Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Wake observations for a circular cylinder undergoing forced two-degrees-of-freedom motions. ERDEM AKTOSUN, University of Rhode Island, ERSEGUN D. GEDIKLI, University of Hawaii at Manoa, JASON M. DAHL, University of Rhode Island — A series of experiments were performed to characterize the wake and forces on a circular cylinder that undergoes forced two-degree-of-freedom sinusoidal motions in a free stream. A comprehensive dataset consisting of 9555 combined in-line and cross-flow motion experiments with force measurement and 819 flow visualization experiments was obtained, varying the in-line amplitude of motion, cross-flow amplitude of motion, reduced velocity, and phase between motions. Experiments were carried out at a constant Reynolds number of 7620. Unique observations are made regarding observed vortex patterns in the wake and force measurements. For example, under certain combinations of motion parameters, unique repeatable patterns of vortex shedding that differ from established patterns are observed. Additionally, non-repeatable patterns may also be observed despite forced periodic motions. A mapping of wake patterns covering the entire parameter space is presented. This map illustrates that there is a large variability in potential wake patterns when a cylinder undergoes combined in-line and cross-flow motion, in contrast to when a cylinder is constrained to cross-flow motion only. We observe that over the range of motion parameters tested and in most cases, when a change in motions results in a sign change in the average power transferred from the cylinder to the fluid, there is a corresponding change in the wake pattern, however this transition is not universally true over the entire database of motions.

Erdem Aktosun
University of Rhode Island

Date submitted: 03 Aug 2020 Electronic form version 1.4