Single Degree of Freedom 3D S-Plane GUI Documentation
M-File Use

INTRODUCTION

The 3D S-Plane GUI was designed to be used to assist in a student's understanding of a single degree of freedom's general response characteristics. This GUI allows the user to vary the mass, damping and stiffness of the system and view the resulting frequency response components.

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

- s_plane.fig
-.s_plane.m
- s_plane.p

RUNNING THE 3D S-Plane GUI

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

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 bar.
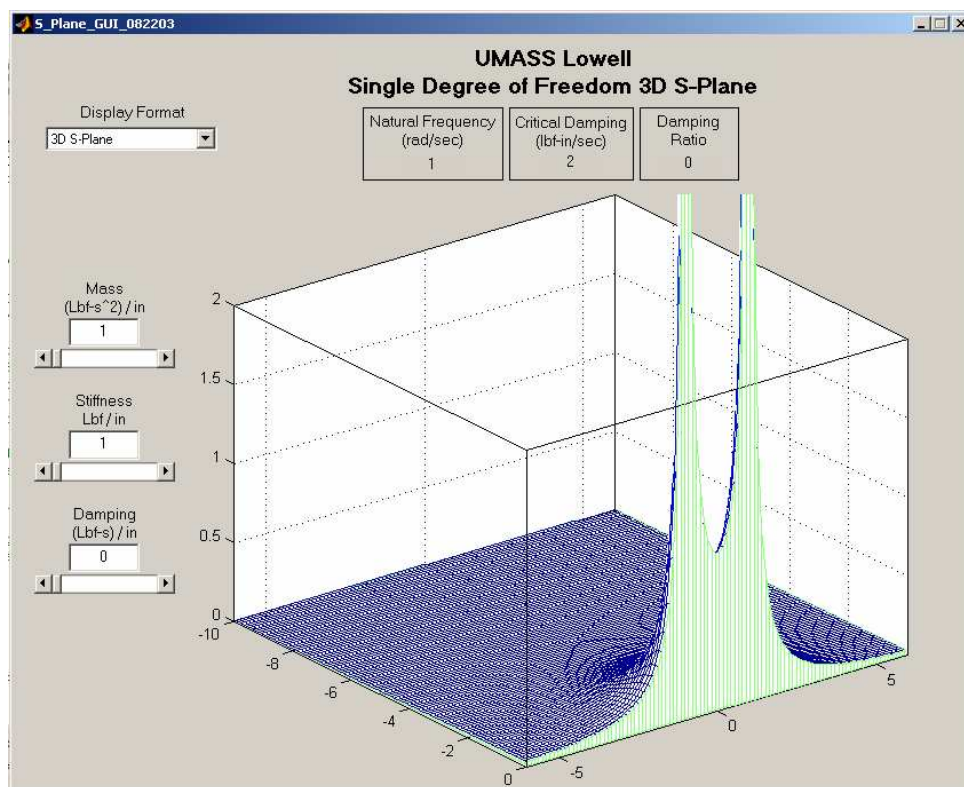
Figure 1: SDOF 3D S-Plane GUI (3D Magnitude)

Allowable input values

Mass
(Lbf-s^2) / in
| 1 |

\- Mass: 1 – 10

Stiffness
Lbf / in
| 1 |

\- Stiffness: 1 – 25

Damping
(Lbf-s) / in
| 0 |

\- Damping: 0 – 50

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 above the FRF plot field. The calculated 3D Linear Magnitude, Phase, Real, Imaginary, 2D Phase/Magnitude and Root Locus components of the frequency response function are available for plotting.

Natural Frequency (rad/sec)	Critical Damping (lbf-in/sec)	Damping Ratio
1	2	0

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 frequency responses and a repeating pole.

Different components of the frequency response function can be viewed within this GUI. These components can be viewed by selecting the proper format from the *Display Format* dropdown menu. Figures 2 through 6 show the different displays available.

Display Format

| Root Locus | ▼ |

3D S-Plane
3D Phase Plane
3D Real Plane
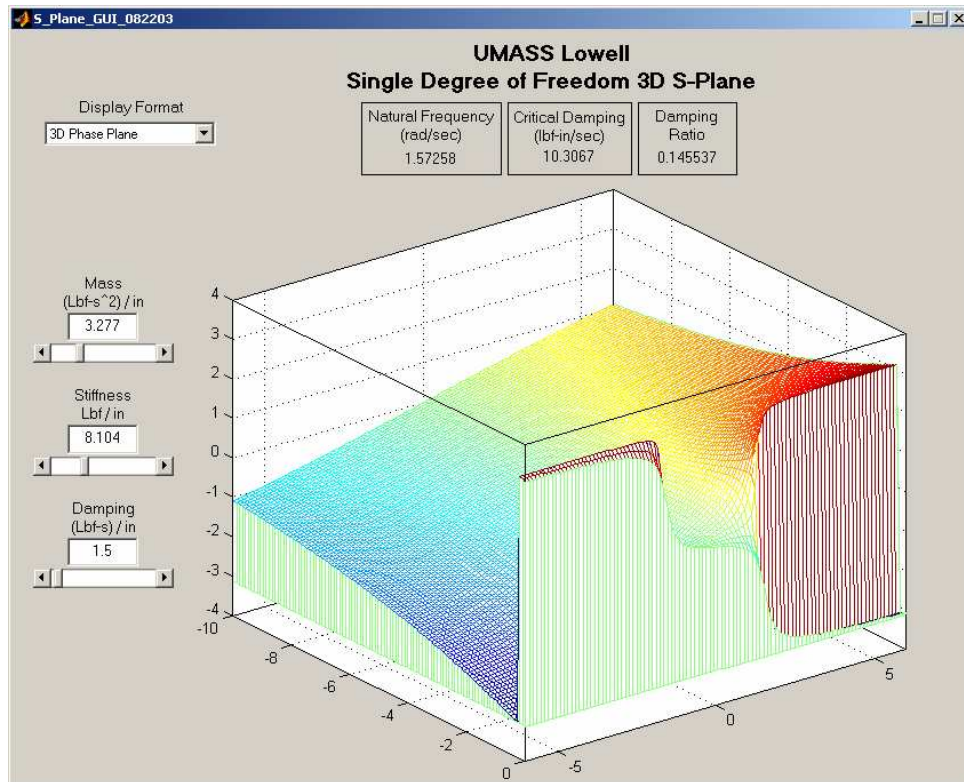3D Imaginary Plane
2D Magnitude and Phase
Root Locus

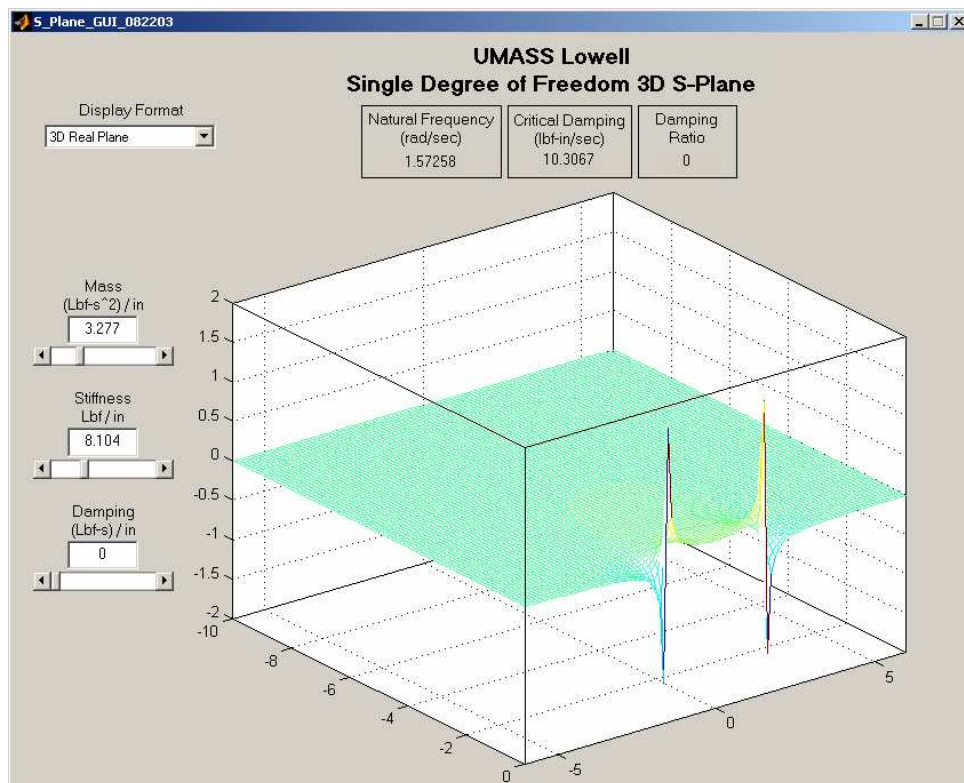**Figure 2: SDOF 3D S-Plane GUI (3D Phase)**
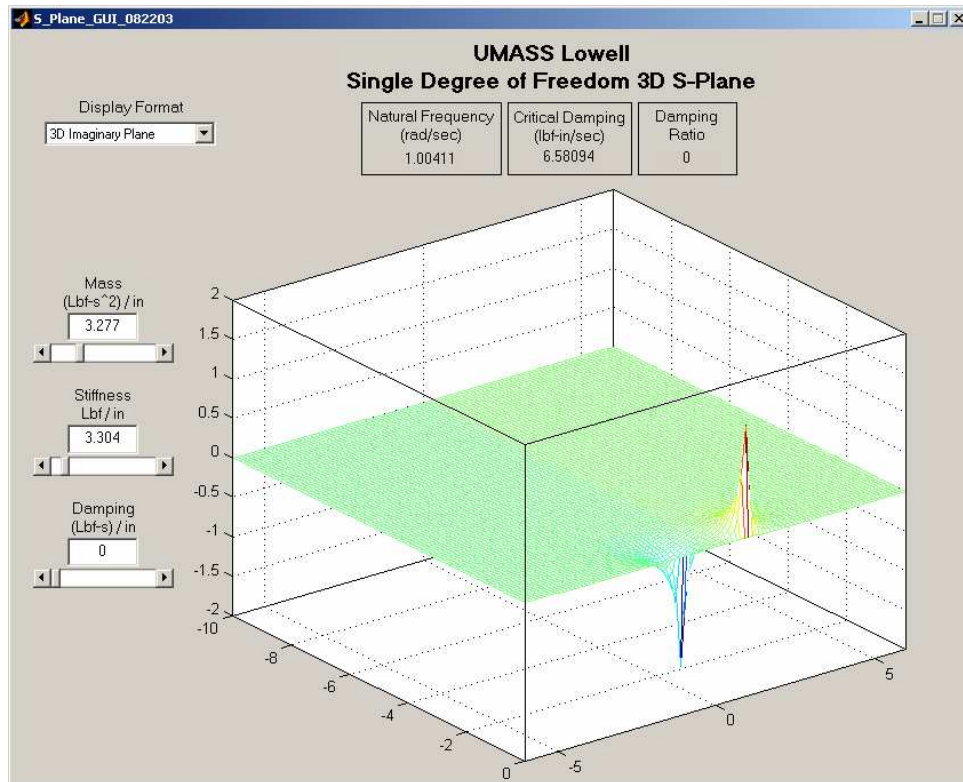

Figure 3: SDOF 3D S-Plane GUI (3D Real)

Figure 4: SDOF 3D S-Plane GUI (3D Imaginary)

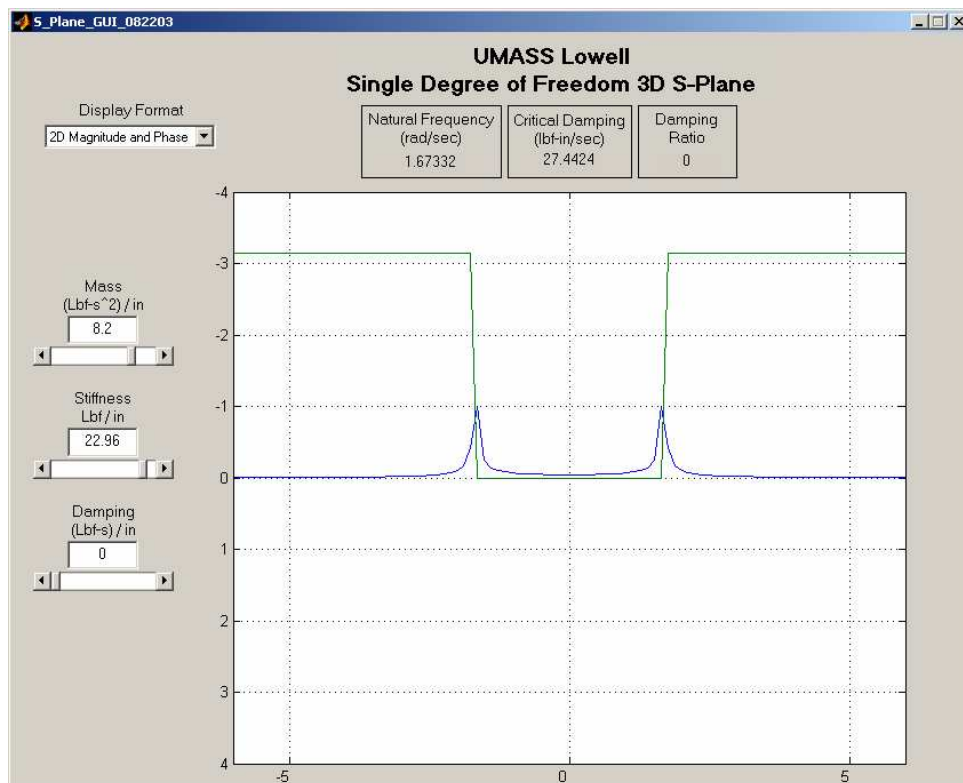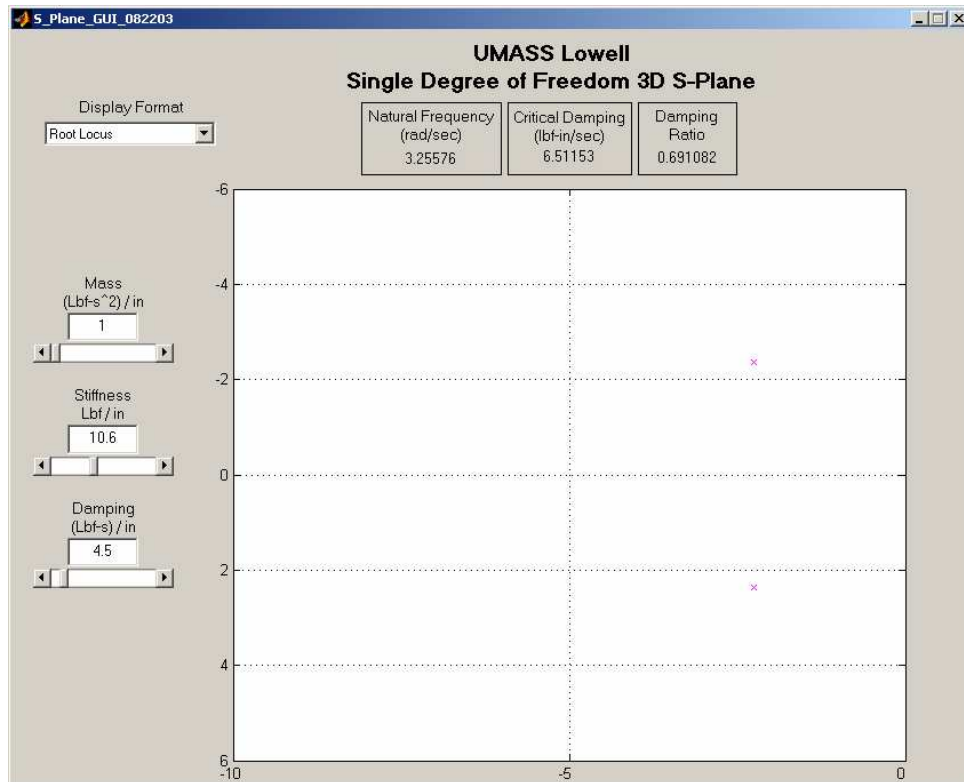**Figure 5: SDOF 3D S-Plane GUI (2D Magnitude/Phase)**

Figure 6: SDOF 3D S-Plane GUI (2D Root Locus)