Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Single frequency lock-on of wake behind a circular cylinder using oscillatory actuation PHILLIP MUNDAY, KUNIHIKO TAIRA, Florida State University — We numerically investigate the influence of oscillatory flow control on the two-dimensional wake behind a circular cylinder at Re = 100. Understanding under what conditions the shedding frequency locks solely onto the actuation frequency and drag reduction is of particular interest. We investigate the influence of steady and oscillatory components of actuation with the actuator position, direction, frequency, and amplitude varied. For oscillatory forcing a V-shaped lock-on region can be seen in the frequency–amplitude plot about the natural shedding frequency, which resemble stability horns in oscillator dynamics. Steady actuation is observed to reduce mean and fluctuating components of drag. With oscillatory forcing reducing drag fluctuation allows the wake to lock-on to a wider range of actuation frequencies. We find that there exists a set of forcing amplitudes and frequencies that achieves both lock-on and drag reduction. Low frequency oscillation due to the competition between low and high drag states are observed in the vicinity of the lock-on boundary.

Phillip Munday
Florida State University

Date submitted: 06 Aug 2012 Electronic form version 1.4