Lamé and Treibich-Verdier potentials as models of one-dimensional periodic potentials in the Schrödinger equation

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Energy spectrum of a quantum particle in a lattice can be discribed by Schrödinger equation with a periodic potential. In the general case solving this problem analytically is impossible. But there are some potentials for which the precise analytical solution can be obtained.

In particular, a good model is realized by means of g-gap Lamé potentials of the form $g(g+1)\wp(x)$, and Treibich - Verdier potentials $\mathcal{U}(x) = g(g+1)\wp(x) + \sum_i^N g_i(g_i+1)\wp(x+\omega_i), N \leq 3$, in one-dimensional Schrödinger equation. In our study we solve the problem with potentials $2\wp(x)$, $6\wp(x)$, $2\wp(x) + 2\wp(x+\omega_i)$ and $6\wp(x) + 2\wp(x+\omega_i)$, and analyse energy spectra and energy-quasimomentum relations.