Data-driven Modeling and Optimization of Dissipative Dynamics

Christopher Beattie, Virginia Tech

Computational models of physical systems should take into account the manner in which systems handle energy flux and more broadly, underlying conservation laws. This can be a significant challenge when models are derived directly from system response data; observational noise can further complicate the enterprise.

I will discuss modeling frameworks that account for energy conservation and dissipation for dynamical systems and in particular, allow one to ascertain whether an observed response profile is compatible with a particular dissipation/conservation model. This leads naturally to a data-driven modeling framework that has features in common with classic Nevanlinna-Pick interpolation and port-Hamiltonian modeling. This analysis framework results in a convex parametric family of dissipative models all of which are consistent with observed response profiles and well-suited for further optimization with respect to usual design and control metrics.