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Structure-preserving model reduction of linear time-varying port-Hamiltonian systems

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Port-Hamiltonian (pH) systems are a natural way to model many physical processes. Numerous specialized numerical techniques have been created to take advantage of and maintain the structure of pH systems, such as model order reduction (MOR) and space- and time-discretization. In this work, we focus on the structure-preserving MOR of linear time-varying (LTV) pH systems. LTV systems appear quite naturally in many applications, e.g. in the linearization of nonlinear systems around non-stationary reference solutions, or when some of the system parameters are time dependent. In the literature there are few works on the MOR of general LTV systems, but even fewer on the MOR of LTV-pH systems. In this talk, we introduce a general approach for or the structure-preserving MOR of LTV-pH systems based on (Petrov)- Galerkin projection. We present multiple variants of the usual balanced truncation method to obtain a reduced pH model. Numerical experiments are provided to demonstrate the effectiveness of the proposed methods.

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