Model-Based Design Curriculum: Basic Component Modeling

Last updated: 09/26/2014

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Course Details

Description

The Model-Based Design Curriculum is a series of self-paced learning modules aimed at developing a basic understanding of Model-Based Design within the context of hybrid electric vehicles. In this course, Model-Based Design is defined as a method for developing mathematical models for physical systems and controllers in complex systems such as a vehicle powertrain. The intent of this course is to build understanding of complex systems through the development of basic models that can be modified to incorporate more complex behaviors. Basic Component Modeling is the first course in the series. It provides an overview of model-based design, introduces powertraing component and modeling, and also introduces powertrain control strategies and applications.

The content of this course is designed for sophomore or higher college engineering students. The models developed in this module are built using MATLAB and Simulink release 2012b.

Prerequisites

- This course assumes a basic understanding of MATLAB and Simulink.

Original Course Documents

Source file URL (Includes lecture videos)

Course Contents

Lesson 1: Introduction to Model-Based Design

- Introduction to Model-Based Design and Hybrid Electric Vehicles
  - Lecture 1
  - Lecture 2
  - Lecture 3
- Modeling Basics in MATLAB/Simulink
  - Lecture 4
  - Demo: Overview of Simulink Basics and Modeling Essentials
    - Video
- Introduction to Models
  - Lecture 5
  - Assignment 1: Glider Model
    - Application_GliderQuestions.docx
    - Glider_X2_DOrd_init.m
    - Glider_X2_DOrd.mdl
    - MBDCP_Glider_Soln.pdf
  - Demo: Generating and Applying a PID Controller in Simulink
    - Video
  - Assignment 2: Driver-Glider Model
    - Application_DriverGliderQuestions.docx
    - NTER_Assign2_SOLUTION_init.m
    - NTER_Assign2_SOLUTION.mdl
    - DriveCycles_Scaled.xls
    - MBDCP_Driver_Soln.pdf

Lesson 2: Powertrain Components and Models

- Vehicle Powertrain Architectures and Components
  - Lecture 6
  - Lecture 7
  - Lecture 8
  - Assignment 3: Conventional Vehicle Model
    - Application_ConventionalVehicleQuestions.docx
    - NTER_Assign3_SOLUTION_init.m
    - NTER_Assign3_SOLUTION.mdl
- Electrical Components

    - Lecture 9
    - Lecture 10
    - Assignment 4: Battery Electric Vehicle (BEV) Power Loss and Torque-Speed Model
        - Application_BEVQuestions.docx
        - NTER_Assign4PL_SOLUTION_init.m
        - NTER_Assign4PL_SOLUTION.mdl
        - NTER_Assign4TS_SOLUTION_init.m
        - NTER_Assign4TS_SOLUTION.mdl

Lesson 3: Model Hybridization and Control

- Hybrid Vehicle Supervisory Controller (HVSC) Implementation and Strategy
    - Lecture 11
    - Demo: Modeling a HVSC Genset Using Stateflow
        - Video
    - Lecture 12
    - Assignment 5: Series Plug-in Hybrid Electric Vehicle (PHEV) Architecture
        - Application_PHEVQuestions.docx
        - NTER_Assign5_SOLUTION_init.m
        - NTER_Assign5_SOLUTION.mdl
- Model-Based Design Applications and Conclusions
    - Lecture 13
    - Lecture 14

Links

- EcoCAR2 Website
- EcoCAR3 Website
- EcoCAR2 Team at Virginia Polytechnic Institute and State University