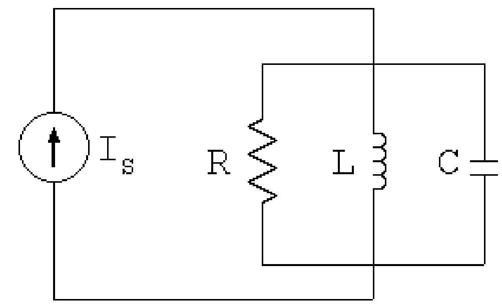
Lecture 23, Monday, February 28, 2022

- *Resonance:* possible existence of steady-state co-sinusoidal oscillations wihtout sources..
  - RLC in parallel
    - Has resonant frequency $\omega_0 = \frac{1}{\sqrt{LC}}$
    - At ω_0,
      - $Z_L = -Z_c \quad \rightarrow \quad Z_L \parallel Z_c = \infty$

        parallel combination of L and C is like an open circuit

        $\rightarrow \quad I_c + I_L = 0 \quad \rightarrow \quad I_c = -I_L \neq 0$

        $\rightarrow \quad I_R = I_s$
      - Get maximum voltage in circuit: $V = RI_s$



- Frequency response of LTI systems: $H(\omega)$

$$f(t) = |F|\cos(\omega t + \angle F) \ \rightarrow \boxed{H(\omega)} \rightarrow \ y(t) = \underbrace{|F||H(\omega)|}_{=|Y|} \cos\left(\omega t + \underbrace{\angle F + \angle H(\omega)}_{=\angle Y}\right)$$

- $|H(\omega)|$ is called the magnitude (or amplitude) response of the LTI system:

$$|Y| \ = \ |F||H(\omega)|$$

the amplitude of the input gets multiplied by the amplitude response at the corresponding frequency.

- $\angle H(\omega)$ is called the phase response of the LTI system:

$$\angle Y = \angle F + \angle H(\omega)$$

  the phase of the input gets shifted by the phase response at the corresponding frequency.

– It works the same way for sine functions:

$$f(t) = |F|\sin(\omega t + \angle F) \rightarrow \boxed{H(\omega)} \rightarrow y(t) = \underbrace{|F||H(\omega)|}_{=|Y|}\sin\left(\omega t + \underbrace{\angle F + \angle H(\omega)}_{=\angle Y}\right)$$

