

**Outline of Lecture #2: A.C. Circuits**

This lecture covers the concepts and principles used to analyze *circuits* containing, alternating (or oscillating) power supplies, resistors, capacitors, and inductors.

**Concepts:**

- Capacitance and capacitors: units = Farads (F)
- Inductance and inductors: units = Henrys (H)
- Angular frequency,  $\omega = 2\pi f$  : units = radians/sec
- Impedance: units = Ohms ( $\Omega$ )
- Decibels
- Phasors

**Principles:**

- Voltage across a capacitor:  $V = \frac{Q}{C}$  or  $\tilde{V} = \tilde{I} \left( \frac{-j}{\omega C} \right)$
- Voltage across an inductor:  $V = L \frac{dI}{dt}$  or  $\tilde{V} = \tilde{I} (j\omega L)$
- Complex Ohm's Law:  $\tilde{V} = \tilde{I} Z$
- Energy stored in a capacitor:  $W = \frac{1}{2} CV^2 = \frac{Q^2}{2C} = \frac{1}{2} QV$
- Energy stored in an inductor:  $W = \frac{1}{2} LI^2$

**Examples:**

- Combining capacitors in parallel:  $C_{eq} = C_1 + C_2 + C_3$
- Combining capacitors in series:  $\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$
- Inductors combine like resistors
- RC filter circuits: high-pass, low-pass
- RLC resonant circuits: mechanical analog