A cantilevered flexible cylinder in cross-flow\textsuperscript{1} JESSICA SHANG, ALEXANDER SMITS, HOWARD STONE, Princeton University — Biological fluid-structure interactions of high aspect ratio bluff bodies are commonplace: flow around tall plants; flow through arrays of sensory vibrissae, antennae, and hairs. In this study, we seek insight to this class of problems by generalizing the flow configuration to uniform flow past a flexible cantilevered cylinder. Experiments were conducted for $Re_D = 100$-500. Cylinders deflected with the flow and demonstrated multimodal oscillations in both the streamwise and transverse directions. Oscillation frequencies were correlated with vortex shedding frequencies, but low oscillation frequencies (sub-1 Hz), which were not apparently vortex-induced, were also present. Two $Re_D$ regimes were noted in which the vortex shedding frequency remained relatively constant with $Re_D$, while the two regimes were separated by an intermediate transition region. This feature results in an apparently linear relationship between $St$ and $Re_D$ in each regime. Hydrogen bubble visualization showed strong three-dimensionality in the wake, as well as a diversity of wake structures varying with $Re_D$.

\textsuperscript{1}NSF-GRFP

Jessica Shang
Princeton University

Date submitted: 07 Aug 2011
Electronic form version 1.4