Pseudorational transfer functions - a class of infinite-dimensional systems

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We give an overview of the class of pseudorational transfer functions. This class consists of the ratio of entire functions of exponential type that are Laplace transforms of distributions with compact support. This class gives a convenient platform for dealing with distributed systems whose state space is determined by bounded-time data. Delay-differential systems, with retarded, neutral or distributed delays, are typical examples. We explore its interesting interplay with the ring of entire functions, and highlight some appealing structures as follows: Starting from a completely general input/output framework, we derive a concrete realization procedure based on the above fractional representation of transfer functions (or impulse responses). It is then also possible to give a complete characterization of spectral properties of such realizations via zeros of the denominator of transfer functions. Such spectral properties allow us to give a stability criterion and also an appropriate relationship between internal and external stability notions. Based on a concrete representation of the state space, we are led to a concrete characterization of left-shift invariant subspaces of H^2. This result has a direct consequence on H_∞ control theory. We give a concise yet comprehensive and unified overview of such results. The paper is concluded with this and also a criterion on the existence of a Bezout identity in this class.