Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Experimental study on flow-induced vibration of a flexible cylinder with high-mass ratio in tandem arrangement SARAH DULAC, University of Massachusetts Dartmouth, NATHANIEL ANDERSON, Miami University, BANAFSHEH SEYED-AGHAZADEH, University of Massachusetts Dartmouth —
Flow-induced vibration of a flexible cylinder placed in the wake of a stationary cylinder is studied, experimentally. The flexible cylinder with an aspect ratio of 47 and a mass ratio of 120 was held fixed at both ends and placed horizontally in the wake of the upstream rigid cylinder in the test-section of a subsonic wind tunnel. The dynamic response of the cylinder is studied in both the streamwise (inline) and transverse (crossflow) directions for center-to-center spacing range from 3 to 9 times the diameter of the cylinder. Amplitudes and frequencies of oscillation, as well as flow forces on the cylinder are studied in the reduced velocity range of $U^* = 3.3 - 50.3$ and the Reynolds number range of $Re = 3,057 - 46,536$. Despite the high-mass ratio of the flexible cylinder, higher modes of vibrations up to the fifth mode are excited in both the crossflow and inline directions, owing to the high-flexibility of the cylinder. Both odd and even modes are excited in the crossflow and inline directions. As the separation distance between the cylinders increases, the amplitudes of oscillation increase over a wider range of reduced velocities. Spanwise trajectories of motion are studied and regions along the length of the cylinder that are excited or damped by the flow, are identified.

Sarah Dulac
University of Massachusetts Dartmouth

Date submitted: 31 Jul 2020 Electronic form version 1.4