Linear systems theory, operator model theory, Beurling-Lax representations for shift-invariant subspaces: extensions to multivariable weighted Bergman space functional models

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It is well known that subspaces of the Hardy space over the unit disk which are invariant under the backward shift operator occur as the image of an observability operator associated with a discrete-time linear system with stable state-dynamics, as well as the functional-model space for a Hilbert space $C_{\cdot 0}$-contraction operator, while forward shift-invariant subspaces have a Beurling-Lax representation in terms of an inner function. We discuss several variants of these statements in the context of (1) weighted Bergman spaces on the unit disk (the single-variable context) as well as (2) a weighted Fock space of formal power series in a collection of d freely noncommuting indeterminates. The first case gives a model theory for n-hypercontractions and Beurling-Lax representations for forward shift-invariant subspaces of a weighted Bergman space on the unit disk; the second case gives a model theory for n-hypercontractive operator d-tuples and Beurling-Lax representations for the weighted-Bergman multishift invariant subspaces of a weighted Fock space. The talk reports on joint work with Vladimir Bolotnikov of the College of William and Mary.