Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

A spectral representation of oscillators SHERVIN BAGHERI, Linné Flow Centre, KTH Mechanics, Stockholm — We investigate Koopman modes as an expansion basis for describing the nonlinear dynamics of self-sustained oscillating flows. The method decomposes the flow evolving on a limit cycle and on its stable manifold into asymptotic/transient and steady/oscillatory components, providing an accurate prediction of both frequencies and relaxation rates. We find that the leading Koopman modes of an oscillator correspond to the mean flow, shift modes and nonlinear global modes. Close to the critical bifurcation threshold the modes are explicitly formed using multiple scale expansion of the flow field and a spectral expansion of the corresponding amplitudes. The analytic modes are in good agreement with Ritz vectors obtained computationally using the dynamic mode decomposition algorithm. We further discuss the ability of the Koopman modes and Ritz vectors of a nonlinear system to approximate the dynamics of unstable equilibria and the transient dynamics characterized by non-exponential behavior.

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Date submitted: 12 Aug 2012 Electronic form version 1.4