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CSE 4030
November 9th, 2022

Lab 11: AC Steady State Power Analysis

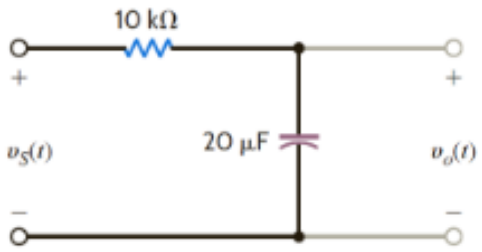
Introduction

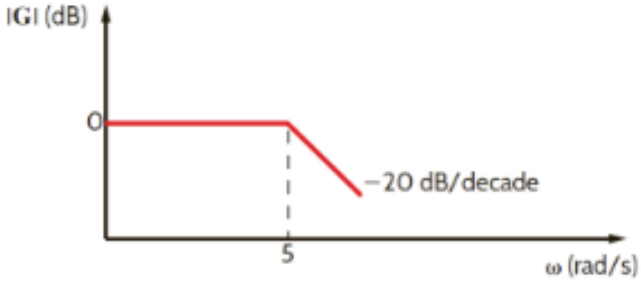
In this lab, we have to find the voltage, the bode plot of the amplitude, and phase of initial voltage of two circuits that consist of resistors and capacitors. First, we show our work by hand then use Pspice simulation software to check. The purpose of this lab is to understand AC characteristics and variable frequency network performance.

Purpose

The purpose of this lab is to understand AC characteristics and variable frequency network performance.

1-1

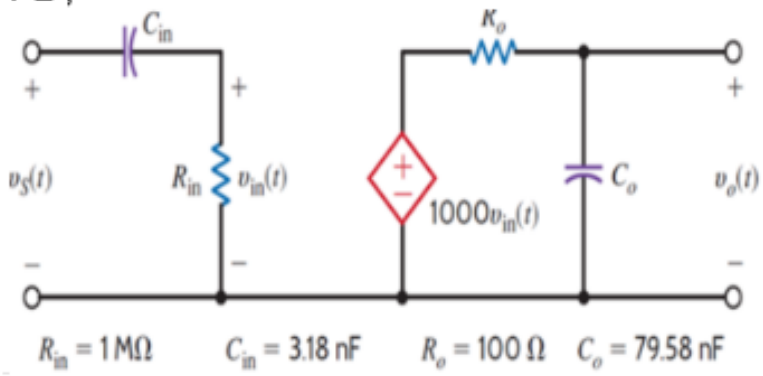


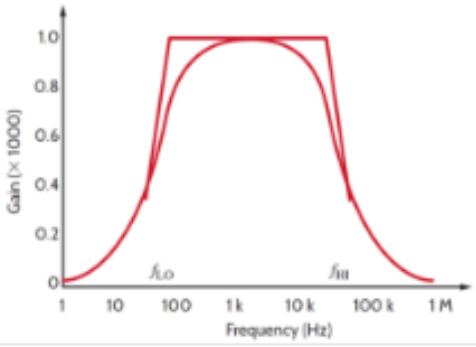


Preparation

1. Find the bode plot of the amplitude and the phase of vo(t) (calculate by hand). Change from 20uF to 10uF.
2. By using pspice simulation, find vs(t) and the bode plot of the amplitude and the phase of vo(t)..

1-2 ,



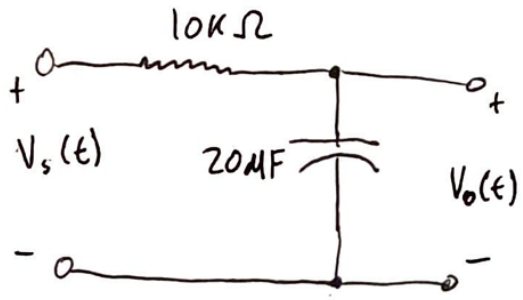


Preparation

1. Find vs(t) and the bode plot of the amplitude and the phase of vo(t). (calculate by hand),
2. By using pspice, find vs(t) and the bode plot of the amplitude and the phase of vo(t).

Hand Written Work

Circuit 1:



$$G_v(j\omega) = \frac{1}{1+j\omega(10k)(20\mu)}$$

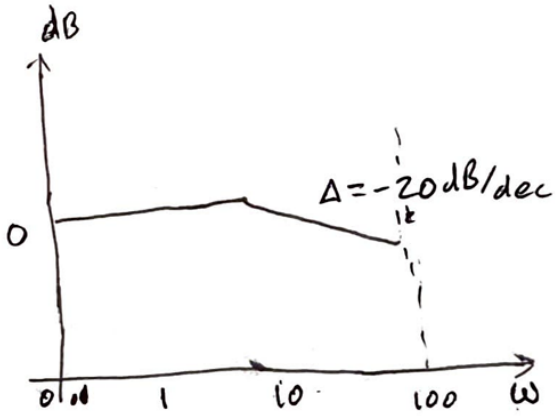
$$= \frac{1}{1+j\omega(0.2)}$$

$$\rightarrow \omega_c = \frac{1}{0.2} = 5 \text{ rad/s}$$

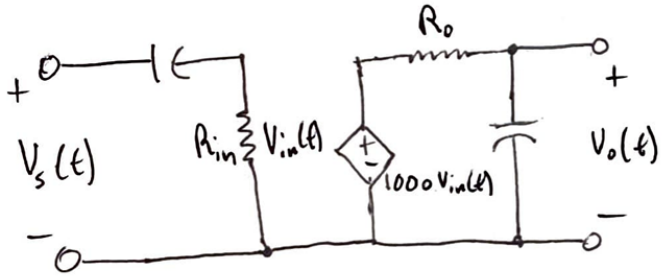
$$\Delta = -20$$

$$20\log(1) = 0\text{dB}$$

$$-20\log\left(\frac{100}{5}\right) = -26.02\text{dB}$$

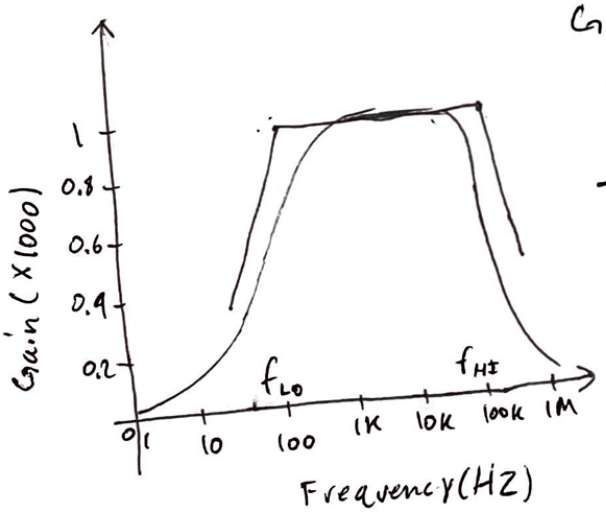


Circuit 2:



$R_{in} = 1M\Omega \quad C_{in} = 3.18nF \quad R_o = 100\Omega$

$C_o = 79.58nF$



$$G_v(s) = \frac{V_o(s)}{V_s(s)} = \frac{V_{in}(s)\,V_o(s)}{V_s(s)\,V_{in}(s)} = \left(\frac{R_{in}}{R_{in}+1/sC_{in}}\right)(1000)\left(\frac{1/sC_o}{R_o+1/sC_o}\right)$$

$$\rightarrow G_v(s) = \left(\frac{s}{s+100\pi}\right)(1000)\left(\frac{40{,}000\pi}{s+40{,}000\pi}\right)$$

$f_{LO} \ll f \ll f_{in}$

$100\pi \ll |s| \ll 40000\pi$

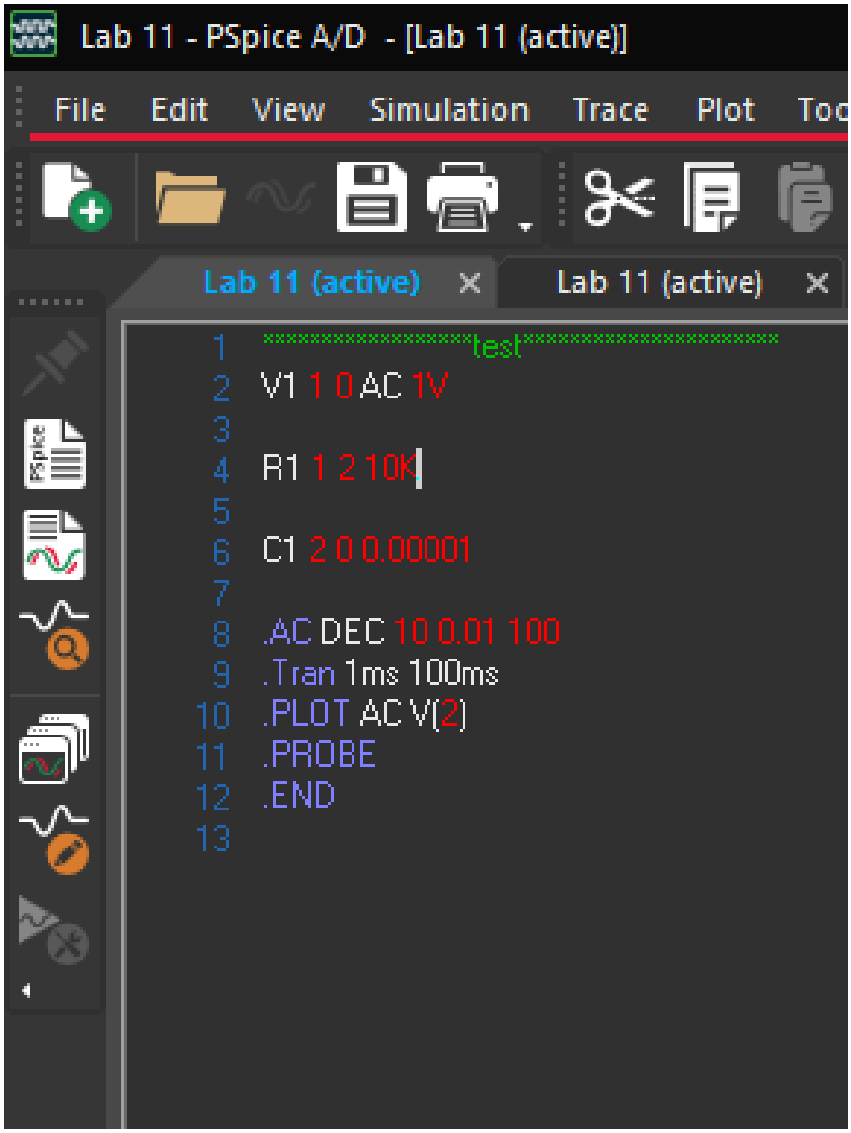
$$G_v(s) \approx \left|\frac{s}{s}\right|(1000)\left(\frac{1}{1+0}\right)$$

$$= 1000$$

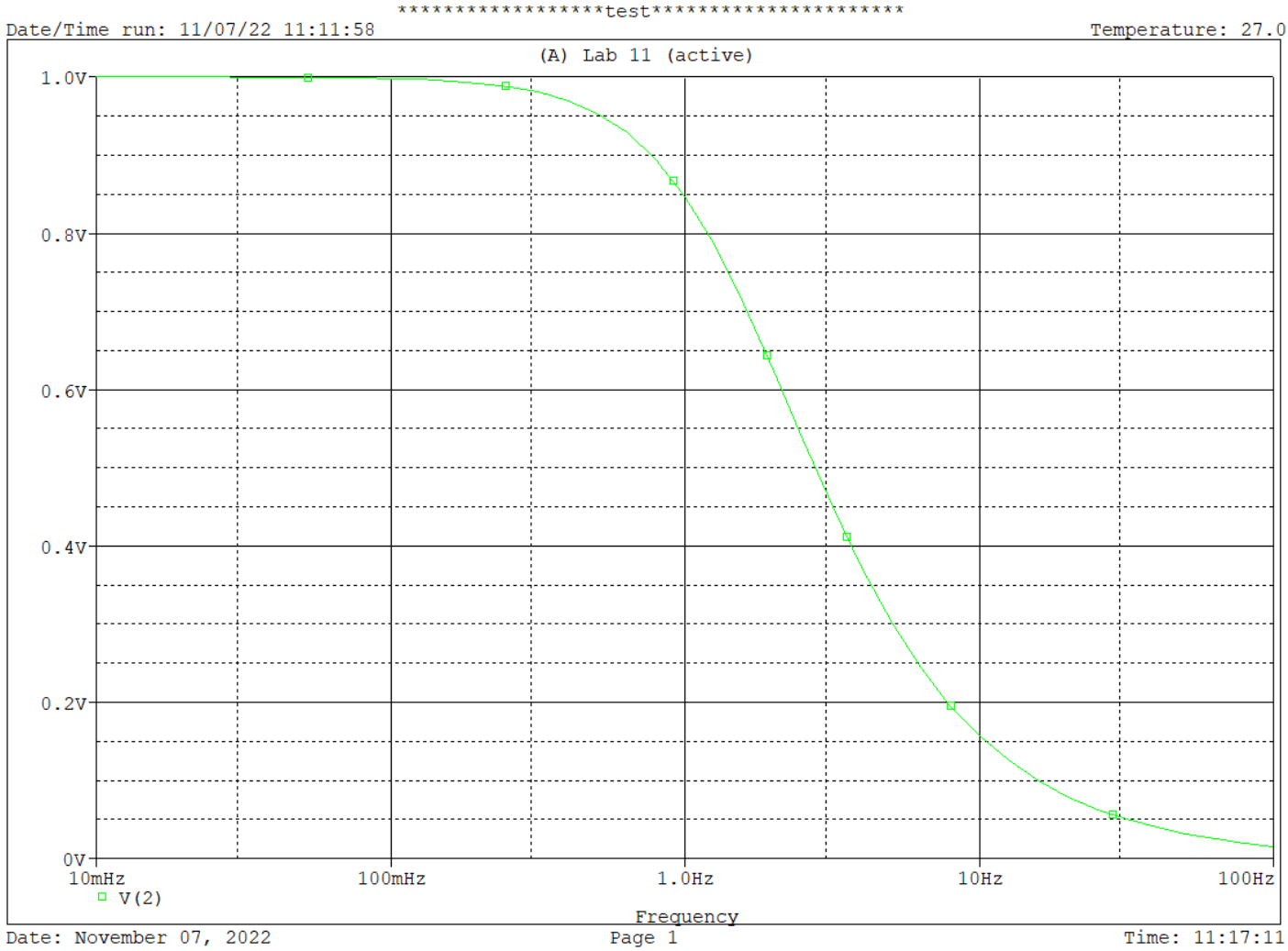
$$\rightarrow G_v(s) \simeq \left[\frac{s}{s+100\pi}\right](1000)$$

Pspice simulation

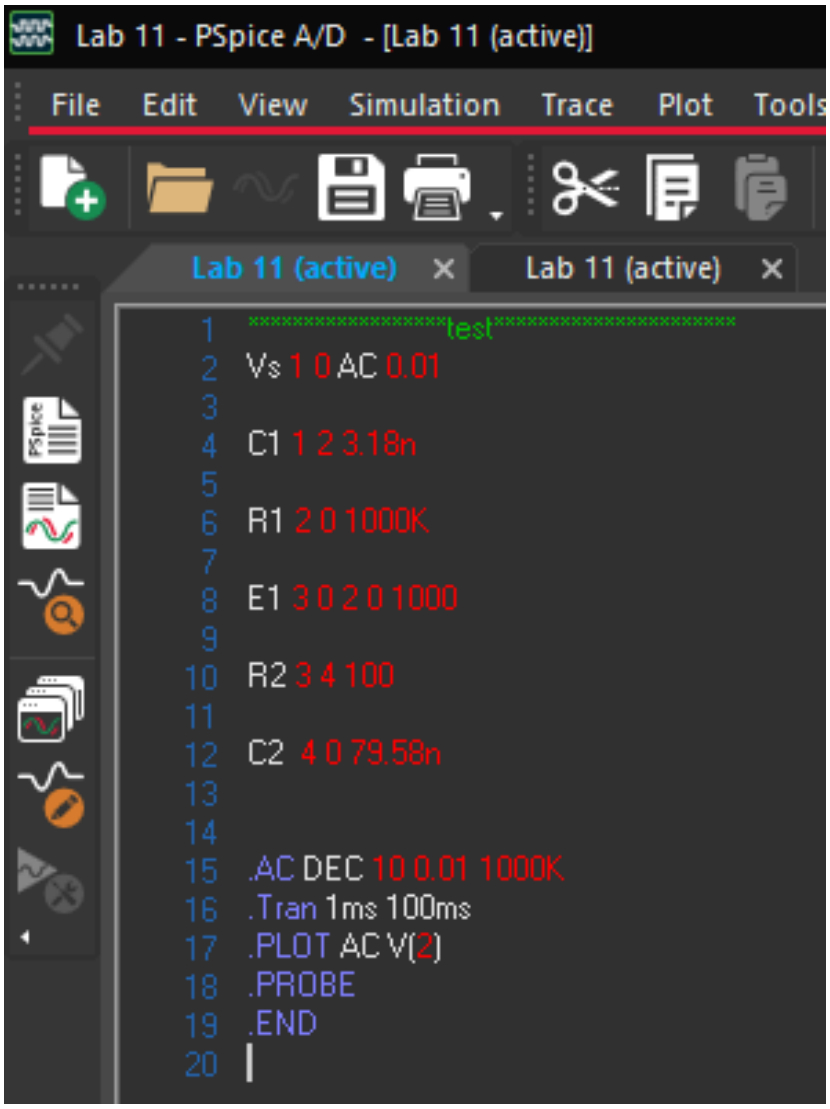
Circuit 1:
Code used



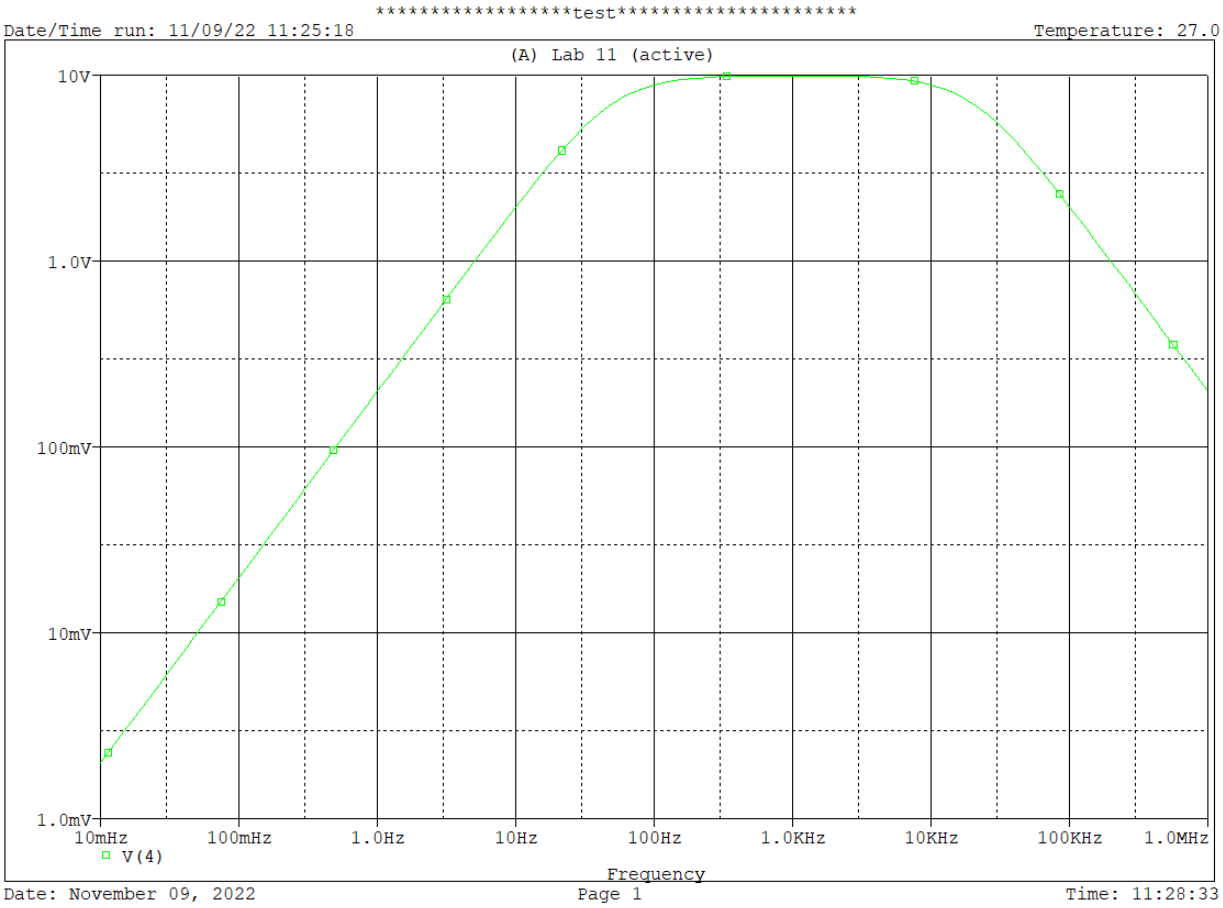
Bode plot


**********test**********
Date/Time run: 11/07/22 11:11:58
Temperature: 27.0
(A) Lab 11 (active)
1.0V
0.8V
0.6V
0.4V
0.2V
0V
10mHz
100mHz
1.0Hz
10Hz
100Hz
V(2)
Frequency
Date: November 07, 2022
Page 1
Time: 11:17:11

Circuit 2:
Code used



Bode plot:


**********test**********
Date/Time run: 11/09/22 11:25:18
Temperature: 27.0
(A) Lab 11 (active)
10V
1.0V
100mV
10mV
1.0mV
10mHz
100mHz
1.0Hz
10Hz
100Hz
1.0KHz
10KHz
100KHz
1.0MHz
V(4)
Frequency
Date: November 09, 2022
Page 1
Time: 11:28:33

Conclusion

In this lab, I learned how to find the bode plot of two different circuits. After reviewing the answers obtained from handwritten work and pspice, I can conclude the answers concur and are correct.