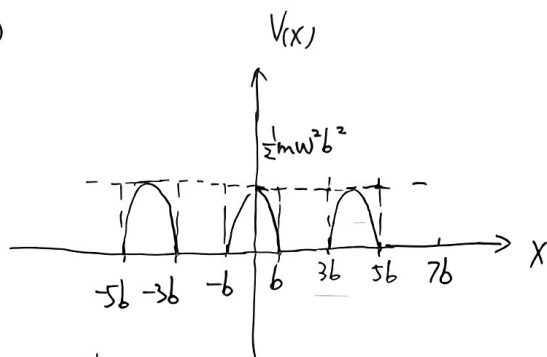


苏. 13. 1/12, 2019010448 HW 7 图 1

1.

1)



$$\bar{V}(x) = \int_{-b}^{3b} V(x) dx \cdot \frac{1}{4b}$$

$$= \frac{1}{4b} \int_{-b}^b \frac{1}{2}m\omega^2(b^2 - x^2) dx = \frac{1}{6}m\omega^2b^2$$

2)

$$V_n = \frac{1}{a} \int_0^a e^{-j \frac{2\pi n x}{a}} V(x) dx$$

$$= \frac{1}{a} \int_0^a \frac{1}{2}m\omega^2(b^2 - x^2) e^{-j \frac{2\pi n x}{a}} dx$$

$$= \frac{4m\omega^2b^2}{h^2\lambda^3} \left(\sin \frac{n\lambda}{2} - \frac{n\lambda}{2} \cos \frac{n\lambda}{2} \right)$$

带隙宽度为 $2|V_n|$

$$n=1 \text{ 时 } d_1 = 2|V_1| = \frac{8m\omega^2b^2}{\lambda^3}$$

$$n=2 \text{ 时 } d_2 = 2|V_2| = \frac{m\omega^2b^2}{\lambda^2}$$

$$2. \quad \psi(x+a) = e^{ika} \psi(x)$$

$$1) \quad \psi(x) = \sin \frac{x\lambda}{a}$$

$$\psi(x+a) = \sin \left(\frac{x\lambda}{a} + \lambda \right) = -\sin \left(\frac{x\lambda}{a} \right)$$

$$= e^{ika} \sin \left(\frac{x\lambda}{a} \right)$$

$$\Rightarrow e^{ika} = -1, \quad k = \frac{\pi}{a}$$

$$2) \quad \psi(x) = i \cos \frac{3x\lambda}{a}$$

$$\psi(x+a) = -i \cos \frac{3x\lambda}{a} = e^{ika} i \cos \frac{3x\lambda}{a}$$

$$\Rightarrow k = \frac{\lambda}{a}$$

$$3) \quad \psi(x) = \sum_{l=-\infty}^{+\infty} f(x-la)$$

$$\psi(x+a) = \sum_{l=-\infty}^{+\infty} f(x-la+a) = \sum_{l=-\infty}^{+\infty} f(x-l(-1)a)$$

$$= e^{ika} \sum_{l=-\infty}^{+\infty} f(x-la)$$

$$\Rightarrow e^{ika} = 1, \quad k=0$$

$$4) \quad \psi(x) = \sum_{m=-\infty}^{+\infty} (-i)^m f(x-ma)$$

$$\psi(x+a) = \sum_{m=-\infty}^{+\infty} (-i)^m f(x-(m-1)a)$$

$$= \sum_{n=-\infty}^{+\infty} (-i)^n \cdot (-i) \cdot f(x-na) \quad (n=m-1)$$

$$= e^{ika} \sum_{m=-\infty}^{+\infty} (-i)^m (-i) f(x-ma)$$

$$\Rightarrow e^{ika} = -i, \quad k = -\frac{\pi}{2a}$$

扫码使用

夸克扫描王

