**Lab #4 - Modal Analysis (Experiment) Name:**

**Short Form Report Date:**

**Section / Group:**

# *Procedure Steps (from lab manual):*

# *Follow the Start-Up Procedure in the laboratory manual. Note the safety rules.*

# *Locate the various springs and masses for the mass-spring-dashpot experimental system.*

# Part I – The Three Mass System Experiment A

1. (5%) Attach “Figure 4.A1” and “Figure 4.A2” to the end of this report.

2. (5%) Compare the modal frequencies you just obtained from your experiment to the theoretical frequencies from the pre-lab. Explain what could account for the differences.

Mode # Example

m3

m2

m1

Disp. from equilibrium

**Experiment B**

3. (5%) Attach Figures 4.B1-B3 to the end of this report.

4. (5%) In the space below make a sketch of each of the system mode shapes.

Mode #1

m3

m2

m1

Displacement from equilibrium

Mode #3

m3

m2

m1

Displacement from equilibrium

Mode #2

m3

m2

m1

Displacement from equilibrium

5. (5%) You will notice that the second mode shape's 2nd mass displacement is not exactly 0, it wobbles back and forth a little bit. DISCUSS which assumptions we made in our pre-lab mathematical model that would not account for the small displacement of the 2nd mass in our physical model.

6. (5%) Look back at the frequency response, plot ''Figure 4.A2". For the second mode, what do you notice about the relative amplitudes of each of the masses? EXPLAIN how closely these represent your sketched mode shape from question 4.

# Part I – The Three Mass System Experiment C

7. (5 %) Examine the plot Plot 4.C0. Explain what frequencies you expect to observe and if you see them in the plot.

8. (5 %) Examine the Figures 4.C1-C3. Explain what frequencies you expect to observe and if you see them in the plot.

# Part II – The Cord

9. (5%) On the following axes sketch the first three modes. Fill in the blanks on the right\*.

*\* Do not count the boundary conditions for counting nodes.*

Mode # 1

Number of Nodes \_\_\_\_\_\_\_

Number of Peaks \_\_\_\_\_\_\_

Mode # 2

Number of Nodes \_\_\_\_\_\_\_

Number of Peaks \_\_\_\_\_\_\_

Mode # 3

Number of Nodes \_\_\_\_\_\_\_

Number of Peaks \_\_\_\_\_\_\_

10. (5%) Who was able to excite the highest mode at steady state? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Sketch the mode shape below. What is the mode number? Can you estimate the frequency?

Mode # \_\_\_\_\_

Number of Nodes \_\_\_\_\_\_\_

Number of Peaks \_\_\_\_\_\_\_

Frequency: \_\_\_\_\_\_\_\_\_ Hz

11. (5%) Explain what happens to the modal frequencies and mode shapes compared to the case when you don’t add any tension. Hypothesize why this occurs.

# Part III – The Beam

# 12. (5%) Write the frequency and sketch the mode shape

Mode # \_\_\_\_\_

Number of Nodes \_\_\_\_\_\_\_

Frequency: \_\_\_\_\_\_\_\_\_ Hz

|  |  |
| --- | --- |
| **Table 1: Nodes and Frequency** | |
| Number of Nodes | Frequency (Hz) |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

13. (5%) As you increase the frequency please fill in Table 1

with the appropriate frequency and number of nodes.

14. (5%) Can you find a frequency over 100 Hz? Why or why not?

# Part IV – General

15. (5%) In a short paragraph, discuss some possible applications of how the material covered in this laboratory could be used in a real application.