VALOVI - DZ 5

1. Harmonički val

$f = 0{,}75\,Hz$ ✓

$T = 0{,}6625$

$\omega = 4{,}71\ rad/s$ ✓

$v = 0{,}90\ m/s \rightarrow \omega$ ✓

$\lambda = 1{,}2\ m \rightarrow \lambda$ ✓

$k = 5{,}24\ rad/m^{-1} \rightarrow \omega$ ✓

$\omega = \frac{2\pi}{T} = 2\pi f$

$T = \frac{1}{f} \rightarrow f = \frac{1}{T}$

$0{,}75\,Hz = \frac{3}{4}$

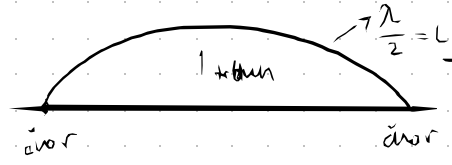
$\frac{4}{3}s = T = 1{,}333$

$\omega = k \cdot v$

$\lambda = \frac{2\pi}{k}$

Treći DOBAR

2.



$\frac{\lambda}{2} = L \rightarrow f_1 = 300\,Hz$

$\rightsquigarrow \omega_1 = \frac{\pi v}{L}$

$\hookrightarrow 3/2\,\lambda = L$

$\rightarrow$ 3x veća napetost

Hz = ?

$\rightsquigarrow 3\omega_1 = \omega_2$

$f_1 = 100\,Hz$

T_1

$T_2 = 3\,T_1$

napetost na period

$f = \left[\frac{1}{s}\right] = \frac{v}{\lambda} \rightarrow \left[\frac{\frac{m}{s}}{m} = \frac{1}{s}\right]$

$L = \frac{3}{2}\lambda \rightarrow L = \frac{n}{2}\lambda$

$f_2 = ?$

$\rightarrow$ brzina stojnog vala na užetu: $v^2 = \frac{T}{\mu} \rightarrow v = \sqrt{\frac{T_2}{\mu}}$ (period)

$\lambda = \frac{2L}{n} \rightarrow \lambda_1 = 2L$

$\lambda_2 = \frac{2}{3}L$

$f_1 = \frac{v_1}{\lambda_1} = \frac{\sqrt{\frac{T_1}{\mu}}}{2L} = \frac{\sqrt{T_1}}{\sqrt{\mu}\,2L}$

najniža frekvencija mane užeta

$f_2 = \frac{v_2}{\lambda_2} = \frac{\sqrt{\frac{T_2}{\mu}}}{\frac{2}{3}L} = \frac{\sqrt{T_2}}{\sqrt{\mu}\,2L \cdot \frac{1}{3}} = \frac{3\sqrt{3T_1}}{\sqrt{\mu}\,2L}$

$f_2 = 3\sqrt{3}\,f_1 \Rightarrow 3\sqrt{3} \cdot 300\,Hz$

$f_2 = 1558{,}846$

3. Harmonički val

v_1 - brzina vala

$v_2 < v_1$

$\frac{P_2}{P_1} = \frac{4}{5}$

$\frac{v_2}{v_1} = ?$

FORMULA:

$$\frac{P_{REFLEKTIRANO}}{P_{UPADNO}} = \left(\frac{v_2 - v_1}{v_2 + v_2}\right)^2$$

$$\frac{P_2}{P_1} = \frac{4}{5} = \left(\frac{v_2 - v_1}{v_2 + v_1}\right)^2 \Rightarrow \frac{4}{5} = \frac{v_2^2 - 2v_1v_2 + v_1^2}{v_2^2 + 2v_1v_2 + v_1^2}$$

$$4(v_2^2 + 2v_1v_2 + v_1^2) = 5(v_2^2 - 2v_1v_2 + v_1^2)$$

$$4v_2^2 + 8v_1v_2 + 4v_1^2 = 5v_2^2 - 10v_1v_2 + 5v_1^2$$

$$v_2^2 - 18v_1v_2 + v_1^2 = 0 \quad / : v_1^2$$

$$\left(\frac{v_2}{v_1}\right)^2 - 18\frac{v_2}{v_1} + 1 = 0$$

$t = \frac{v_2}{v_1}$ to je ono što se traži!

(pa je lakša supstitucija)

$$t^2 - 18t + 1 = 0$$

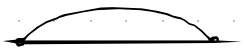
$$t = 0{,}056$$

ROKO ZAD

$f_1 = 300\,Hz - f_2$

$f_u = ?$

Žica gitare:



2 čvora i trbuh → $L = \frac{\lambda}{2}$

$\lambda = 2L$

$f = \frac{v}{\lambda} \rightarrow f = \frac{v}{2L} = \frac{\sqrt{\frac{T}{\mu}}}{2L}$

T - napetost žice

T_2 - napetost nakon ugađanja

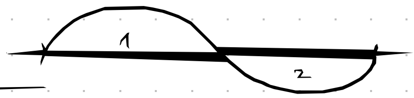
$T_2 = 1{,}03\,T$

$f_u = \sqrt{\quad}$

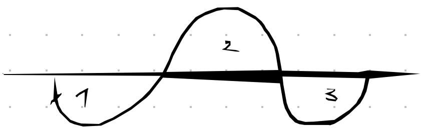
$\Delta f_u = ? \rightarrow f - f_u$ ili $F_u - f$

Gracia

$L = \lambda$



1. val — frekv. 200Hz — napetost T_1



2. val — $f = ?$ — $T_2 = 4T_1$

$L = \frac{3}{2}\lambda$

$\rightarrow \lambda = \frac{2}{3}L$

$f_1 = 200Hz$ $\quad T_2 = 4T_1$

$f_2 = ?$

$$f = \frac{v}{\lambda} = \frac{\sqrt{\frac{T}{\mu}}}{\lambda}$$

T – napetost, μ – konstanta špage

$$f_1 = \frac{\sqrt{\frac{T_1}{\mu}}}{L} = \frac{\sqrt{T_1}}{\sqrt{\mu}\cdot L}$$

$$f_2 = \frac{\sqrt{\frac{4T_1}{\mu}}}{\frac{2}{3}L} = \frac{2\sqrt{T_1}}{\sqrt{\mu}\,2L\cdot\frac{1}{3}} = 3f_1 = 600Hz$$

Gracia

$2r_2 = 1.1 \cdot 2r_1$

$r_2 = 1.1\, r_1$

T_1 – ona koja je pukla

r_1 – ||–

T_2 – ona nova veće napetosti

$r_2 = 1{,}1\, r_1$

$f_1 = f_2$ (jer moraju isti ton)

koliko ću posto(cima) će biti napetija?

$$2\pi f = \frac{\pi}{L}\sqrt{\frac{T}{\rho r^2 \pi}}$$

$$f_1 = \frac{1}{2L}\sqrt{\frac{T_1}{\rho \cdot r_1^2 \pi}} = \frac{1}{2L}\cdot\frac{1}{r_1\sqrt{\rho\pi}}\cdot\sqrt{T_1}$$

$$f_2 = \frac{1}{2L}\sqrt{\frac{T_2}{\rho\, r_2^2\, \pi}} = \frac{\sqrt{T_2}}{2L}\cdot\frac{1}{\sqrt{\rho(1{,}1r_1)^2\pi}}$$

$f_1 = f_2$

$\Downarrow$

$$\frac{\sqrt{T_1}}{r_1} = \frac{\sqrt{T_2}}{1{,}1 r_1}$$

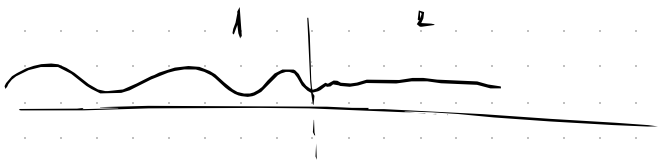
$$1{,}1\cdot\sqrt{T_1} = \sqrt{T_2} \quad /^2$$

$$1{,}21\, T_1 = T_2$$

$\longrightarrow T_2 = 21\%$ veća od T_1

Grafa

v_1 - brzina vala



$v_2 \neq v_1$

$\frac{A_{trans}}{A_{upad}} = \frac{1}{2}$ * netko s discorda ispiši

$\frac{v_2}{v_1} = ?$

$A_r = \frac{k_1 - k_2}{k_1 + k_2} A_u$

$k_1 \sim \frac{1}{v} \Rightarrow k_2 \neq k_1$

$\frac{1}{2} = \frac{k_1 - k_2}{k_1 + k_2}$

$k_1 + k_2 = 2k_1 - 2k_2$

$3k_2 = k_1$

$3\frac{1}{v_2} = \frac{1}{v_1} \rightarrow \frac{v_1}{v_2} = \frac{1}{3}$?