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Prediction of the Onset of Aeroelastic Flutter using Complex Networks SOMBUDDHA BAGCHI, VISHNU R. UNNI, ABHISHEK SAHA, Department of Mechanical and Aerospace Engineering, University of California San Diego — We use complex network-based methods to unravel the dynamic characteristics of strain rate fluctuations of a structure suspended in turbulent flow to examine the viability of using network parameters as precursors for onset of aeroelastic flutter. The dynamic transition from low amplitude chaotic regime to the high amplitude limit cycle oscillations can be detected by measures that quantify the topology of the network. Strain rate time series contain a range of information regarding the dynamical states of the system. The network construction technique determines the information extracted from time series. We use quantification measures corresponding to 3 types of networks, modified recurrence network (MRN), visibility network (VN) and synchronization network (SN). The information on periodicities in the system dynamics is provided by the MRN; VN characterizes local patterns in the time series and thus provides information on temporally local interactions, and the SN embodies information about the attractor geometry and correlations at larger time scales. We show that degree, clustering and characteristic path length (CPL) for MRN; degree, CPL and closeness centrality for VN; and degree, CPL and betweenness centrality for SN can be used as precursors for the onset of flutter.

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