

# Single Degree of Freedom Displacement Response GUI Documentation

## EXE-File Use

### INTRODUCTION

The Step Response GUI was designed to be used to assist in a student's understanding of a single degree of freedom's response due to an initial displacement. This GUI allows the user to vary the mass, damping and stiffness of the system and view the resulting time/frequency response due to a negative unit initial displacement.

Instruction on GUI usage will be shown in this document. For further explanation on the topic of single degree of freedom responses, see the [Second Order System](#) Tutorial.

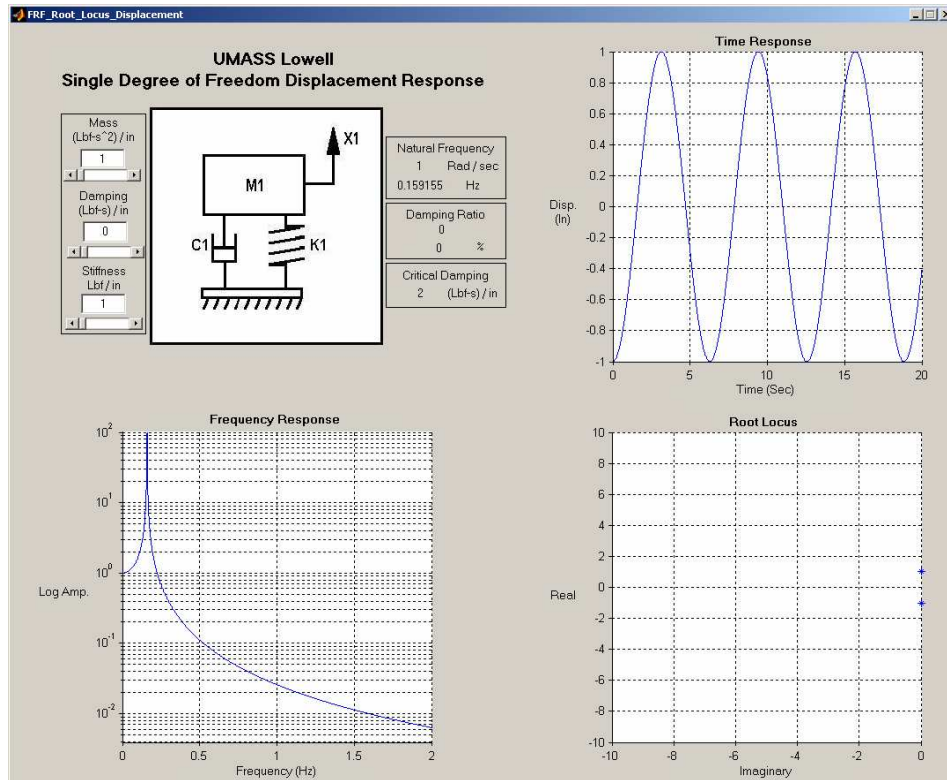
### FILES NEEDED TO USE STEP RESPONSE GUI

- displacement\_response.exe
- displacement\_response.ctf
- SDOF.JPG

### RUNNING THE DISPLACEMENT RESPONSE GUI

Once the MATLAB Component Runtime Environment is installed, click on displacement\_response.exe and the GUI will run.

Figure 1 shows the appearance of the GUI after it is first opened. There are initial values selected for the mass, damping and stiffness. These values can be changed by inputting a value manually by selecting the respective value field, or by using the respective slider bars.



**Figure 1: SDOF Displacement Response GUI**

*Allowable input values*

Mass  
(Lbf-s<sup>2</sup>) / in

- Mass: 1 – 10

Damping  
(Lbf-s) / in

- Damping: 0 – 70

Stiffness  
Lbf / in

- Stiffness: 1 – 100

With the given mass, damping and stiffness, the natural frequency (radians/second and Hz), damping ratio (real and %), and critical damping ((lbf-s)/in) are calculated and presented in the fields to the right of the single degree of freedom illustration. The calculated time response (in), frequency response (Log Amplitude. vs. Hz) and root locus (Real vs. Imaginary) are plotted in their respective fields.

Natural Frequency	
1	Rad/sec
0.159155	Hz
Damping Ratio	
0	
0	%
Critical Damping	
2	(Lbf-s)/in

The value shown in the Critical Damping can be copied and used in the Damping field. This value will result in the display of a critically damped time/frequency responses and a repeating pole.