

Nonlinear model order reduction via Dynamic Mode Decomposition.

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Abstract: In this talk we propose a new approach to obtain reduced order modelling for nonlinear dynamical systems. The method consists of a first reduction by Proper Orthogonal Decomposition (POD) which is a Galerkin projection approach where the basis functions are computed upon information contained in time snapshots of the dynamical system. Unfortunately, POD does not allow a complete reduction of the nonlinear term since its evaluation is still dependent from the full dimension of the problem. Therefore, it is useful to use a further reduction for the nonlinear term such as the Discrete Empirical Interpolation Method. In the present work we propose the use of the Dynamic Mode Decomposition, an equation-free method, to approximate the nonlinear term. In this way we can obtain a fully reduced dimensional surrogate model and we avoid the evaluation of the nonlinear term in the online stage. This allows an impressive speed up of the computational cost, and, at the same time, accurate approximations of the problem. Finally, we present numerical tests to illustrate our approach and to show the effectiveness of the method in comparison to existing approaches. This is a joint work with J. Nathan Kutz.