Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Characterization of vortex-induced vibration of a flexible cylinder JESSICA SHANG, HOWARD STONE, ALEXANDER SMITS, Princeton University — In this study, the phenomena of 3D vortex-induced vibration (VIV) of a flexible cylinder (diameter D) is shown to be distinct from 2D VIV. We seek to identify correlations between wake regimes and vibration responses for a low mass-ratio ($m^* = 1.2$), flexible ($E = 1.2$ MPa, natural frequency in water $f_N = 0.37$ Hz) cantilevered cylinder undergoing cross-flow for reduced velocity $U^* = 20$-120 ($U^* = U/f_N D$). A P+S wake mode appears for a range of U^*; the onset of this range may be correlated with a hysteretic jump to an upper branch in the transverse amplitude response ($A_Y^* = A_Y/D$) at several locations along the midspan. This asymmetric wake mode does not present a unique transverse frequency response ($f_Y^* = f_Y/f_N$) in the cylinder. The upper branch in the amplitude response gives way to an abrupt decrease in A_Y^* to a lower branch, accompanied by a bifurcation in f_Y^*. The bifurcation takes place over a narrow range of U^* where the lower f_Y^* gradually transfers power to a higher f_Y^*, and may demarcate a wake transition regime between laminar and turbulence states.

Jessica Shang
Princeton University

Date submitted: 01 Aug 2012 Electronic form version 1.4