



Fejér-Riesz factorizations and the structure of bivariate polynomials orthogonal on the bi-circle

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We give a complete characterization of the positive trigonometric polynomials $Q(\theta, \phi)$ on the bi-circle, which can be factored as $Q(\theta, \phi) = |p(e^{i\theta}, e^{i\phi})|^2$ where $p(z, w)$ is a polynomial nonzero for $|z|=1$ and $|w| \leq 1$. The conditions are in terms of recurrence coefficients associated with the polynomials in lexicographical and reverse lexicographical ordering orthogonal with respect to the weight $1/(4\pi^2 Q(\theta, \phi))$ on the bi-circle. We use this result to describe how specific factorizations of weights on the bi-circle can be translated into identities relating the recurrence coefficients for the corresponding polynomials and vice versa. In particular, we characterize the Borel measures on the bi-circle for which the coefficients multiplying the reverse polynomials associated with the two operators: multiplication by z in lexicographical ordering and multiplication by w in reverse lexicographical ordering vanish after a particular point. This can be considered as a spectral type result analogous to the characterization of the Bernstein-Szegő measures on the unit circle.

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