

$$2.1.1 \quad V=0 \text{ when } y=0$$

$$V=0 \text{ when } y=a$$

$$V=0 \text{ when } x=b$$

$$V=V_0 \text{ when } x=0$$

$$V = (A \cosh(m(b-x)) + B \sinh(m(b-x))) (C \cos(my) + D \sin(my))$$

$$\text{For } V=0 \text{ when } y=0,$$

$$D \sin(my) = 0 \text{ and } C \cos(my) = 0 \text{ if } C=0$$

$$\text{For } V=0 \text{ when } y=a,$$

$$D \sin\left(\frac{n\pi y}{a}\right) = D \sin(n\pi) = 0, \text{ so } m = \frac{n\pi}{a}$$

$$V = (A \cosh\left(\frac{n\pi}{a}(b-x)\right) + B \sinh\left(\frac{n\pi}{a}(b-x)\right)) D \sin\left(\frac{n\pi y}{a}\right)$$

$$\text{For } V=0 \text{ when } x=b,$$

$$(b-x) \text{ is used instead of } x$$

$$B \sinh\left(\frac{n\pi}{a}(0)\right) = 0 \text{ and } A \cosh\left(\frac{n\pi}{a}(0)\right) = 0 \text{ if } A=0$$

$$V = B D \sinh\left(\frac{n\pi}{a}(b-x)\right) \sin\left(\frac{n\pi y}{a}\right)$$

$$V_0 = \sum_{n=1}^{\infty} C_n \sinh\left(\frac{n\pi b}{a}\right) \sin\left(\frac{n\pi y}{a}\right) \text{ for } x=b$$

$$\text{Using Fourier } C_n \sinh\left(\frac{n\pi b}{a}\right) = \frac{2}{a} \int_0^a V_0 \sin\left(\frac{n\pi y}{a}\right) dy$$

$$C_n = \frac{2}{a \sinh\left(\frac{n\pi b}{a}\right)} \int_0^a V_0 \sin\left(\frac{n\pi y}{a}\right) dy$$

$$C_n = \frac{2V_0}{a \sinh\left(\frac{n\pi b}{a}\right)} \frac{a}{n\pi} \left[-\cos\left(\frac{n\pi y}{a}\right) \right]_0^a$$

$$C_n = \frac{4V_0}{n\pi \sinh\left(\frac{n\pi b}{a}\right)}$$

→ will be 0 with even n
and 2 with odd n

$$V_r = \frac{4V_0}{\pi} \sum_{n=1,3,5,\dots} \frac{\sinh\left(\frac{n\pi(b-x)}{a}\right) \sin\left(\frac{n\pi y}{a}\right)}{n \sinh\left(\frac{n\pi b}{a}\right)}$$

2.1.2 $V=0$ when $x=0$
 $V=0$ when $x=b$
 $V=0$ when $y=a$
 $V=V_0$ when $y=0$

$$(A \cos(mx) + B \sin(mx))(C \cosh(m(a-y)) + D \sinh(m(a-y)))$$

At $x=0$, $V=0$ when $A=0$

At $x=b$, $V=0$ when $m = \frac{n\pi}{b}$

At $y=a$, $V=0$ when $C=0$

$$V = B D \sin\left(\frac{n\pi x}{b}\right) \sinh\left(\frac{n\pi}{b}(a-y)\right)$$

At $y=0$, $V=V_0$

$$V_0 = \sum_{n=1}^{\infty} C_n \sin\left(\frac{n\pi x}{b}\right) \sinh\left(\frac{n\pi a}{b}\right)$$

$$C_n = \frac{4V_0}{n\pi \sinh\left(\frac{n\pi a}{b}\right)}$$

$$V_b = \frac{4V_0}{\pi} \sum_{n=1,3,5,\dots} \frac{\sinh\left(\frac{n\pi(a-y)}{b}\right) \sin\left(\frac{n\pi x}{b}\right)}{n \sinh\left(\frac{n\pi a}{b}\right)}$$

2.1.3 $V=0$ when $x=0$
 $V=0$ when $x=b$
 $V=0$ when $y=0$
 $V=V_0$ when $y=a$

$$V = (A \cos(mx) + B \sin(mx))(C \cosh(my) + D \sinh(my))$$

At $x=0$, $V=0$ when $A=0$

At $x=b$, $V=0$ when $m = \frac{n\pi}{b}$

At $y=0$, $V=0$ when $C=0$

At $y=a$,

$$V_0 = \sum_{n=1}^{\infty} C_n \sinh\left(\frac{n\pi a}{b}\right) \sin\left(\frac{n\pi x}{b}\right)$$

$$C_n = \frac{4V_0}{n\pi \sinh\left(\frac{n\pi a}{b}\right)}$$

$$V_t = \frac{4V_0}{\pi} \sum_{n=1,3,5,\dots} \frac{\sinh\left(\frac{n\pi y}{b}\right) \sin\left(\frac{n\pi x}{b}\right)}{n \sinh\left(\frac{n\pi a}{b}\right)}$$

2.1.4

$$V=0 \text{ when } y=0$$

$$V=0 \text{ when } y=a$$

$$V=0 \text{ when } x=0$$

$$V=V_0 \text{ when } x=b$$

$$V = (A \cosh(mx) + B \sinh(mx))(C \cos(my) + D \sin(my))$$

$$\text{When } y=0, V=0 \text{ when } C=0$$

$$\text{When } y=a, V=0 \text{ when } m = \frac{n\pi}{a}$$

$$\text{When } x=0, V=0 \text{ when } A=0$$

$$\text{When } x=b, V=V_0$$

$$V_0 = \sum_{n=1}^{\infty} C_n \sinh\left(\frac{n\pi b}{a}\right) \sin\left(\frac{n\pi y}{a}\right)$$

$$C_n = \frac{4V_0}{n\pi \sinh\left(\frac{n\pi b}{a}\right)}$$

$$V_r = \frac{4V_0}{\pi} \sum_{n=1,3,5,\dots} \frac{\sinh\left(\frac{n\pi x}{a}\right) \sin\left(\frac{n\pi y}{a}\right)}{n \sinh\left(\frac{n\pi b}{a}\right)}$$