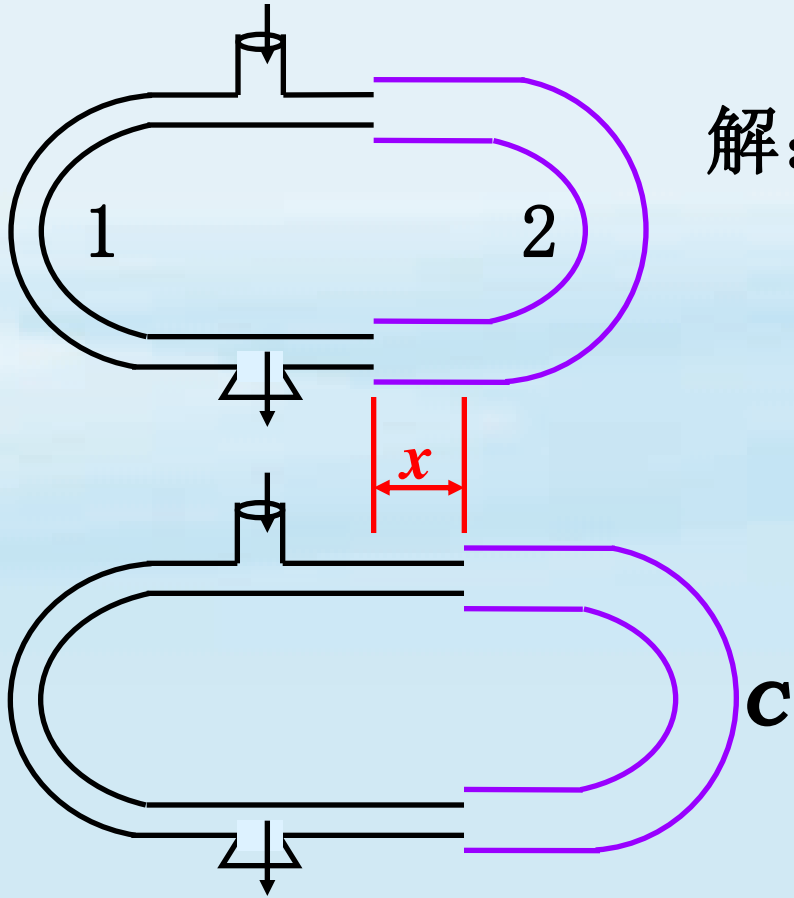


[例5-5] C管每移动 x , 其声音减弱一次, 求 λ (课本P190)



$$\text{解: } \begin{cases} \Delta r_i = r_2 - r_1 = (2k + 1) \frac{\lambda}{2} \\ \Delta r_f = (r_2 + 2x) - r_1 = [2(k + 1) + 1] \frac{\lambda}{2} \end{cases}$$

$$\Rightarrow \lambda = 2x$$

差分法:

对波程差两边微分

$$d\delta = d[(2k + 1) \frac{\lambda}{2}] \rightarrow d\delta = dk \cdot \lambda$$

$$\text{微分有限化} \rightarrow \Delta\delta = \Delta k \cdot \lambda$$

$$\Delta k = 1$$

[讨论6] $\nu_1 = \nu_2 = 100\text{Hz}$, $A_1 = A_2 = 1\text{cm}$, $\varphi_1 = 0, \varphi_2 = \pi$, $u = 400\text{m/s}$
 $s_1 s_2 = 30\text{m}$, 求 (1) P点及M点的振动方程

(2) $S_1 S_2$ 连线上静止点坐标

解 ① $y = A \cos(\omega t + \varphi)$

$$A = \sqrt{A_1^2 + A_2^2 + 2A_1A_2 \cos \Delta \Phi}$$

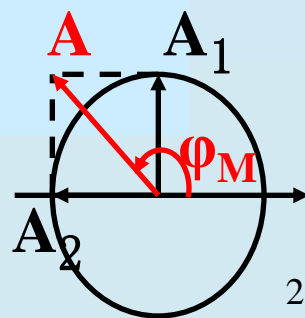
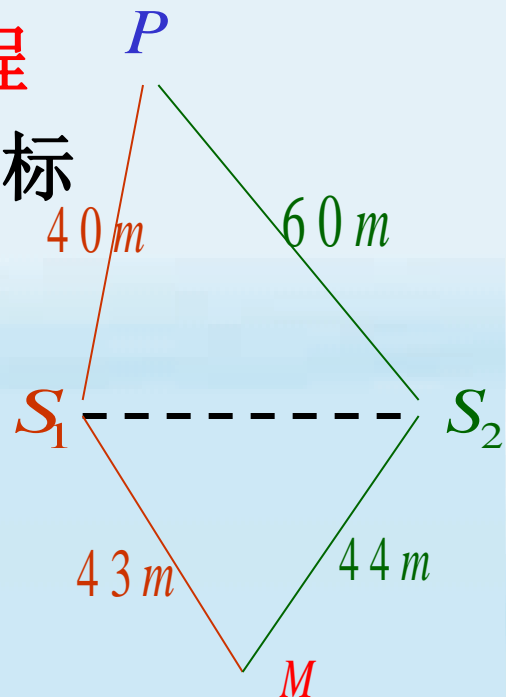
$$\Delta \Phi = \varphi_2 - \varphi_1 - 2\pi(r_2 - r_1) / \lambda$$

$$\Delta \Phi_P = -9\pi \Rightarrow A_P = |A_1 - A_2| = 0 \Rightarrow y_P = 0$$

$$\lambda = \frac{u}{\nu} = 4\text{m}$$

$$\Delta \Phi_M = \frac{\pi}{2} \begin{cases} \phi_{1M} = \varphi_1 - \frac{2\pi}{\lambda} r_1 = \frac{\pi}{2} \\ \phi_{2M} = \varphi_2 - \frac{2\pi}{\lambda} r_2 = \pi \end{cases}$$

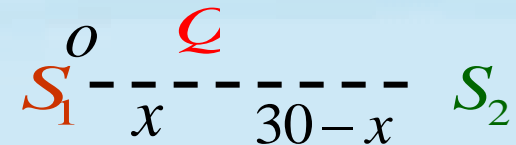
$$y_M = \sqrt{2} \cos(200\pi t + 3\pi / 4) \text{cm}$$



[讨论6] $\nu_1 = \nu_2 = 100\text{Hz}$, $A_1 = A_2 = 1\text{cm}$, $\varphi_1 = 0, \varphi_2 = \pi$, $u = 400\text{m/s}$
 $s_1 s_2 = 30\text{m}$, 求 (1) P点及M点的振动方程

(2) $S_1 S_2$ 连线上静止点坐标

解(2) : 令 S_1 为坐标原点



$$\Delta \Phi_{\varphi} = \varphi_2 - \varphi_1 - 2\pi(r_2 - r_1)/\lambda$$

$$\Delta \Phi_{\varphi} = \pi - 0 - \frac{2\pi}{4}[(30 - x) - x] = \pm(2k + 1)\pi$$

$$\Rightarrow x = 15 \pm 2k \in [0, 30] \quad (k = 0, 1, 2, \dots, 7)$$

[讨论5] 船距悬崖 x , C收不到桅杆发出的无线电波. 求 λ_{\max}

解: 波程差 $\delta = AB + BC - AC + \lambda / 2 = (2k+1)\lambda / 2$ 半波损失

$$\sqrt{50^2 + a^2} + \sqrt{150^2 + (2000 - a)^2} - \sqrt{2000^2 + 100^2} + \frac{\lambda}{2} = (2k+1)\frac{\lambda}{2}$$

ADB~ΔCEB: $\frac{50}{150} = \frac{a}{2000 - a} \Rightarrow a = 500$

$$\Rightarrow \lambda = \frac{7.47}{k} \Rightarrow \lambda_{\max}|_{k=1} = 7.47\text{m}$$

无线电波波长: $10^{-3} \sim 10^5$ 米

ITU—国际电信联盟规定:

无线电频率3KHz—300GHz

