Second-Order Displacement Response MATLAB GUI Documentation

INTRODUCTION

The Displacement Response GUI was designed to help a student better understand the response of a second-order, single degree of freedom system to an initial displacement. This GUI allows the user to vary the mass, damping and stiffness of the system and view the resulting time response and frequency response due to a negative unit initial displacement, along with the root locus of the system.

This document contains instruction on the use of the GUI. Other documents are available which contain further explanation of single degree of freedom system responses.

FILES NEEDED TO RUN DISPLACEMENT RESPONSE GUI

displacement_response.fig
displacement_response.p
SDOF.jpg

Place these files in the same directory, and select this as your working directory in MATLAB.

RUNNING THE DISPLACEMENT RESPONSE GUI

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

Fig. 1 shows how the GUI appears when it is first opened. There are initial values selected for the mass, damping and stiffness. Each of these values can be changed by inputting a value in the text box, or by using the slider bar.

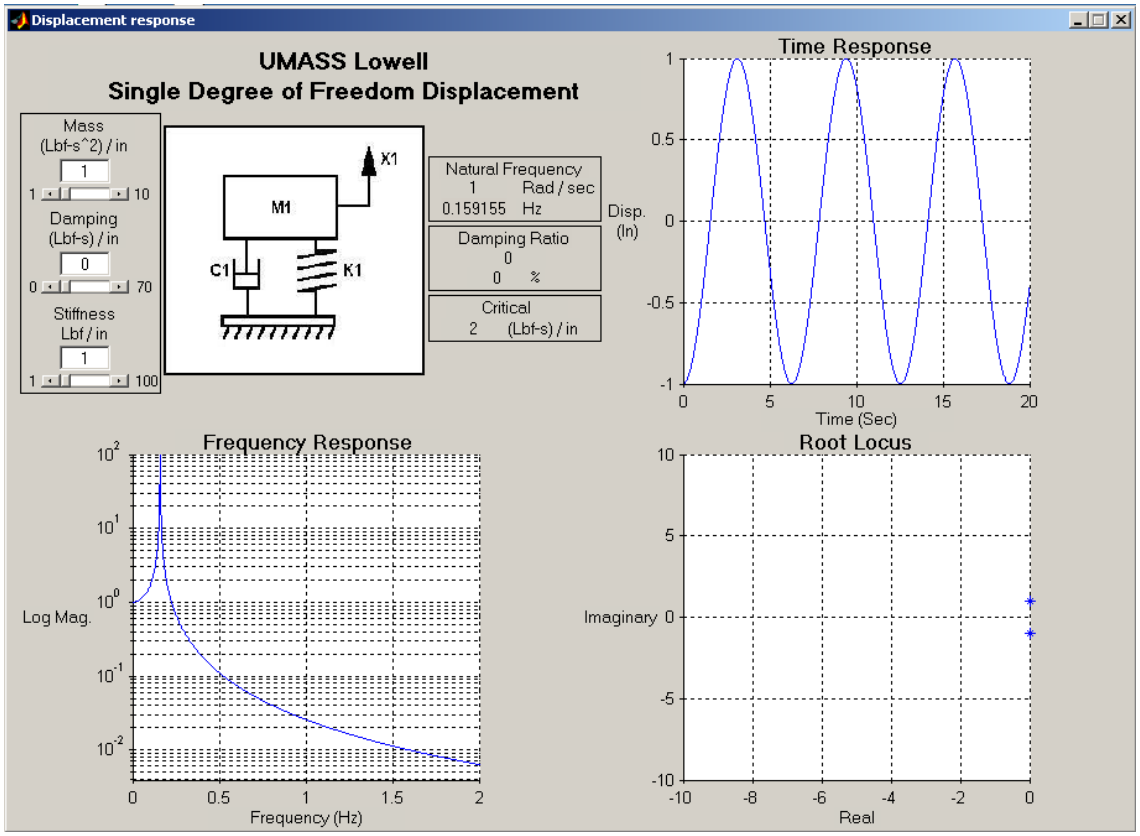
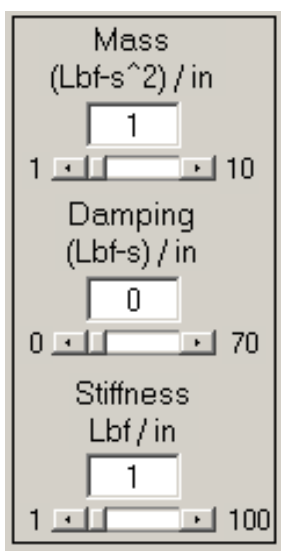


Fig. 1. SDOF Displacement Response GUI.

The allowable input values for the GUI, and the controls used to enter these values, are shown in Fig. 2.



Mass: 1 – 10

Damping: 0 – 70

Stiffness: 1 – 100

Fig. 2. Allowable input values for mass, damping, and stiffness.

When any value is changed, the new natural frequency (in radians/second and Hz), damping ratio (real and % of critical), and critical damping ((lbf-s)/in) are calculated and presented in the fields to the right of the system illustration. These fields are shown below in Fig. 3.

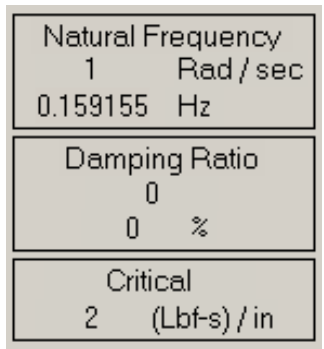


Fig. 3. Fields displaying values calculated by GUI.

The critical damping value can be copied and entered as the damping for the system. This will result in a critically damped system having a repeating pole.

When any value is changed, the resulting time response (displacement in inches vs. time), frequency response (log magnitude. vs. log frequency in Hz) and root locus (imaginary vs. real) are plotted in their respective figures.