Port-Hamiltonian differential-algebraic systems: Stability and passivity through structure.

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Structured matrices, pencils or dynamical systems are a key topic of mathematics for centuries. Using the algebraic or geometric structure often allows to derive properties. In this talk we will discuss the stability and passivity of dynamical systems and show that for port-Hamiltonian systems, these properties are directly encoded in the structure and so the representation is extremely robust under perturbations. Motivated from an industrial application of studying brake squeal, we study questions like the spectral properties or distance to instability/stability, passivity/non-passivity for these system classes. We will show that the structure leads to interesting new canonical forms, linearizations for matrix polynomials and new techniques for model reduction and stabilization of such systems.