

Advanced Model-Based System Design

Last updated: 10/18/2013

Author Information

Zachariah Chambers

Rose-Hulman Institute of Technology

Marc Herniter

Rose-Hulman Institute of Technology

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

[Source file URL](#)

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.

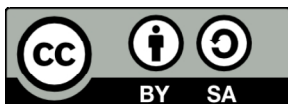
Problem Sets

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](#)



This work is licensed under a [Creative Commons Attribution-ShareAlike 3.0 Unported License](#).
 Learn more about MathWorks academic resources:

- [MATLAB Courseware](#)
- [Hardware Resources](#)

- [Classroom Resources](#)
- [MATLAB Examples](#)
- [Books](#)
- [Tutorials](#)
- [Webinars](#)
- [Technical Articles](#)