

ASSIGNMENT11.15 _ 13Q

EE22BTECH11219 - Sai Sujan Rada

QUESTION

Given below are some functions of x and t to represent the displacement (transverse or longitudinal) of an elastic wave. State which of these represents (a) travelling wave, (ii) a stationary wave or (iii) none at all:

- 1) $y = 2 \cos(3x) \sin(10t)$
- 2) $y = 2 \sqrt{x - vt}$
- 3) $y = 3 \sin(5x - 0.5t) + 4 \cos(5x - 0.5t)$
- 4) $y = \cos x \sin t + \cos 2x \sin 2t$

Solution:

TRAVELLING WAVE	STATIONARY WAVE
$y(x, t) = A \sin(kx \pm \omega t)$	$y(x, t) = A \sin kx \cos \omega t$
PARAMETERS	DEFINITION
A	Amplitude
ω	Angular Velocity
x	Position
k	Wavenumber

TABLE I

TRAVELLING WAVE vs STATIONARY WAVE

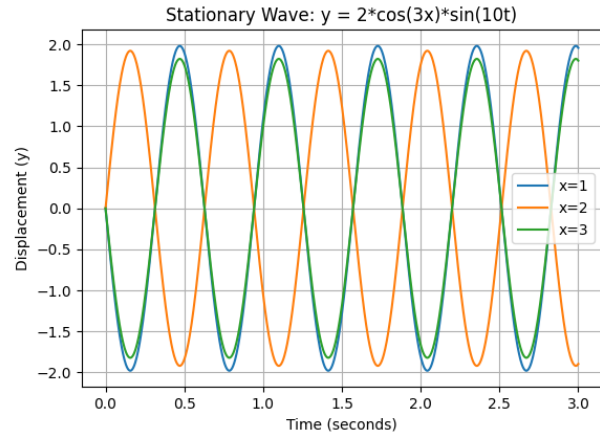


Fig. 1. DIPLACEMENT vs TIME-graph1

Let us assume an equation:

$$y = A(x) \cos(\omega t + \phi(x)) \quad (1)$$

STATIONARY WAVE CON- DITION	TRAVELLING WAVE CON- DITION
$A(x) = A_0 \sin(\omega t + \alpha)$	$A(x) = k$
$\phi(x) = k$	$\phi(x) = kx + c$

TABLE II

TRAVELLING WAVE vs STATIONARY WAVE

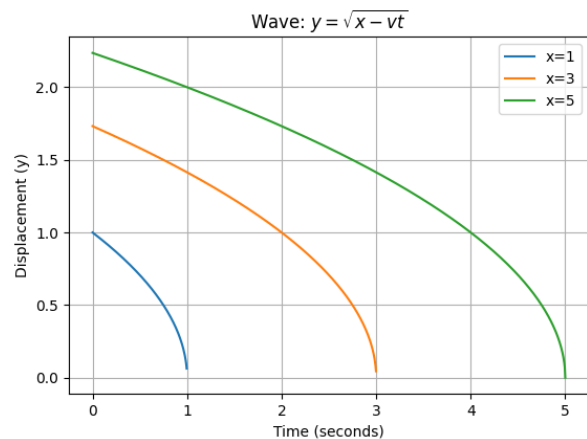


Fig. 2. DIPLACEMENT vs TIME-graph2

The figures Fig. 1 and Fig. 3 are self explanatory for stationary and travelling waves. The figures Fig. 2 and Fig. 4 are neither stationary nor travelling waves.

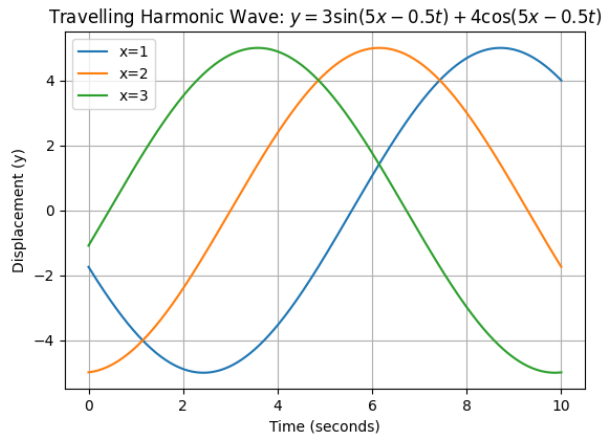


Fig. 3. DIPLACEMENT *vs* TIME-graph3

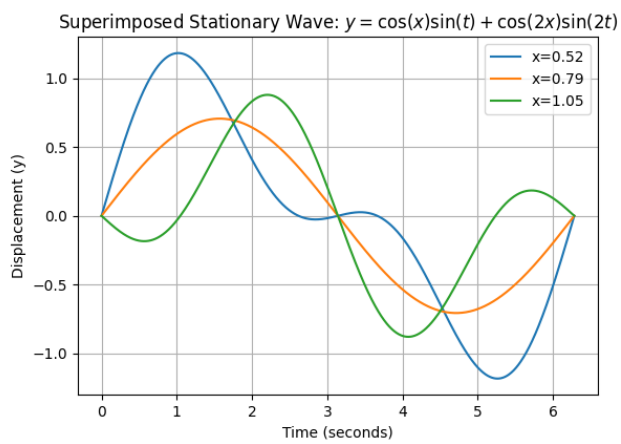


Fig. 4. DIPLACEMENT *vs* TIME-graph4