Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Vortical and modal network analysis of unsteady cylinder wake[1]
ADITYA NAIR, MURALIKRISHNAN GOPALAKRISHNAN MEENA, KUNIHIKO TAIRA, Florida State Univ, STEVEN BRUNTON, University of Washington — Characterization of vortical and modal interactions among coherent structures in unsteady fluid flows is essential in understanding its complex behavior. Through a canonical example of incompressible flow over a circular cylinder at low Reynolds number, we quantify the interaction properties for both the vortical-wake and modal-interaction networks. For the vortical interactions, we represent the vortex elements as nodes and induced velocity between them as edge weights. With this formulation, we are able to capitalize upon network-theoretical toolsets to identify key vortical nodes and edges. Analogously, the modal-interaction network can be formulated using the modal decomposition bases and the coupling functions over the network. Based on this viewpoint, perturbations can then be tracked in terms of their amplitude and phase dynamics. We compare and contrast these network-based approaches to analyze unsteady fluid flows and discuss their implications in uncovering complex nonlinear dynamics and potential strategies towards flow field manipulation.

[1]National Science Foundation (CBET 1632003)

Aditya Nair
Florida State Univ

Date submitted: 01 Aug 2016 Electronic form version 1.4