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Wake Modes of Rotationally Oscillating Cylinders at low Re
PRABU SELLAPPAN, TAIT POTTEBAUM, University of Southern California —
Vortex shedding from bluff bodies is important in various engineering applications because the wake can have many effects, including exciting vibrations in structures and altering convective heat transfer. While vortex shedding from cylinders in cross-flow and cylinders undergoing transverse and in-line oscillations has been studied extensively, only limited data is available for rotational oscillations and is mainly limited to spectral analysis of the wake. Water tunnel experiments were carried out at Re = 150 to investigate the wake of a rotationally oscillating cylinder for oscillation frequencies from 0.67 to 3.5 times the natural shedding frequency and peak-to-peak oscillation amplitudes up to 320 $^\circ$. DPIV was used to study both the near and far wake within this parameter space. Well-defined patterns of wake vortices were observed in distinct regions of the parameter space, similar to the wake modes of transversely oscillating cylinders in cross-flow. In portions of the parameter space for which information exists in the literature the wake modes are well-related to spectral data. Variants of modes in previously unexplored regions are explained in terms of harmonics. The initial application of these results to understanding heat transfer enhancement from rotationally oscillating cylinders will also be addressed.

Tait Pottebaum
University of Southern California

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