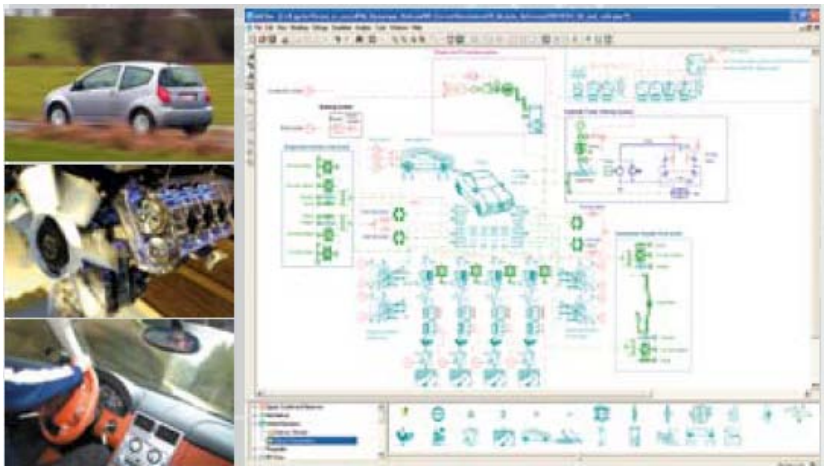
THE CENTER FOR
PROFESSIONAL STUDIES



Design of Vehicle Energy Management for Improved Performance

Today intelligent system integration is driving improved product performance and delivering innovative designs in a variety of industries. Recent surveys show that approximately 80% of the next-generation systems and products will be derived from so-called intelligent systems. One of the most common examples is the advanced injection and control systems essential to clean-running and fuel-efficient car engines.

- First, the basics of an IFP-Drive library and its global approach, mainly through tabulated data, for vehicle architecture studies. Insight into the simulation and analysis of conventional, hybrid and electrical vehicle global performance, fuel consumption and emissions.

- Next, participants will focus on a clear overview of the process to accurately simulate system-level vehicle energy management. State of the art system level simulation solutions will be utilized to demonstrate the capabilities to address the current challenges of optimizing fuel economy for automotive, trucks and military industries throughout the complete design process of their products.

- Lastly, participants will be shown how to run the model and interpret output results on LMS software products. A thorough understanding of what these results mean and how to use them to improve the product design will be discussed.

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Course Syllabus

I IDENTIFYING INFORMATION

Course:	Design of Vehicle Energy Management Systems for Improved Performance
Prerequisites:	None
Time Frame:	40 total contact hours
Instructor:	A technical specialist with LMS International BS in Mechanical Engineering 5 years of experience with LMS software and hardware 5 years of applicable industrial experience
Phone:	(248) 952-5664
E-mail:	caesupport.us@lmsintl.com

II REFERENCE MATERIALS

1. LMS software usage documentation

III COURSE GOALS AND OBJECTIVES

1. Understand the concepts behind 1D and Multi-Domain System Simulation
2. To provide insight in the use of the IFP-Drive library dedicated to the simulation and analysis of conventional, hybrid and electrical vehicle global performance, fuel consumption and emissions.
3. Present in detail the components of the IFP-Drive library and its global approach, mainly through tabulated data, for vehicle architecture studies.
4. Provide a clear overview of the process to accurately simulate system-level vehicle energy management. State of the art system level simulation solutions will be utilized to demonstrate the capabilities to address the current challenges of optimizing fuel economy throughout the complete design process.
5. Demonstrate how different subsystems (cooling, transmission, engine, A/C, electric grid, etc.) can be addressed in detail within the global approach.

IV METHODOLOGY

This course is an introduction to the techniques that are used in the design of vehicle energy management systems for improved performance, fuel economy and emissions. Each module will introduce new material that the student will be allowed to experience for himself with the associate In-class Tutorials.

Lectures

Each detailed subject will be presented in a lecture format outlining the theory and standardized accepted methodology. A printed copy of the lecture material will be provided for the student's personal in-class use and as a reference material.

Specific Industry Examples

Real life examples will be covered that explain the application of the theory to various industries such as automotive, aerospace, home appliance. This will give the students a clear understanding of how and why these techniques are utilized in different industries and the value they add to fuel economy.

In-Class Assignments

The student will conduct several hands-on tutorials to reinforce the theoretical concepts. These tutorials will increase in complexity as the students further develop their skills.

V COURSE OUTLINE & ASSIGNMENTS

Module 1 – An Introduction to 1D and Multi-Domain System Simulation

1D and Multi-Domain Simulation
The LMS Imagine Lab AME Sim Environment
Using Standard Design Libraries
In-class Tutorial – Understanding connection rules
In-class Tutorial – Simple Pendulum
In-class Tutorial – Nonlinear Pendulum

Module 2 – Driving Performance, Fuel Economy and Emissions

Presentation of the IFP Drive Library
The different components and their assumptions:

- Drive cycle (mission profile)
- Drivers
- Vehicle loads
- IC engine
- Drive train components
- Electric components
- Cooling system
- Exhaust/after-treatment

Manipulation of data files and the different outputs
Driving performance, fuel economy and emissions
Links with other libraries
Illustration with basic practical examples
In-class Tutorial - A complete gasoline vehicle with exhaust system
In-class Tutorial - A diesel vehicle with manual gearbox and clutch
In-class Tutorial - A gasoline vehicle with automatic gearbox
In-class Tutorial - A hybrid vehicle
In-class Tutorial – Other applications

Module 3 – Vehicle Energy Management Simulation

Analysis of component performance (Actuators, Heat exchangers)

Analysis of subsystem performance (Cooling System, Lubrication System, Engine Thermal model, Vehicle performance module, Electric auxiliaries)

Analysis of subsystem interaction / integration within their real life environment

Trade-off studies: impact of component geometry, subsystem architecture changes, and control strategies on critical attributes:

- Global energy flow distribution
- Impact on vehicle performance
- Fuel economy
- Pollutant emissions
- Passenger thermal comfort

In-class Tutorial – Trade-off Studies