ECE 30
Day 14 Notes

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Agenda

- Midterm Overview
- Simple Harmonic Motion Review
- Traveling Waves

Midterm Review

- Some did really good, some did really really bad. Hopefully I'm closer to the good side.
- I can't think of any difficult problems. even the bonus problem seemed pretty chill.
- Uniform Electric field problem

  Make sure to pause and understand the dynamics before you start.

  This is a constant acceleration problem, the orthogonal velocity stays the same. Remember Coulomb's law, and usetilize the provided constants to reduce the problem to a dynamics problem.

  Answer was $-3.5 \times 10^{13}\mathrm{m/s^2}$, which I think I got correct.

  For the second part its just Newtonian dynamics. Things to remember is that the initial x veclocity stays constant.

- Circuit Review

  Open switches should be interpreted as completely seperate circuits.

  The first current was 0.05A. And the voltage was 15V.

  The charge on capacitors in series combines such that it acts like one large capacitor. We end up getting an equivalent capacitance of 3 $\mu\mathrm{F}$. Which ends up giving a total charge of $45\mu\mathrm{C}$

- For the first spring problem

  Should have gotten 275 N/m which I think I got correct.

  When asked to draw the force, k is the slope, so we should have A point from the origin to, $(2, -5.5)$

  For calculating the work, remember the force is not constant, therefore you have to integrate. I did integrate and it comes out to the area of a triangle which is kinda fun.

  The graph one is easy. Its just the sum of a bunch of areas so its chill.

  Displacement is the integral of velocity, so you can just numerically integrate using basic area functions.

- Friction problem

  I ended up saying that the coefficient of static friction is the tangent of the critical angle.

  Garunteed 100% so thats epic

- Bonus

  I think I got this right since I noticed both things he pointed out, ie: using $(\pi - \theta)$ rather than θ directly. As well as there being $2n$ capacitors instead of n capacitors.

Harmonic Motion quick Review

We can imagine simple harmonic motion as arising from vectors spinning in circles.

Each circle has two waves that can be derived, a sine and cosine wave. The radius is the magnitude of the wave, and the frequency is the number of revolutions per unit time.

For springs we had an equation:

$$x = Acos(\omega t)$$

With the following relationships:

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

Where T is the period, and f is the frequency. ω is scaled by 2π because we are using radians and 2π is one revolution.

ω is the angular frequency in $\mathrm{Rad/s}$. Which is arguably just $1/\mathrm{s}$ or Hertz(Hz)

f is the frequency, which is the number of times a full cycle happens per second. It uses Hz without caveats.

λ is the usual symbol for wavelength, which is measured in meters in the case of space waves and seconds for oscilitory motion.