Cooper, Fred; **Dawson, John**; **Shepard, Harvey**

SUSY-based variational method for the anharmonic oscillator. (English) Zbl 0941.81526

Phys. Lett., A 187, No. 2, 140-144 (1994).

Summary: Using a newly suggested algorithm of Gozzi, Reuter and Thacker for calculating the excited states of one-dimensional systems, we determine approximately the eigenvalues and eigenfunctions of the anharmonic oscillator, described by the Hamiltonian $H = \frac{1}{2}p^2 + gx^4$. We use ground state post-Gaussian trial wave functions of the form $\Psi(x) = N\exp(-b|x|^{2n})$, where n and b are continuous variational parameters. This algorithm is based on the hierarchy of Hamiltonians related by supersymmetry (SUSY) and the factorization method. We find that our two-parameter family of trial wave functions yields excellent energy eigenvalues and wave functions for the first few levels of the anharmonic oscillator.

MSC:

81Q05 Closed and approximate solutions to the Schrödinger, Dirac, Klein-Gordon and other equations of quantum mechanics
81-04 Software, source code, etc. for problems pertaining to quantum theory
81Q60 Supersymmetry and quantum mechanics

Full Text: DOI

References:

[1] Schrödinger, E., (), 9
[2] Infeld, L.; Hull, T.E., Rev. mod. phys., 23, 21, (1951)
[3] Gozzi, E.; Reuter, M.; Thacker, W., Variational methods via supersymmetric techniques, INFN preprint, (1993)
[4] Sukumar, C.V.; Sukumar, C.V., J. phys. A, J. phys. A, 18, 2917, (1986)
[5] Adrianov, A.A.; Borisov, N.V.; Ioffe, M.V., Phys. lett. A, 105, 19, (1984)
[6] F. Cooper, A. Khare and U. Sukhatme, Supersymmetry and quantum mechanics, Phys. Rep., to be published. · Zbl 0988.81001
[7] Witten, E., Nucl. phys. B, 188, 513, (1981)
[8] Cooper, F.; Freedman, B., Ann. phys., 146, 262, (1983)
[9] Khare, A.; Sukhatme, U., J. phys. A, 21, L501, (1988)
[10] Cooper, F.; Shepard, H.; Lucheroni, C.; Sodano, P., Physica D, 68, 344, (1993)
[11] Hioe, F.T.; Montroll, E.W., J. math. phys., 16, 1945, (1975)