Rational approximation and Sobolev orthogonal polynomials

03.08

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Abstract: Let $\{S_n\}_{n=0}^{\infty}$ be the sequence of orthogonal polynomialswith respect to the Sobolev-typeinner product

$$\langle f, g\rangle = \int_{-1}^{1} f(x)g(x)\,d\mu(x) + \sum_{j=1}^{N} \eta_j\, f^{(d_j)}(c_j)g^{(d_j)}(c_j),$$

where μ is in the Nevai class $\mathbf{M}(0,1)$, $\eta_j > 0$, $N, d_j \in \mathbb{Z}_+$ and $\{c_1, \ldots, c_N\} \subset \mathbb{R} \setminus [-1,1]$. Under some restriction of order in the discrete part of $\langle\cdot,\cdot\rangle$, we proof that for n sufficiently large the zeros of S_n are real, simple, $n-N$ of them lie on $(-1,1)$ and each of the mass points c_j "attracts" one of the remaining N zeros. The sequences of associated polynomials $\{S_n^{[k]}\}_{n=0}^{\infty}$ are defined for each $k \in \mathbb{Z}_+$. We prove an analog of the Markov's theorem on rational approximation of some class holomorphic functions and we give an estimate of the "speed" of convergence. This is a joint work with Abel Díaz-González.