Gaps in the spectrum of 1d periodic selfadjoint operator of order 4

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Spectrum of a self-adjoint differential operator with periodic coefficients is formed by a system of spectral bands separated by gaps. In 1975 V.Marchenko and I.Ostrovskii demonstrated how to open collapsed gaps and to close sufficiently small gaps in the spectrum of Hill's operator

$$H = -\frac{d^2}{dx^2} + q(x), \quad q(x+\pi) = q(x), \quad x \in \mathbb{R},$$

with small perturbations of its potential q.

We describe a method of treating the same problem for a self-adjoint operator $\frac{4}{4}$

$$H = \frac{d^{2}}{dx^{4}} + \frac{d}{dx}p(x)\frac{d}{dx} + q(x), \quad p(x+\pi) = p(x), \quad q(x+\pi) = q(x), \quad x \in \mathbb{R}.$$