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Anharmonic oscillator and double-well potential: approximating eigenfunctions

A simple uniform approximation of the logarithmic derivative of the ground state eigenfunction for both the quantum-mechanical anharmonic oscillator and the double-well potential given by $V = m^2x^2 + gx^4$ at arbitrary $g \geq 0$ for $m^2 > 0$ and $m^2 < 0$, respectively, is presented. It is shown that if this approximation is taken as unperturbed problem it leads to an extremely fast convergent perturbation theory. A connection with WKB approximation is briefly discussed.

Dedicated to the memory of Professor Felix A. Berezin.