

What is this class about?  
How does it apply to mechanical engineering?  
What areas of engineering will we cover?  
Remember those math classes?  
Major Topic Covered

## Module 1 - Introduction

ME3050 - Dynamics Modeling and Controls

Mechanical Engineering

Tennessee Technological University

### Topic 1 - What is Analysis

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# What is this class about?

Define *Analysis*:

- detailed examination of the elements or structure of something, typically as a basis for discussion or interpretation.

- Analysis
- Design

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# How does it apply to mechanical engineering?

## **This is not just another math class!**

- we will study mathematical modeling of engineering systems and the theoretical and numerical solutions to non-linear equations, systems of linear equations, and ordinary and partial differential equations
- mathematical methods for solving mechanical engineering problems with modern computing tools
- we can solve the BIG problems!

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# What areas of engineering will we cover?

- Statics and Mechanics
- Rigid Body Dynamics
- Fluid Dynamics
- Thermodynamics and Heat Transfer
- Vibrations

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## Remember those math classes?

We will be doing some *applied mathematics* in this class!

- Algebra and Arithmetic
- Matrix/Linear Algebra
- Calculus
- Ordinary and Partial Differential Equations
- The Fourier Series

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## Remember those math classes?

This class is different than a traditional mathematics class.

- By nature engineering problems are hard to solve on paper.
- So, will be using calculators but we will also be using...
- 

Modern Computing Tools

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## Major Topic Covered

- 1 Mathematical Modeling
- 2 Solutions to Non-Linear Equations
- 3 Solving Systems of Linear Equations
- 4 Numerical Integration and Curve Fitting
- 5 Ordinary Differential Equations
- 6 Partial Differential Equations



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# Major Topic Covered

## 1) Mathematical Modeling



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## Major Topic Covered

### 2) Solutions to Non-Linear Equations

- Rigid Body Dynamics
- Optimization and Design

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## Major Topic Covered

### 3) Solving Systems of Linear Equations

- Statics and Structural
- Equilibrium Equations
- The Eigenvalue Problem
- Mechanisms and Machines

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### 4) Numerical Integration and Curve Fitting

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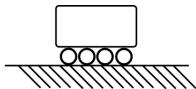
**Major Topic Covered**

## Major Topic Covered

### 5) Ordinary Differential Equations

- What is a Differential Equations? What about a system of them?
- What does it mean to solve a differential equation?

- A very simple example:



ODE:

Solution:

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### 6) Partial Differential Equations

- What is different about a Partial Differential Equation?
- What is different about the solution to a PDE?
- What does this allow us to do?