Advanced Model-Based System Design

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Course Details

Description

Advanced Model-based System Design: Modeling of a complex system, model development, control, verification and validation, real-time simulation.

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.
- Manage the development of large system models
- Connect component models together to model a larger more complex system.
- Setup and run Model-in-the-Loop Simulations (MIL).
- Setup and run Software-in-the-Loop Simulations (SIL).
- Setup and run real-time simulations for a physical system.
- Setup and run Hardware-in-the-Loop Simulations (HIL).
- Develop a controller for a large complex system.
- Deploy a control algorithm on a real-time target.
- Apply verification and validation methods to a model of a physical systems.

Original Course Documents

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Course Contents

- Modeling a series hybrid-electric vehicle
  - Introduction to Simulink and SimDriveline
  - Models for the Driver, Battery, and Electric Motors.

    - Creating and Running Drive Cycles
    - Models for Engines.
    - Developing the hybrid-electric vehicle controller.
    - Measuring and predicting vehicle performance.
- Real-Time Simulations
    - Stand-Alone Simulations
    - Verify logical operation
    - Give user feel of controls and vehicle operation
    - Plant and controller on same target
- Introduction to CAN
    - Message IDs
    - Scaling and Offset
    - Big Endian and Little Endian
    - CAN Message Database
    - Cabling,isolation, and termination
    - Introduction to MotoHawk and MotoTune tools.
- HIL Simulations (Real-Time)
    - Separate the Plant from the Controller.
    - Controller on real-time target.
    - Plant on real-time target.
    - V&V Using HIL RT Model
    - Setup a standard set of tests for the series controller.
    - Run standard set of tests, record and report results, indicate faults.
    - Verify communications interfaces and A/D inputs and outputs.
    - Verify that controller can execute control algorithm in specified time step.
    - Verify Communication data rates.

Problem Sets

Resources

- Models, Drive Cycle Files, and Component Information
- Download the MathWorks Automotive Advisory Board Style Guide

MotoHawk 80-PIN Target Documentation

- ECU555-80 Datasheet
- ECU555-80 Data Sheet R-13
- 80-Pin Development Harness Documentation

- MATLAB Courseware
- Hardware Resources

- Classroom Resources
- MATLAB Examples
- Books
- Tutorials
- Webinars
- Technical Articles