Abstract Submitted
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A generalized Landau model for oscillatory to complex shear flows — enablers for reduced, low and least-order Galerkin models[1] GILEAD TADMOR, Northeastern University, BERND R. NOACK, MICHAEL SCHLEGEL, Berlin Institute of Technology, MAREK MORZYNSKI, Poznan University of Technology — Landau's (1944) celebrated amplitude equation $dA/dt = \sigma A - \beta A^3$ for a supercritical Hopf bifurcation connects linear instability with a nonlinear amplitude saturation mechanism, thereby describing the transient and post-transient phase of oscillations. This model is significantly generalized for a much larger class of laminar to turbulent shear flows within the finite-time thermodynamics (FTT) formalism (Noack et al. 2008 JNET). In this talk, we highlight the critical role of FTT in deriving reduced to least-order Galerkin models for oscillatory to complex shear flows. This includes shift modes as well as a novel nonlinear subgrid turbulence representation. Intriguingly, both can lead to a similar, nonlinear damping term for fluctuation energy as described by Landau's model.

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