maximum extensibility of the polymer chains (L), the viscosity ratio and the spanwise wavenumber. For the Oldroyd-B model, the amplification of the most energetic components of velocity and polymer stress fields scales as We^2 and We^4. On the other hand, the finite extensibility of polymer molecules limits the largest achievable amplification even in flows with infinitely large Weissenberg numbers: in the presence of wall-normal and spanwise forces the amplification of the streamwise velocity and polymer stress fluctuations is bounded by quadratic and quartic functions of L.

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