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Root system of perturbations of harmonic and anharmonic oscillators

We analyze perturbations of the harmonic oscillator type operator in a Hilbert space, i.e. of the self-adjoint operator with simple positive eigenvalues μ_k satisfying $\mu_{k+1} - \mu_k \geq \Delta > 0$. Perturbations are considered in the sense of quadratic forms. Under a “local subordination assumption”, the eigenvalues of the perturbed non-self-adjoint operator become eventually simple and the root system forms a Riesz basis.

The abstract results are applied to harmonic and anharmonic oscillators and perturbations by singular potentials are particularly considered. Finally, we present classes of perturbations for which the eigensystem of the perturbed oscillators is not even a basis; the norms of spectral projections are found to grow at rates from arbitrarily slowly to exponentially rapidly.

The talk is based on:

- [1] B. Mityagin, P. Siegl: *Root system of singular perturbations of the harmonic oscillator type operators*, arXiv:1307.6245,
- [2] B. Mityagin, P. Siegl, J. Viola: *Differential operators admitting various rates of spectral projection growth*, arXiv:1309.3751.