Module 1 - Introduction

ME3050 - Dynamics Modeling and Controls

May 29, 2020

Topic 1 - What is System Dynamics?

Topic 1 - What is System Dynamics?

- Welcome Back!
- Definition of *Dynamics*
- Modeling and Analysis
- Model Based Design

Welcome to New Video topics

Welcome Back!

- Things are going to be different but we will still learn!
- These new outlines should help keep me/us on track.
- The material will be organized in $\sim$ 10 min videos, and you can watch them at anytime.

Definition of Dynamics

Dynamics is ...

the study of how moving objects behave,

or

an area of mechanics that studies movement and its causes,

or

system dynamics is the study of **modeling** and **analysis** of dynamical systems as a function of time.

Dynamics vs System Dynamics

Dynamics: find state of object at a specific instant in time

System Dynamics: find state of system as a function of time

$\rightarrow$ Leads to use of differential equations. $m\ddot{x} + c\dot{x} + kx = f(t)$

What is Mathematical Modeling?

A mathematical model is a description of a system using mathematical concepts and language. The process of developing a mathematical model is termed mathematical **modeling** ...

... used in the natural sciences and engineering disciplines ... Wikipedia

- Model Simplification
- Force and Loading Analysis with FBDs
- Fundamental Laws Lead to Equations of Motion
- Newton's Second Law and Conservation of Energy

What is Analysis?

Analysis is the process of breaking a complex topic or substance into smaller parts in order to gain a better understanding of it...

Wikipedia

- Study Model to find System Response
- Time-Domain analysis: examine system response in time to various inputs and initial conditions
- Frequency-Domain analysis: examine system response when subject to sinusoidal inputs

Model Based Design

Model-Based Design (MBD) is a mathematical and visual method of addressing problems associated with designing complex control, signal processing and communication systems. It is used in many motion control, industrial equipment, aerospace, and automotive applications... Wikipedia

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