Fundamentals of Mathematics for Engineers Lab

ENGR 2194
Lab # 8 – Differential Equations in Engineering: Spring-Mass Vibration
Many engineering disciplines (e.g., electrical, mechanical) commonly use:

• Differential equations
• Derivatives
Today's Learning Objectives

- After today's lab, students will be able to:
  1. Apply principles of modeling and analysis to a spring-mass system
  2. Identify and measure the key parameters of a spring-mass system
  3. Validate a mathematical model (differential equation) with measured data
Spring-Mass System

Governing equation

\[ m \ddot{y}(t) + k y(t) = 0 \]

\[ m \ddot{y}(t) + k y(t) = m \ddot{y}(t) \]

\[ y_{total}(t) = A \cos \left( \sqrt{\frac{k}{m}} t \right) \]
Lab Equipment
Lab Demo

Demonstration

Diagram:

- Spring
- Masses
Excel

- Cell referencing
Important Takeaways

- Essential to Engineers
  - Differential equations
  - Derivatives
  - Data Analysis
    - Excel
Preview of Next Lab

- Lab Exam: Presentations