PHYS 202 Formula Sheet

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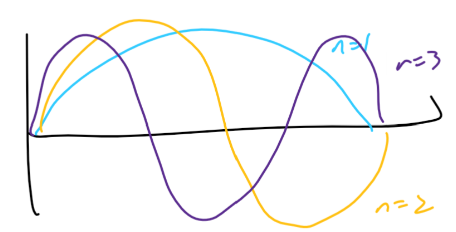
Boundary conditions for N masses The solutions for the n mass oscillators are in the form of:

$$\psi(m, t) = A\text{Ixp}(\omega t + k_m a) + B\text{Ixp}(\omega t - k_m a)$$

Plugging into the 2nd order DE, we derive an expression for the angular frequency.

$$\omega_m = 2\omega_0 \sin(k_m \frac{a}{2})$$

k_m is the mth wave number. Recall that $k := \frac{2\pi}{\lambda}$. λ_n can be computed by drawing diagrams.



With some algebraic hassle, it is possible to derive the expressions for k_m.

For closed-closed and open-open ends:

$$k_m a = \frac{m\pi}{n+1} \quad \text{or} \quad k_m = \frac{m\pi}{a(n+1)} = \frac{m\pi}{L}$$

Where $m \in \mathbb{Z}^+$

For open-open ends:

$$k_m a = \frac{m\pi}{(2n+1)/2} \quad \text{or} \quad k_m = \frac{m\pi}{L}$$

Where $m \in \mathbb{Z}^+$

Transverse waves From the geometry of the springs, we use approximation. Let theta be the angle between the horizontal axis and the string. $\tan(\theta) \approxeq \theta = \Delta y/a$. Consequently, we arrive at:

$$k \mapsto T/a$$