Lab Report3

Arnav Yadnopavit- EE24BTECH11007
Prajwal - EE24BTECH11051

February 11, 2025

Objective

To analyze the magnitude and phase response of 1-stage, 2-stage, and 3-stage RC low-pass filters using Bode plots.

Apparatus

- Resistors ($1k\Omega$ each)

- Capacitors (100nF each)

- Function generator

- Oscilloscope

Theory

A low-pass filter allows low-frequency signals to pass while attenuating higher-frequency signals. The transfer function for an n-stage RC low-pass filter is given by:

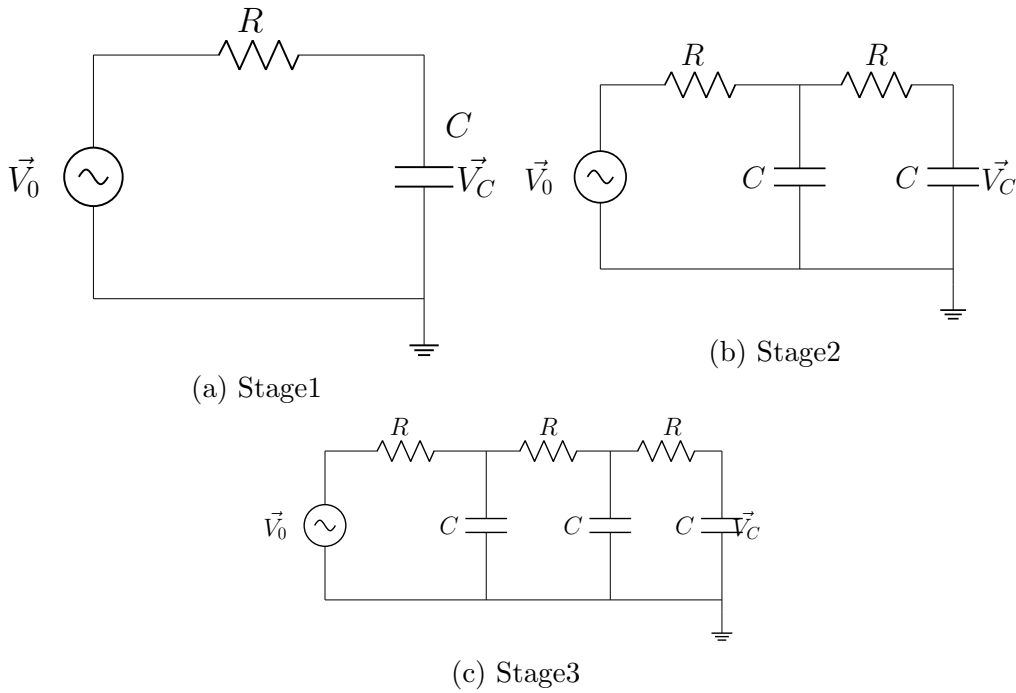$$H_n(s) = \frac{V_C(s)}{V_0(s)} = \frac{1}{(1 + RCs)^n} \tag{1}$$

where R is the resistance, C is the capacitance and $s = j\omega$.

The magnitude response in dB is:

$$|H_n(s)|_{dB} = 20n \log_{10}\left(\frac{1}{\sqrt{1 - (sRC)^2}}\right) \tag{2}$$

The phase response is:

$$\angle H_n(s) = -n \tan^{-1}(wRC) \qquad (3)$$

(a) Stage1

(b) Stage2

(c) Stage3

Procedure

1. Assemble the RC low-pass filter circuits for 1-stage, 2-stage, and 3-stage configurations.

2. Apply an AC signal of varying frequency using the function generator.

3. Measure the output voltage using the oscilloscope.

4. Compute the magnitude and phase response.

5. Plot the Bode magnitude and phase graphs.

Readings

Frequency (Hz)	$|H_n(j\omega)|_{dB}$(dB)	Phase (deg)
10^2	0	-0.3
10^3	-0.81643989	-3.0
10^4	-28.54232711	-30.0

Table 1: Stage1

Frequency (Hz)	$|H_n(j\omega)|_{dB}$(dB)	Phase (deg)
10^2	0	-14.4
10^3	-8.31030888	-60.48
10^4	-57.64807176	48.24

Table 2: Stage2

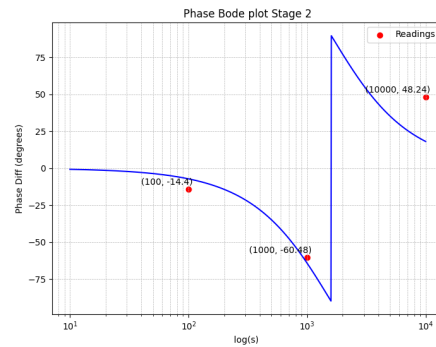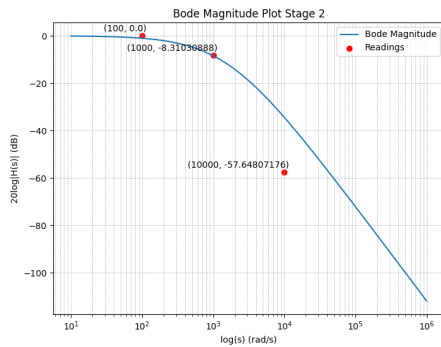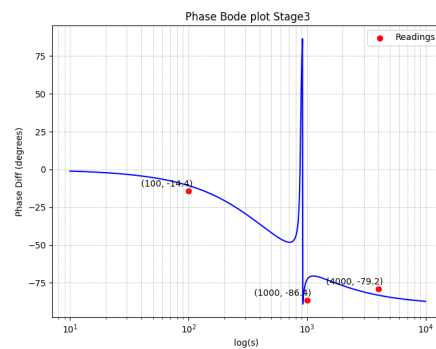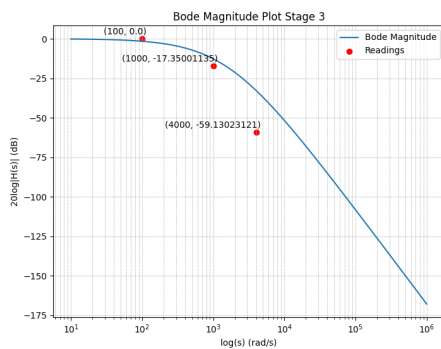| Frequency (Hz)	$|H_n(j\omega)|_{dB}$(dB)	Phase (deg)
10^2	0	-14.4
10^3	-17.35001135	-86.4
10^4	-59.13023121	-79.2

Table 3: Stage3

Graphs

Stage1
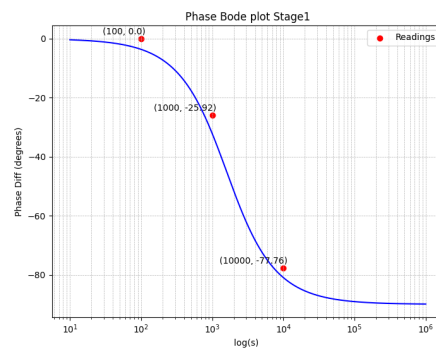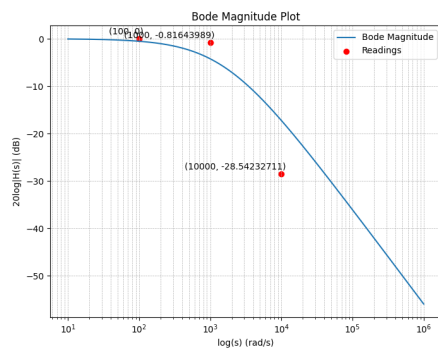
Stage2

Stage3

For codes and readings photos refer
https://github.com/ArnavYadnopavit/ElectricalLabEE1200/tree/main/
LabReport3

Thank You