Title: Determinantal representations certifying hyperbolicity and stability

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Abstract: I will briefly review positive definite determinantal representations of real homogeneous hyperbolic polynomials and linear matrix inequality representations of hyperbolicity cones. I will then present determinantal representations of complex polynomials that are stable (i.e., zero free) with respect to the polyupper half-plane ${\mathbb H}^d$ or the unit polydisc ${\mathbb D}^d$ in the complex space ${\mathbb C}^d$ that similarly certify their stability. Subject to strict stability, the case of the unit polydisc can be tackled using a ``Hermitian Positivstellensatz'' (representing a polynomial in $z_1,\ldots,z_d$ and $\bar z_1,\ldots,\bar z_d that is positive definite when evaluated on d-tuples of commuting operators on separable Hilbert spaces as a sum of weighted hermitian squares of polynomials in $z_1,\ldots,z_d$) and powerful tools of multivariable operator theory (contractive realizations of functions satisfying the von Neumann inequality). The case of the polyupper half-plane can then be addressed by the Cayley transform mapping the upper half-plane conformally onto the unit disc. I will discuss the relation with hyperbolic polynomials, and time permitting mention generalizations to more general tube domains ${\mathbb C}^d$.

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