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MATHEMATICS COLLOQUIUM SERIES

UNIVERSITY OF CENTRAL FLORIDA

Orthogonal Rational Functions

Dr. Arthur H. Vartanian
Department of Mathematics
College at Charleston

Abstract

Orthogonal Rational Functions (ORFs) are meromorphic functions with no poles in the extended complex plane outside of the real pole set $\{\alpha_1, \ldots, \alpha_K\}$, with $0 \leqslant |\alpha_k| < +\infty$, $k = 1, \ldots, K$, which satisfy a system of orthogonality conditions; in particular, ORFs orthogonal with respect to varying exponential weights $\varpi(z) = \exp(-\mathcal{N} V(z))$, $\mathcal{N} \in \mathbb{N}$, where $V \colon \mathbb{R} \setminus \{\alpha_1, \ldots, \alpha_K\} \to \mathbb{R}$ is real analytic and satisfies certain 'growth conditions' at ∞ and at α_k, $k = 1, \ldots, K$, are considered. The principal question addressed in this talk is: how does one obtain asymptotics in a *double-scaling limit* as $\mathcal{N}$ and n (= the 'degree' of the ORF) tend to infinity in such a way that $\mathcal{N}/n = 1 + o(1)$ for z anywhere in the extended complex plane and $k = 1, \ldots, K$? This will be addressed by considering the FOKAS-ITS-KITAEV reformulation of the ORF problem as a matrix Riemann-Hilbert problem on $\mathbb{R}$, and then extracting the asymptotic behaviour via the DEIFT-ZHOU non-linear steepest-descent method. Possible applications of ORFs to Multi-Point Padé Approximants, Random Matrix Theory, and Painlevé Transcendents will be discussed.

DATE: Friday, April 13, 2007
TIME: 3:00 - 4:00pm
PLACE: Math and Physics Building, Room 204