Model reduction for port-Hamiltonian descriptor systems

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We analyze model reduction methods and their use in treating large scale port-Hamiltonian differential-algebraic systems in a way that is able to preserve and take advantage of the underlying structural features of the system. We introduce approaches that incorporate regularization. We focus on linear time-invariant systems and present a systematic treatment of a variety of model classes that include combinations of index-1 and index-2 systems, describing in particular how constraints may be represented in the transfer function so that the polynomial part can be preserved with interpolatory methods.