Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

A data-driven framework for the isolation, tracking and aerodynamic load estimation of distinct vortex structures[1] KARTHIK MENON, RAJAT MITTAL, Johns Hopkins University — This work presents a physics-based and data-driven computational framework for the analysis of vortex-dominated fluid-structure interaction problems. The dynamics of such problems are typically dictated by multiple distinct, force-producing vortical structures. However, accurately estimating the aerodynamic loads induced by each of these vortex structures in complex viscous flows remains an open question. In the analysis framework presented here, a rigorous force and moment partitioning method is used in conjunction with clustering techniques to simultaneously isolate, track, and quantify the force-production due to several distinct vortex structures in complex, unsteady flow-fields. This flexible, automated framework allows us to precisely compute the force and moment induced by each vortical structure on an immersed body, and also correlate the spatio-temporal evolution of each structure to its dynamical influence on the problem.

[1]The authors acknowledge support from AFOSR Grant FA9550-16-1-0404

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Date submitted: 31 Jul 2020 Electronic form version 1.4