Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Simulations of Bio-inspired Undulated Cylinders through Dynamic Morphing of Surface Topography MIKIHISA YUASA, KATHLEEN LYONS, JENNIFER A. FRANCK, University of Wisconsin - Madison — Undulations on a cylinder, inspired by seal whiskers, lower the drag force and vibration in the flow when compared to smooth cylinders. Hence, these geometric features can be applied to the development of underwater devices and other engineering applications in need of vibration suppression, frequency tuning, or force reduction. Flow simulations are utilized to analyze the hydrodynamic response by varying the individual geometric parameters that define the undulatory features. Previous methodologies require a manual mesh re-generation when making geometric changes to the undulated cylinder. Instead of this time-intensive process, the current research introduces an algorithm that directly controls the surface topography and updates the undulation features during the simulation. This is accomplished with a dynamic mesh methodology, and a parameterization of the complex seal whisker inspired morphology. Morphing the surface results in easy transitions from one geometric value to the next as well as a significant reduction of the simulation time, allowing for exploration of a wider range of parameters. Results demonstrate the effects of chordwise and transverse undulation amplitudes in terms of the hydrodynamic force and frequency response.

Mikihisa Yuasa
University of Wisconsin - Madison

Date submitted: 07 Aug 2020 Electronic form version 1.4