

Module 6 - Spring Systems

ME3050 - Dynamics Modeling and Controls

Mechanical Engineering
Tennessee Technological University

Topic 3 - The Mass Spring Model

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- Motivation
- The Mass-Spring Model
- Newton's Approach
- Example: Automotive Suspension



Motivation



- Automobile Suspension
- Internal Combustion Engine
- Clocks
- so many more

Images: Wikipedia

The Mass-Spring Model

First, consider the physical problem and list all simplifying assumptions necessary or desired. In general, the designed should start simple and add complexity incrementally.

Model Assumptions:

- 1
- 2
- 3

Images: T. Hill

Newton's Approach

Newton's Second Law Approach

- ① Draw a Free Body Diagram
- ② Make an assumption of motion
- ③ Determine all forces acting on the system and their directions.
- ④ Write Newton's second law for the appropriate DOF.
- ⑤ Re-write the ODE in the standard form of a system equation.

Newton's Approach

This results in a fundamental **equation of motion** that will use throughout the rest of the semester.

Example: Automotive Suspension



Example: Automotive Suspension - Steps 1,2 and 3

Example: Automotive Suspension - Steps 4,5