

# Data-driven dynamical modeling and nonlinear eigenvalue problems

**Serkan Gugercin**

*Department of Mathematics, Virginia Tech, Blacksburg, VA, USA*  
gugercin@vt.edu

Projection-based model reduction has been successfully employed in prominent applications ranging from inverse problems to uncertainty quantification to optimal control. The projection-based methods require access to internal dynamics, i.e., a state-space representation, which is not always accessible. Rather, in these cases, one might have access to input/output measurements in the form of transfer function evaluations. We will discuss how one can employ this available data to construct high-fidelity (in some cases optimal) data-driven dynamical reduced models, both for non-parametric and parametric systems. Finally, we will connect the data-driven modeling framework to nonlinear eigenvalue problems and discuss how the classical realization theory gives further insights into certain classes of methods for nonlinear eigenvalue computations.