

Mathematical Physics

Properties of the exceptional (X_{ℓ}) Laguerre and Jacobi polynomials

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We present various results on the properties of the four infinite sets of the exceptional X_{ℓ} polynomials discovered recently (Odake and Sasaki, Phys. Lett. **B679** (2009) 414-417). These X_{ℓ} polynomials are global solutions of second order Fuchsian differential equations with $\ell+3$ regular singularities and their confluent limits. We derive equivalent but much simpler looking forms of the X_{ℓ} polynomials. The other subjects discussed in detail are: factorisation of the Fuchsian differential operators, shape invariance, the forward and backward shift operations, invariant polynomial subspaces under the Fuchsian differential operators, the Gram-Schmidt orthonormalisation procedure, three term recursion relations and the generating functions for the X_{ℓ} polynomials.

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