Abstract Submitted
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Discovering time-varying aerodynamics of a prototype bridge during vortex-induced vibrations[1] SHANWU LI, Harbin Institute of Technology, EURIKA KAISER, University of Washington, SHUJIN LAIMA, HUI LI, Harbin Institute of Technology, STEVEN L. BRUNTON, J. NATHAN KUTZ, University of Washington — Vortex-induced vibrations (VIVs) of a long-span bridge are measured based on the structural health monitoring (SHM) system. The significantly nonstationary wind flow in the field results in intrinsically time-varying aerodynamics, which is difficult to describe by the laboratory model (Ehsan and Scanlan, 1990) with the stationary (or steady) flow assumption. We thus propose a slight variant of *sparse identification of nonlinear dynamics* (SINDy) (Brunton et al., 2016) to discover a parsimonious, time-dependent ordinary differential equation of the vibration amplitude that captures the wind-bridge interactions from the field measurements. The library of candidate nonlinear functions is constructed based on the laboratory model. A moving time window is introduced to apply a typical SINDy regression at each time instant during the VIV event. A time series of sparse coefficient vectors of the candidate functions are obtained to reveal the time-varying aerodynamics. It is found that the level of self-excited effects is significantly varying with the temporal wind flow and bridge motion state. Further, cluster analysis of the obtained coefficient vectors for all VIV events has identified dynamical regimes distinguished by level of self-excited effects.

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