Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

An input-output approach to the robustness analysis of transverse wall oscillations in channel flows ARMIN ZARE, DHANUSHKI HEWAWADUGE, University of Texas at Dallas — Transverse wall oscillations have been shown to reduce the receptivity of wall-bounded shear flows to exogenous disturbances, suppress turbulence, and reduce skin-friction drag by as much as 40%. However, the success of wall oscillations is tied to the appropriate selection of their amplitude and frequency. We analyze the robustness of this flow control strategy to imperfections in the amplitude and phase of oscillations. Design imperfections are modeled as parametric uncertainties in the time-periodic base flow and result in multiplicative changes to the coefficients of the linearized Navier-Stokes equations. We use an input-output analysis of the linearized equations to quantify the effect of additive and multiplicative sources of stochastic uncertainty on the fluctuation dynamics in a simulation-free manner and to specify conditions for the robust performance of the control strategy.

Armin Zare
University of Texas at Dallas

Date submitted: 10 Aug 2020 Electronic form version 1.4