Assignment 7

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1 Overview

In this assignment, our main objective is to analyse two types of circuits, Low-pass and High-pass filters. We are said to write the filter transfer functions using `sympy` with s as the frequency variable and find the impulse and step responses along with outputs to different sinusoidal inputs and plot them.

We do that by converting the `sympy` expression to `scipy` function and then simulate the transfer functions using `lsim` to find the outputs and also impulse and step responses.

The input given to the lowpass filter is

$$v_i(t) = (sin(2000\pi t) + cos(2 \times 10^6 \pi t))u_o(t)$$

The two inputs to the highpass filter are

$$v_i(t) = sin(2\pi t)e^{-t}$$
$$v_i(t) = sin(2 \times 10^6 \pi t)e^{-100t}$$

2 Plots

Lowpass Filter

The plots for magnitude and phase responses are as follows

The plot for step response is

The plot for the output to the sinusoid is

Highpass Filter

The plots for magnitude and phase responses are as follows

The plot for step response is

The output for the sinusoidal input is

The output plots for the damped sinusoids are

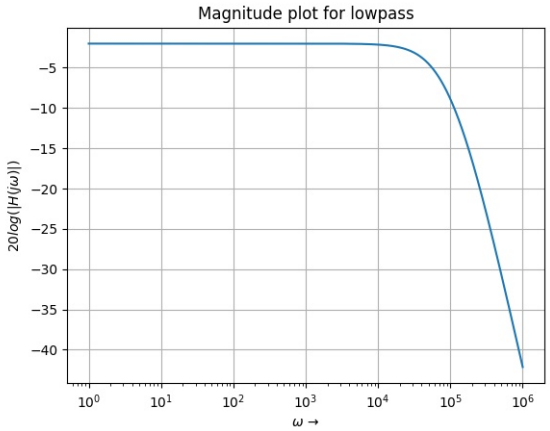

Figure 1: Magnitude plot of lowpass filter

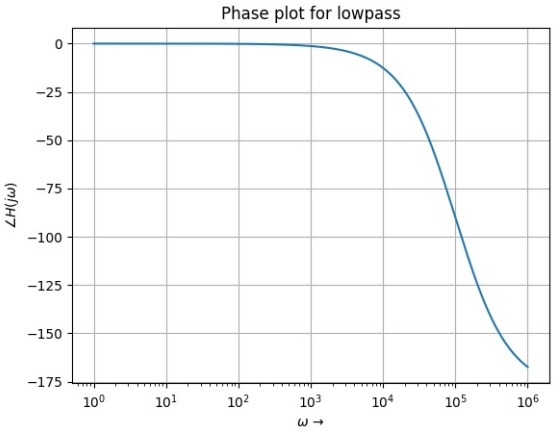

Figure 2: Phase plot of lowpass filter

3 Conclusion

The code for the assignment can be referred to in the other file.

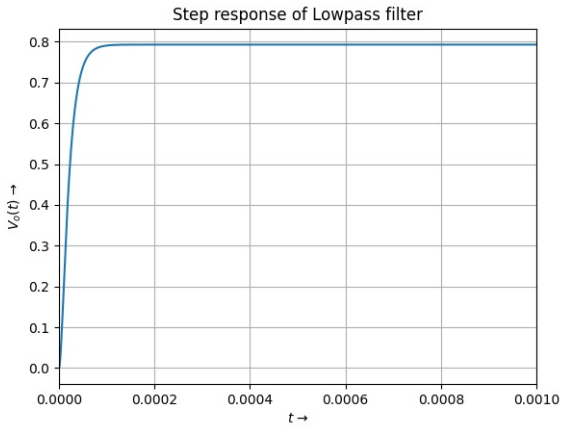

Figure 3: Step response of lowpass filter

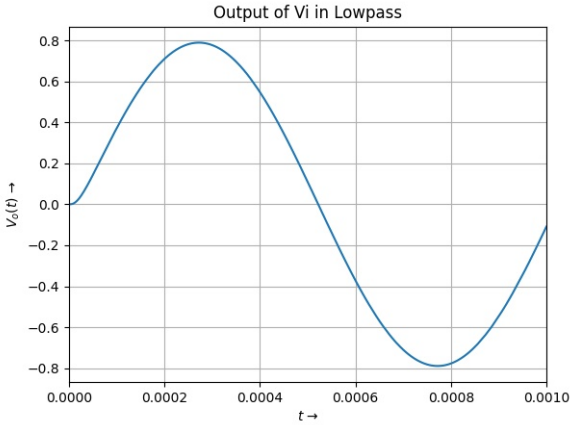

Figure 4: Output for lowpass filter

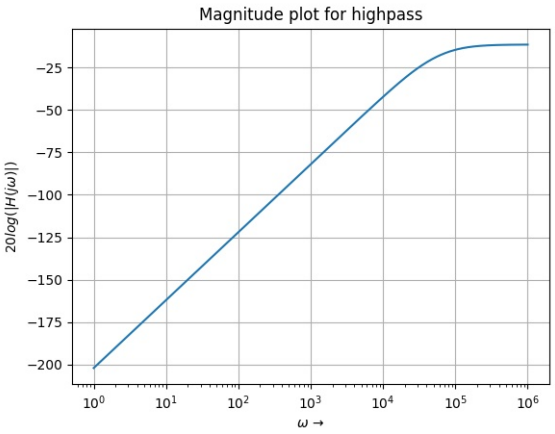

Figure 5: Magnitude plot of highpass filter

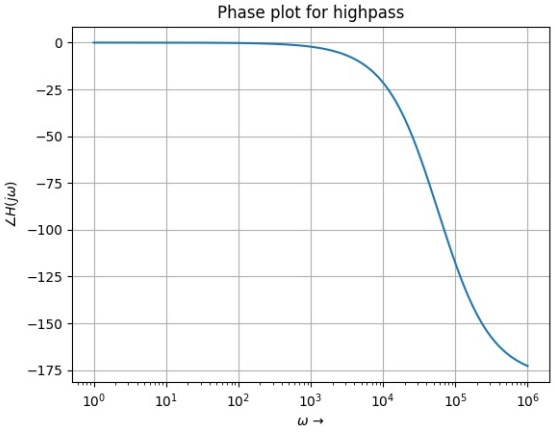

Figure 6: Phase plot of highpass filter

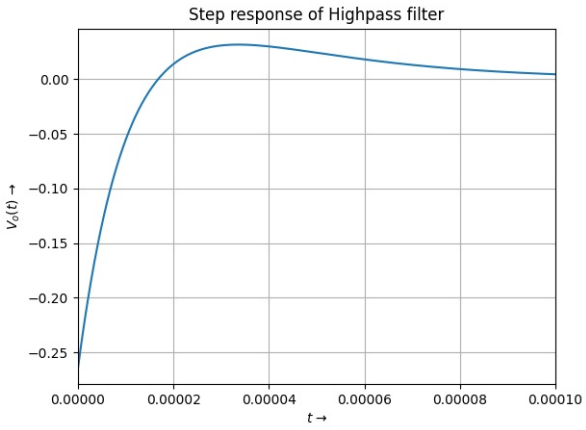

Figure 7: Step response of highpass filter

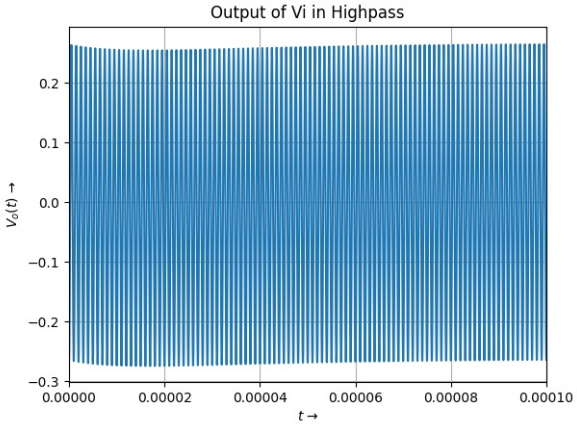

Figure 8: Output for highpass filter

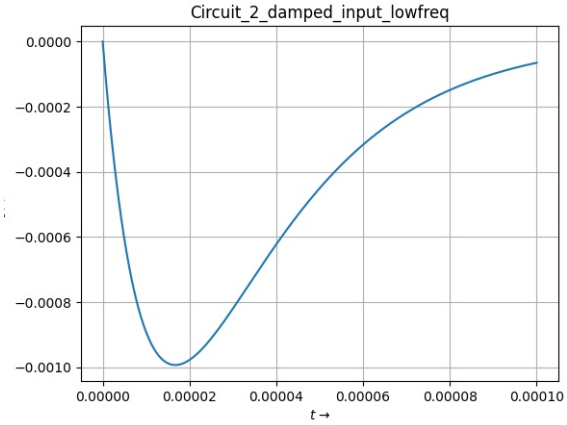

Figure 9: Output for damped sinusoid with smaller coefficient

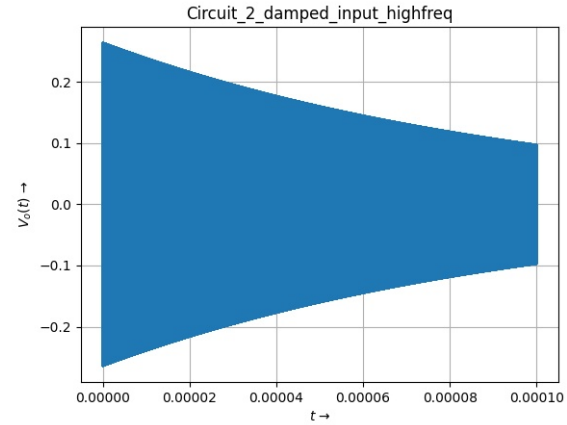

Figure 10: Output for damped sinusoid with larger coefficient