Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Boundary layers and forces on a cylinder in vortex-induced vibrations RAVI CHAITHANYA MYSA, Agency for Science, Technology and Research (A*STAR), SUMANA INAGANTI, Nanyang Technology University, VINH-TAN NGUYEN, Agency for Science, Technology and Research (A*STAR), CHANG WEI KANG, Institute of High Performance Computing, (A*STAR) — The flow, load on the cylinder and its motion are coupled to each other in a vortex-induced vibration (VIV). The boundary layer on the cylinder is affected by the shedding of vortices and motion of the cylinder. The motion of the cylinder will be in certain phase with respect to shedding vortices depending on the reduced velocity. Based on their phase difference, the cylinder motion dynamics can affect boundary layers differently. This, in turn changes force acting on the cylinder and subsequently its motions. It is believed that boundary layer and its movements on the cylinder play an important role in explaining the responses in vortex induced vibrations. Numerical experiments have been performed on the vortex induced vibrations of the cylinder in laminar flow environment for different mass ratios to better understand its complex coupled physics. The boundary layer on the cylinder is calculated at different locations on the cylinder during its VIV responses. The variation of the boundary layer is characterized in pre-lock-in, lock-in and post-lock-in regions with respect to the pressure and viscous forces generated on the cylinder. The connection between the forces generated, shed vortices and the motion will be presented with the help of boundary layer variation and flow contours. Their respective correlations will be established while the dependence of pattern of shedding vortices on the phase of the cylinder motion will be discussed.

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Date submitted: 16 Sep 2016 Electronic form version 1.4