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

Lecture Module - Introduction and MATLAB Review

ME3023 - Measurements in Mechanical Systems

Mechanical Engineering

Tennessee Technological University

Topic 1 - Introduction to Analysis

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What is this class about?

- Analysis

- Design

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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. -Merriam-Webster

Define *Design*:

- A design is a plan or specification for the construction of an object or system or for the implementation of an activity or process, or the result of that plan or specification in the form of a prototype, product or process. The verb to design expresses the process of developing a design. -Wikipedia

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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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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...
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Modern Computing Tools

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1. Computer Programming for Scientific Computation

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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1) Computer Programming for Scientific Computation

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2) Solutions to Non-Linear Equations

- Rigid Body Dynamics
- Optimization and Design

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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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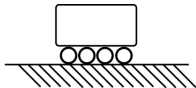What areas of engineering will we cover?
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5) Ordinary Differential Equations

- 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?