

Low Pass Filter MATLAB GUI Documentation

INTRODUCTION

The Low Pass Filter GUI was designed to help a student better understand the effect of a low-pass filter RC circuit on a sinusoidal signal. This GUI allows the user to vary the time constant of the system and the frequency of the input signal, and view the resulting response in the time and frequency domains.

This document contains instruction on the usage of the GUI. Other documents are available which contain further explanation on the use of RC circuits as filters.

FILES NEEDED TO RUN LOW PASS FILTER GUI

low_pass_filter.fig
low_pass_filter.p
RC.jpg

Place these three files in the same directory, and make this your working directory in MATLAB.

RUNNING THE LOW PASS FILTER GUI

With the proper working directory selected, type 'low_pass_filter' in the MATLAB command window

Fig. 1 shows the appearance of the GUI after it is first opened. There are initial values selected for the time constant and the excitation frequency. The excitation signal is a unit amplitude sine wave. These values can be changed by inputting a value manually by selecting the respective value field, or by using the respective slider bars.

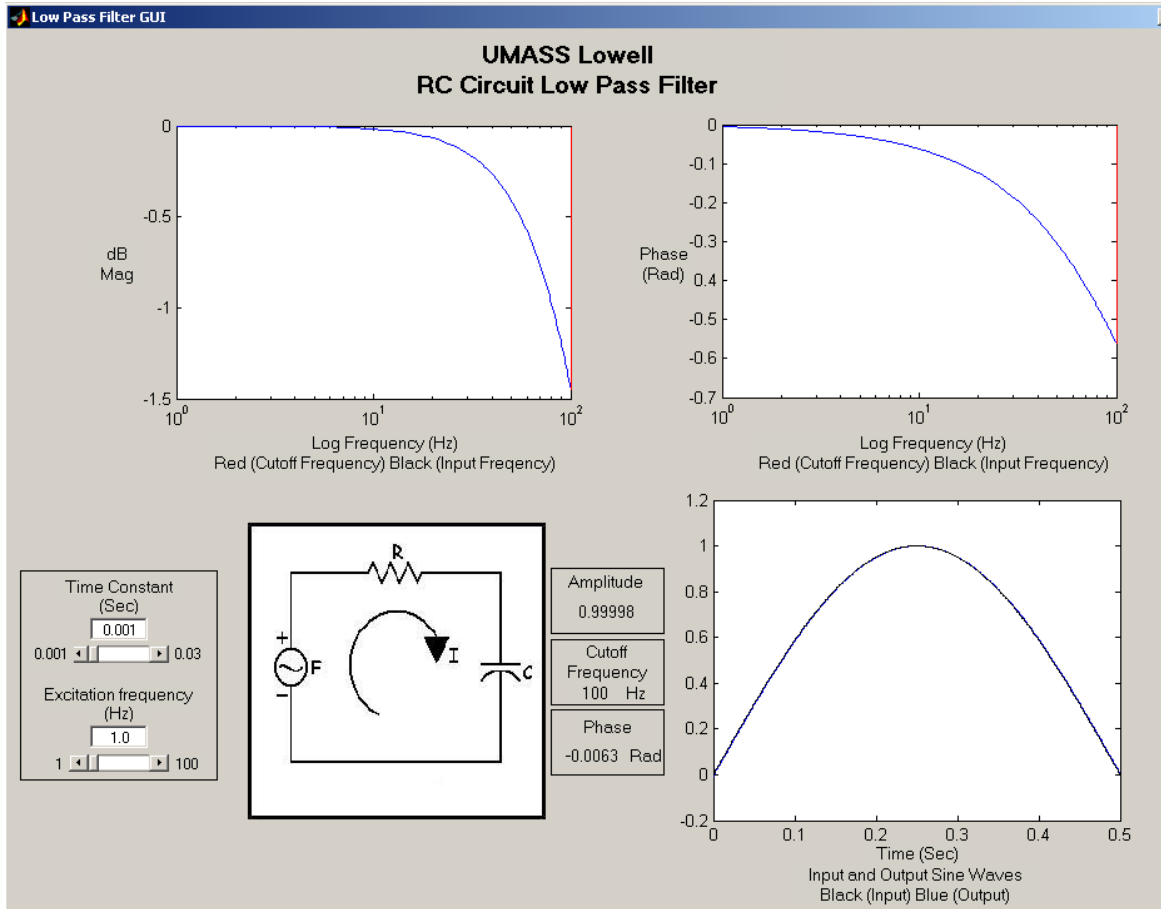


Fig. 1. Low Pass Filter GUI.

Fig. 2 shows the controls used to change the time constant and the excitation frequency, and the allowable range of values for these properties.

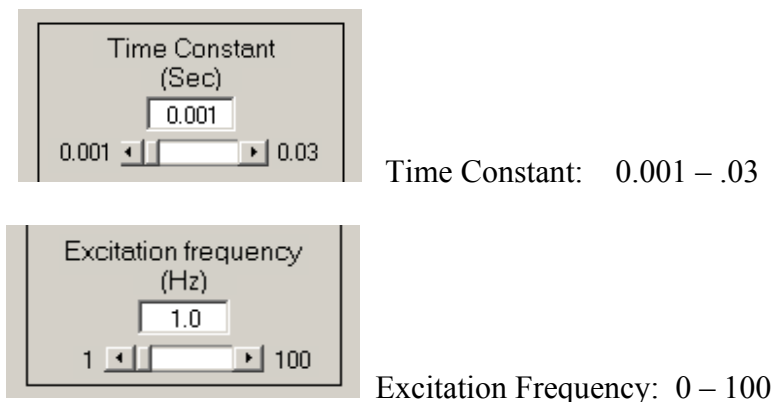


Fig. 2. Allowable input values for time constant and excitation frequency.

For a given time constant and excitation frequency, two frequency domain plots are shown: the magnitude vs. frequency and phase vs. frequency, each plotted over a 100 Hz. range. The red line indicates the cutoff frequency, the black line indicates the input frequency. The time domain plot shows

both the input signal and the output signal, with blue representing the output signal. Three values are also calculated and presented in the field to the right of the RC circuit illustration. The resulting amplitude and phase distortion of the input are given, along with the cutoff frequency of the filter, as shown in Fig. 3.

Amplitude
0.99998
Cutoff Frequency
100 Hz
Phase
-0.0062831 Rad

Fig. 3. Values calculated by GUI.

This calculated value for cutoff frequency can be entered as the excitation frequency. This will result in an output signal which has been attenuated by 3dB, which is the definition of the cutoff frequency.