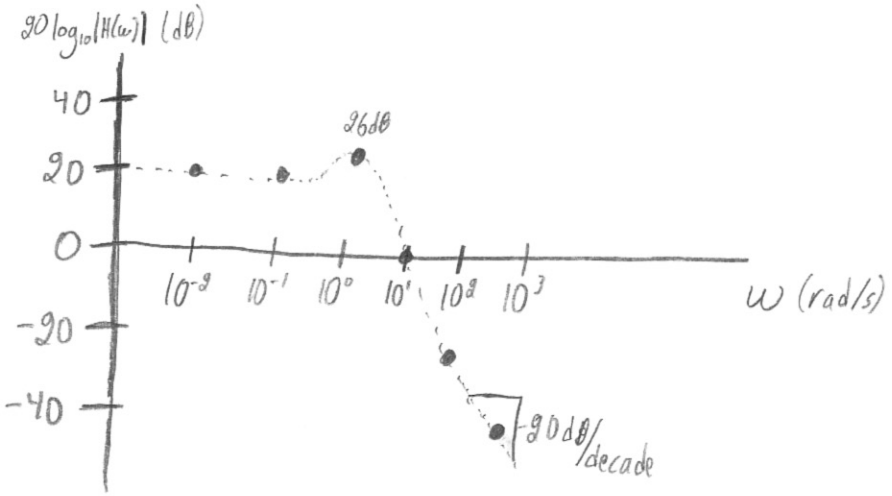
EE16B Section 8B Notes

Warmup



- Why do we plot $20\log_{10}|H(j\omega)|$?
  - decibels are a measure of power.
- Where is $\omega=0$ on this plot?
  - Nowhere! (Infinitely far off to the left.)

Questions from Lecture?

Better Living Through (Complex) Impedance

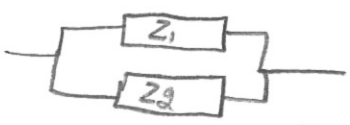
- Define impedance $\frac{V}{I} = Z = R + jX = |Z|e^{j\theta_z}$
  - R: resistance
  - X: reactance

The network rules for impedance are the same as those for resistance:

Series

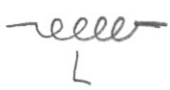
$Z = Z_1 + Z_2$

Parallel



$Z = Z_1 \| Z_2 = \frac{Z_1 Z_2}{Z_1 + Z_2}$

The imaginary part of impedance comes from:

Capacitors	Inductors
 $Z_C = \frac{1}{j\omega C}$	 $Z_L = j\omega L$

Mathematically, these quantities behave the same as $Z_R = R$, but there are some important conceptual differences:

- The impedance varies with ω, the frequency through the element.

Z_C decreases with increasing ω Z_L increases with increasing ω

- They have an imaginary term, which implies a phase shift:

$$Z_C = \frac{1}{e^{j\pi/2}\omega C} = \frac{1}{\omega C} e^{-j\pi/2} \qquad Z_L = \omega L e^{j\pi/2}$$

so voltage and current are out of phase!

SPICE demo.