Module 1 - Introduction

ME3001 - Mechanical Engineering Analysis

Mechanical Engineering

Tennessee Technological University

Topic 1 - What is Analysis

Topic 1 - What is Analysis

- 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

What is this class about?

- Analysis
- Design

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

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!

What areas of engineering will we cover?

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

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

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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Major Topics 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

Major Topics Covered

1) Mathematical Modeling

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Major Topics Covered

2) Solutions to Non-Linear Equations

- Rigid Body Dynamics
- Optimization and Design

Major Topics Covered

3) Solving Systems of Linear Equations

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

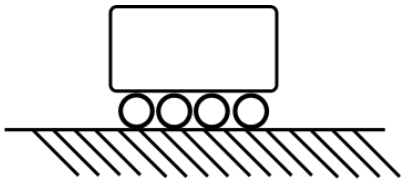
Major Topics Covered

4) Numerical Integration and Curve Fitting

Major Topics 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:

Major Topics Covered

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?