

Abstract Submitted  
for the DFD19 Meeting of  
The American Physical Society

**The recurrence of flow structures in a low Re wake downstream of two cylinders.**<sup>1</sup> HUIXUAN WU, MEIHUA ZHANG, University of Kansas, ZHONGQUAN ZHENG, Utah State University — The recurrence network method is used to study the evolution of coherent structures in the wake downstream of two cylinders. The upstream cylinder is fixed and the downstream cylinder oscillates in the transverse direction at a fixed frequency. The vortices shed from the upstream cylinder interact with those from the other cylinder, generating a complicated vorticity distribution. Proper orthogonal decomposition is used to extract coherent structures from the vorticity field, but the modes, which are spatial distributions of vorticity, provide limited information about the temporal evolution of the system. In order to analyze the evolution, the time dependent modal coefficients are used to construct a high dimensional phase space. The flow evolution is represented by a trajectory in this space. At the Reynolds number studied in this work, the system keeps visiting the neighborhood of a previous state, though it never exactly repeats itself. This kind of visit can be regarded as recurrence within a certain tolerance. The network manifests a few recurrence patterns, which corresponds to the ways of evolution of the flow field. The result shows that the recurrence network is an effective tool to analyze the temporal evolution of coherent structures.

<sup>1</sup>University of Kansas General Research Funding

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Date submitted: 31 Jul 2019

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