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Real Parts of Pair of Nonselfadjoint Commuting Operators Associated to an Algebraic Curve with Application to System Theory

Abstract

It is a well known fact that transfer functions of scattering conservative systems and impedance conservative system are the analytic contractive function in the unit disk and functions with positive real part on the upper half plane, respectively. In this case, the interplay between the transfer functions is via the Moebius transformation. In the system representation the interplay is by the so called diagonal transformation on the system variables. The functional models of these systems lead to two reproducing kernel Hilbert spaces. In the case of real positive functions in the upper half-plane, Carathéodory integral representation plays a major role.

In this talk, we consider these phenomena and relations in the setting of $2D$ conservative systems (or vessels). First, we present the Carathéodory integral representation for real compact Riemann surfaces and study the corresponding reproducing kernel space. The $2D$ scattering conservative systems or equivalently the corresponding quasi–hermitian vessels are well studied. For the $2D$ impedance conservative systems we introduce a new notion, *the Hermitian vessel*. The interplay between these two type of systems is by a generalized diagonal transform and the joint transfer functions are related by the Moebius transformation. In this case, two functional models arise. The first is a reproducing kernel Hilbert space with reproducing kernel $T(q)K_{\zeta}(q,r) + K_{\tilde{\zeta}}(q,r)T(r)^*$ where $K_{\zeta}(q,r)$ is a Cauchy kernel. The second functional model is a L^2 space (with respect to a specific measure) of sections of a vector bundle over the fixed point (with respect to the involution) of a real compact Riemann surface X.

These results are based on joint work with Daniel Alpay and Victor Vinnikov.

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