



Mathematical Physics

The $su(2)_\alpha$ Hahn oscillator and a discrete Hahn-Fourier transform

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We define the quadratic algebra $su(2)_\alpha$ which is a one-parameter deformation of the Lie algebra $su(2)$ extended by a parity operator. The odd-dimensional representations of $su(2)$ (with representation label j , a positive integer) can be extended to representations of $su(2)_\alpha$. We investigate a model of the finite one-dimensional harmonic oscillator based upon this algebra $su(2)_\alpha$. It turns out that in this model the spectrum of the position and momentum operator can be computed explicitly, and that the corresponding (discrete) wavefunctions can be determined in terms of Hahn polynomials. The operation mapping position wavefunctions into momentum wavefunctions is studied, and this so-called discrete Hahn-Fourier transform is computed explicitly. The matrix of this discrete Hahn-Fourier transform has many interesting properties, similar to those of the traditional discrete Fourier transform.

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