

Introduction to Model-Based System Design

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Course Details

Description

Introduction to Model-Based System Design: Model-in-the-Loop (MIL), Software-in-The-Loop Simulations (SIL), Hardware-in-the-Loop (HIL), Real-Time Simulations, Targeting, Verification and Validation, Design of Experiments, Model Refinement.

Objectives

After successfully completing this course the student should be able to:

- Build mathematical models for components in a system.
- Follow a process of continuous refinement and improvement to generate accurate models.
- Connect component models together to model a larger more complex system.
- Setup and run Model-in-the-Loop Simulations (MIL).
- Setup and run real-time simulations for a physical system.
- Setup and run Hardware-in-the-Loop Simulations (HIL).
- Apply basic control algorithms to a real physical system.
- Deploy a control algorithm on a real-time target.
- Apply verification and validation methods to a model of a physical systems.
- Use Design of Experiment methods to create models of physical systems.

Original Course Documents

[Source file URL](#)

Course Contents

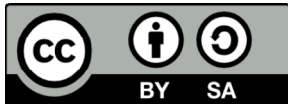
- Model-Based Design for a small system
 - Motor Model
 - Generator Model

- Controller Model
- SimDriveline Intro
- Simulink Simulations
 - Explore the system response using different control methods.
 - Tune the system
 - Explore system limitations
 - Understand and refine motor models.
- Real-time simulations with xPC
 - Plant and Controller Implement on Single Target
- Implement controller on MPC566 or MPC5554 target
 - Install hardware and software.
 - Use Freescale RAppID Toolbox or MathWorks 555 Toolbox
 - Wire up system to familiarize students with pin outs
 - Explore analog inputs, digital and PWM outputs
- Processor In The Loop Real-Time Simulations
 - Controller on Freescale Target
 - Plant on Real-Time Target
 - Display Performance on Virtual Gauge Display
 - Data Collection of Performance
- Test controller on real system
 - Observe system performance
 - Observe the effect of different control methods.
 - Tune the system
- Model Verification
 - Data Collection of Physical Model Response
 - Comparison of Physical Plant Response to Model Response
- Design of Experiments to Collect Experimental Data on Motor and Generator
 - Automatically Generate Test Schedule to Obtain Data
 - Run Experiments and Collect Data
 - Generate Models for Components
 - Table-Lookup
 - Curve Fits
- Model Refinement and Re-Verification
 - Update Models to Include Measured Data
 - Comparison of Updated Physical Plant to Model
- Further Exploration of Alternate Control Methods as Time Permits

[Problem Sets](#)

Resources

- [Models, Drive Cycle Files, and Component Information](#)
- [MPS555x Demo Board Manual](#)
- [MPS555x Demo Board Schematic](#)
- [MPS555x Demo Board Silkscreen](#)



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