

## Module 4 - 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