

# 北京航空航天大学

BEIJING UNIVERSITY OF AERONAUTICS AND ASTRONAUTICS

71066001 - 陈伟杰 物理作业9

11.2 - 横波沿波线传播时的波动表式为

$$y = 0.05 \cos(10\pi t - 4\pi x)$$

(1) 求此波的振幅、波速、频率和波长；

$$y = 0.05 \cos(10\pi t - 4\pi x)$$

$$y = A \cos(2\pi \nu t - 2\pi \frac{x}{\lambda} + \phi_0)$$

$$A = 0.05 \text{ m} \quad \nu = 5 \text{ Hz} \quad \lambda = 0.5 \text{ m} \quad \text{并有 } \omega = 2\pi \nu = 10\pi \text{ rad/s}$$

(2) 各质点振动的最大速度为

$$u = \omega A = 2.5 \text{ m/s} \quad \phi_0 = 0$$

$$v_m = \omega A = 2.5 \pi \text{ m/s} = 1.57 \text{ m/s}$$

各质点振动的最大加速度为  $a_m = \omega^2 A = 5\pi^2 \text{ m/s}^2 = 49.3 \text{ m/s}^2$

(3)  $x = 0.2 \text{ m}$  处质点在  $t = 1 \text{ s}$  时的相位为

$$(10\pi t - 4\pi x) \Big|_{\substack{t=1 \\ x=0.2}} = (10\pi \times 1 - 4\pi \times 0.2) = 9.2\pi$$

这是  $t$  时刻，坐标原点  $x = 0$  处质点的振动相位，即有

$$10\pi t = 9.2\pi \quad t = 0.92 \text{ s} \quad \text{即 } (10\pi t - 4\pi x) \Big|_{x=0} = 10\pi t = 9.2\pi$$

$x = 0$  处质点的振动相位

$$\Delta t = \frac{\Delta x}{u} = \frac{0.2}{2.5} = 0.08 \text{ s}$$

(4)  $t = 1 \text{ s}$  波动方程

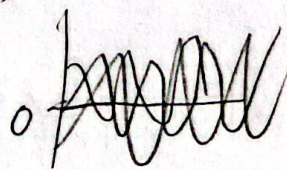
$t = 1.25 \text{ s}$  波动方程

$$y = 0.05 \cos(10\pi - 4\pi x) \\ = 0.05 \cos 4\pi x (\text{m})$$

$$y = 0.05 \cos(12.5\pi - 4\pi x) \\ = 0.05 \sin 4\pi x (\text{m})$$

$t = 1.50 \text{ s}$  波动方程

$$y = 0.05 \cos(15\pi - 4\pi x) \\ = -0.05 \cos 4\pi x (\text{m})$$





11-3 设有一平面简谐波  $y = 0.02 \cos 2\pi \left( \frac{t}{0.01} - \frac{x}{0.3} \right)$

1) 求振幅, 波长, 频率和波速

$$y = 0.02 \cos 2\pi \left( \frac{t}{0.01} - \frac{x}{0.3} \right)$$
$$y = A \cos \left( 2\pi \nu t - \frac{2\pi}{\lambda} x + \phi_0 \right)$$

可得  $A = 0.02 \text{ m}$     $\lambda = 0.3 \text{ m}$     $\nu = 100 \text{ Hz}$     $\phi = 0$

$$u = \lambda \nu = 30 \text{ m/s}$$

2)  $x = 0.1 \text{ m}$  处质点在  $t = 0$  时取何振动的初相位为

$$2\pi \left( \frac{0}{0.01} - \frac{0.1}{0.3} \right) = -\frac{2\pi}{3}$$

