Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Bending mode flutter in a transonic linear cascade RAGHURAMAN GOVARDHAN, PRAHALLADA JUTUR, Indian Institute of Science — Vibration related issues like flutter pose a serious challenge to aircraft engine designers. The phenomenon has gained relevance for modern engines that employ thin and long fan blade rows to satisfy the growing need for compact and powerful engines. The tip regions of such blade rows operate with transonic relative flow velocities, and are susceptible to bending mode flutter. In such cases, the flow field around individual blades of the cascade is dominated by shock motions generated by the blade motions. In the present work, a new transonic linear cascade facility with the ability to oscillate a blade at realistic reduced frequencies has been developed. The facility operates at a Mach number of 1.3, with the central blade being oscillated in heave corresponding to the bending mode of the rotor. The susceptibility of the blade to undergo flutter at different reduced frequencies is quantified by the cycle-averaged power transfer to the blade calculated using the measured unsteady load on the oscillating blade. These measurements show fluid excitation (flutter) at low reduced frequencies and fluid damping (no flutter) at higher reduced frequencies. Simultaneous measurements of the unsteady shock motions are done with high speed shadowgraphy to elucidate the differences in shock motions between the excitation and damping cases.

Raghuraman Govardhan
Indian Institute of Science

Date submitted: 01 Aug 2017 Electronic form version 1.4