Development of accurate and tractable EDMD approximations for analysis and control

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The Koopman operator is a theoretical framework that allows the use of linear analysis tools on transformations of nonlinear systems. Unfortunately, the analytical transformation of an arbitrary system is only possible for a specific family of unforced polynomial systems. To solve the problem of not having analytical transformations, some numerical-decomposition methods; related to the eigenvalues and eigenvectors of the differential equation field, can give a truncated approximation of the Koopman spectrum. For some of these decompositions, part of the method consists in the formulation of a set of functions of the state of the system, and subsequently, find a relation between the linear-time evolution of the functions and the nonlinear-time evolution of the state. To get better approximations of the dynamics in the function space; of smaller order and dimension, and improve the chances of getting the Koopman operator, it is important to have a proper selection of the observables, and carefully track the numerical stability of the algorithm.