Supersymmetry and the Rationally Extended Harmonic Oscillator

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Abstract

Our focus is on the rationally extended harmonic oscillator potential, which is isospectral to conventional simple harmonic oscillatorr potential and its solutions are linked with the exceptional X_m-Orthogonal polynomials of codimension m. We broaden our study by introducing a one-parameter (λ) set of exactly solvable isospectral potentials, each providing a unique quantum signature. We pay particular attention to instances where $\lambda = 0$ and $\lambda = -1$, which align with the fascinating Pursey and Abhram-Moses potentials, respectively. Our in-depth analysis covers the entire isospectral family, offering a fresh viewpoint on the exceptional polynomials.

Keywords: Supersymmetry, Rationally Extended Harmonic Oscillator, Exceptional Orthogonal Polynomials, Pursey Potential, Abhram-Moses Potential, isospectral Potential.

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