

Problem 94(3) Part Three

Start with:

$$\ddot{A}_r + c\ddot{\omega} A_r + c\omega^\circ \dot{A}_r = -\dot{E}_r \quad - (1)$$

$$\ddot{A}_\phi + c\ddot{\omega} A_\phi + c\omega^\circ \dot{A}_\phi = -\dot{E}_\phi \quad - (2)$$

and use:

$$A_r = A_1(r) \sin(\omega t) \quad - (3)$$

$$\omega^\circ = \dot{\omega} = \omega_1(r) \sin(\omega t) \quad - (4)$$

$$-\dot{E}_r = f \quad - (5)$$

for

$$\ddot{A}_r = -\omega^2 A_1(r) \sin(\omega t) \quad - (6)$$

$$\dot{A}_r = \omega A_1(r) \cos(\omega t) \quad - (7)$$

$$\omega^\circ = \omega_1(r) \sin(\omega t) \quad - (8)$$

So:

$$\boxed{-\omega^2 A_1(r) \sin(\omega t) + c\ddot{\omega} A_1(r) \sin(\omega t) + c\omega_1(r) \sin(\omega t) \omega A_1(r) \cos(\omega t) = f}$$

- (9)

I think that eq. (4) should be this.

$$\text{For } \omega t = \pi/4 \quad - (10)$$

$$\sin(\omega t) = \cos(\omega t) = \frac{1}{\sqrt{2}} \quad - (11)$$

- (12)

and:

$$\frac{-\omega^2 A_1(r)}{\sqrt{2}} + \frac{c\ddot{\omega} A_1(r)}{\sqrt{2}} + \frac{c\omega_1 \omega A_1(r)}{2}$$

= f

2)

i.e.:

$$A_1(r) \left(\frac{c\ddot{\omega}}{\sqrt{2}} + \frac{c\omega\omega_1}{2} - \frac{\omega^2}{\sqrt{2}} \right) = f \quad - (13)$$

Resonance occurs when:

$$\boxed{\frac{c\ddot{\omega}}{\sqrt{2}} + \frac{c\omega\omega_1}{2} = \frac{\omega^2}{\sqrt{2}}} \quad - (14)$$

I check out this is the right resonance
condition and it occurs.