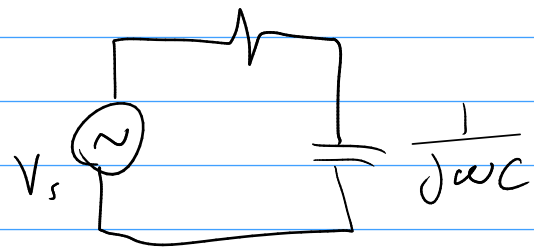


Frequency Response



$$f=0: V_o = V_i \Rightarrow H(s)=1$$

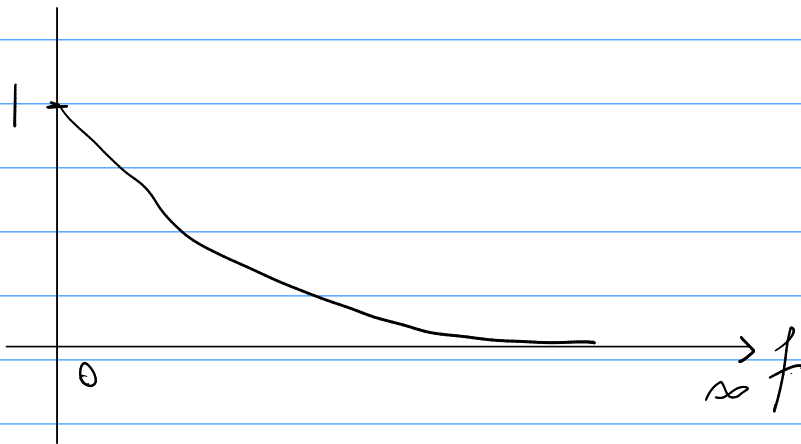
$$f=\infty: V_o = 0 \Rightarrow H(s)=0$$

$$\text{Voltage gain: } \frac{V_o}{V_i}$$

$$\text{Current } i: I_o/I_i$$

$$\text{Voltage transfer: } V_o/I_o$$

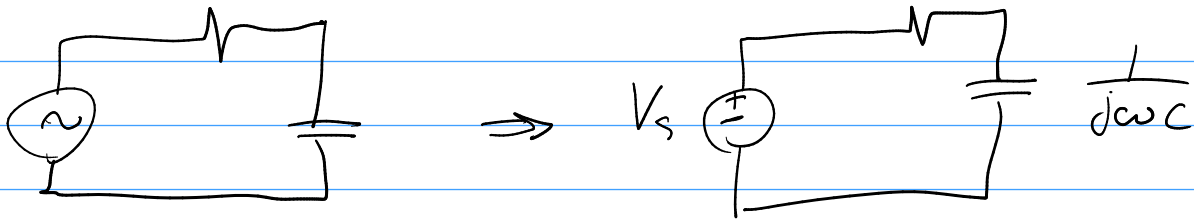
$$\text{Current } i: I_o/V_i$$



Freq. Resp.: change in behavior as frequency changes

$$H(\omega) = \frac{Y(\omega)}{X(\omega)} \quad \Leftarrow \quad R, j\omega L, \frac{1}{j\omega C}$$

$$V_s = V_m \cos \omega t, \quad \omega = [0, \infty[$$



$$H(\omega) = \frac{V_o}{V_s} = \frac{1/j\omega C}{R + 1/j\omega C} = \frac{1}{1 + j\omega RC}$$

$$|H| = \frac{1}{\sqrt{1 + (\omega/\omega_0)^2}}, \quad \phi = \tan^{-1}(\omega/\omega_0)$$

$$\omega_0 = 1/RC$$

↳ cutoff freq.

Decibel Scale: log base 10 scale

$$G = \text{no. of bels} = \log_{10}(P_2/P_1)$$

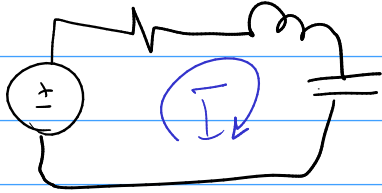
$$G_{dB} = 10 \log_{10}(P_2/P_1)$$

$$G = 0 \Rightarrow P_1 = P_2, \quad G_{dB} = 3 \Rightarrow P_2 = 2P_1$$

$$G_{dB} = -3 \Rightarrow P_2 = \frac{1}{2}P_1$$

Bode Plots. linear freq. vs. log (dB) mag.

Resonance: occurs in any circuit with more than one cap. and ind.



$$Z = \frac{V_0}{I} = R + j\omega L + \frac{1}{j\omega C}$$

$$\omega_0 L = \frac{1}{\omega_0 C} \Rightarrow \omega_0 = \frac{1}{\sqrt{LC}} = R + j\left(\omega L + \frac{1}{\omega C}\right)$$

$$\Rightarrow f_0 = \frac{1}{2\pi\sqrt{LC}}$$

$$I = \frac{V_m}{[R^2 + (\omega L - 1/\omega C)^2]^{1/2}}$$