ECE 30
Day 15 Notes

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Agenda

- Traveling Waves
- Sinusoidal Traveling Waves and the Wave Function
- Magnetism - Intro
- Magnetic Force

Homework 5 Overview

its chill, its just voltage changes so its cool.

Traveling Waves

It begins as a single pulse in a medium like a rope or a field.

Over time the pulse will travel down the medium.

The velocity of propogation or the speed of the traveling wave is $\frac{\lambda}{T}$. Here it is the wavelength in space divided by the wavelength in time. It also implies:

$$v = \lambda f$$

The shape of a traveling wave does not change as it moves.

A given particle in space will be in the same position every T seconds. Or $x - vt$ at $t = 0$.

The wave is described as a function of both distance and time.

$$y(x,t) = y(x - vt, 0)$$

In general:

$$y(x,t) = f(x - vt)$$

Here the sign of the velocity encodes the direction of wave movement.

$$y(x,t) \triangleq \text{Wave Function}$$

One example wave function could be:

$$y(x,t) = \frac{1}{(x-3t)^2 + 1}$$

Wave functions can be any symmetric-ish function with a phase shift applied.

Sinusoidal Traveling Waves

$$y(x, 0) = Asin(ax)$$

Here a is a conversion factor from distance to radians. It has units $\frac{1}{m}$.
When $\frac{\lambda}{2}$ $Asin(ax) = 0$

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

therefore:

$$y(x, 0) = Asin(\frac{2\pi}{\lambda}x)$$

We know that $y(x, t) = y(x - vt, t)$, therefore:

$$y(x, t) = Asin(\frac{2\pi}{\lambda}(x - vt))$$