
On π_N -coherent pair with index M and order (m, k) of orthogonal polynomial sequences

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Abstract: Let M and N be non-negative integer numbers, π_N a monic polynomial of degree N , and $(P_n)_{n \geq 0}$ and $(Q_n)_{n \geq 0}$ two monic orthogonal polynomial sequences such that their normalized derivatives of orders m and k (respectively) satisfy

$$\pi_N(x)P_n^{[m]}(x) = \sum_{j=n-M}^{n+N} r_{n,j}Q_j^{[k]}(x)$$

for all $n = 0, 1, 2, \dots$, where each $r_{n,j}$ is a complex number independent of x . It is shown that under some natural constraints, both $\{P_n\}_{n \geq 0}$ and $\{Q_n\}_{n \geq 0}$ belong to the semiclassical orthogonal polynomials class. In addition we show that the corresponding linear functionals with respect to which $\{P_n\}_{n \geq 0}$ and $\{Q_n\}_{n \geq 0}$ are orthogonal, are also connected by a rational modification (in the distributional sense). This leads to the concept of π_N -coherent pair with index M and order (m, k) , as another generalization of the notion of coherent pair of measures introduced by A. Iserles, P. E. Koch, S. P. Nørsett, and J. M. Sanz-Serna [J. Approx. Theory **65** (1991) 151–175], and subsequently generalized by several authors.

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