POWER AND PROPULSION TECHNOLOGY
EDUCATION & TRAINING GUIDE

May – December 2014

FEATURED COURSES
• Introduction to Gears Seminar – page 08
• Diesel Engine Technology Engineering Academy - page 20
• Piston Ring Design/Materials Seminar - page 31
• The Basics of Internal Combustion Engines Seminar and e-Seminar - page 34
• Turbocharging for Fuel Economy and Emissions Webinar and Webinar Recording - page 36
• Hybrid and Electric Vehicle Engineering Academy - page 72

training.sae.org
Welcome to the Spring Issue of the Power and Propulsion Technology Education and Training guide. We have again included ALL the training and education SAE offers related to Power and Propulsion technology – Live classroom, live online, and online, on demand courses. Training when you want it.

THIS GUIDE INCLUDES COURSES THAT EXPLORE THE FOLLOWING TOPICS:

- Fuels and fuel delivery
- Emissions control and the environment
- Hybrid and Electric Vehicle technology including electric powertrain and battery
- Powertrain/drivetrain
- Internal combustion engines including gasoline and diesel fuel

PLUS NEWLY SCHEDULED COURSES:

- Introduction to Gears Seminar – page 08
- Piston Ring Design/Materials Seminar - page 31

AND ADDITIONAL DATES FOR:

- Turbocharging for Fuel Economy and Emissions Webinar – page 36
- Turbocharging Internal Combustion Engines – page 38
- Emissions-Related OBD Systems: A Design Overview Seminar – page 43
- Hybrid and Electric Vehicle Engineering Academy – page 72

LIFELONG LEARNING.

SAE International is a global association committed to being the ultimate knowledge source for the mobility engineering professional. By uniting over 135,000 engineers and technical experts, we drive knowledge and expertise across a broad spectrum of industries. We act on two priorities: encouraging a lifetime of learning for mobility engineering professionals and setting the standards for industry engineering.

SAE International is the world’s leader in mobility engineering knowledge. We are trusted by engineers and other professionals around the globe to provide a broad, multi-sector source for information and solutions. The SAE International Professional Development program offers access to over 300 classroom, live online, and online, on demand learning opportunities — training that supplies the right content to help solve your specific challenges.

Mylearn.SAE.ORG
Access your SAE education and training transcripts, and plan and schedule future training.
A LEARNING FORMAT TO FIT EVERY NEED

As the world’s leader in offering access to the most extensive, multi-sector source of knowledge and expertise, SAE International provides the mobility engineering training and education needed to turn your challenges into solutions.

What is your learning need?
SAE International offers a variety of learning formats to accommodate diverse learning styles. Explore classroom, live and online, and online and on demand courses.

Many courses are offered in multiple formats to fit your exact need. Be sure to watch for the icons that identify the format available for each course.

Seminars or workshops available as similar live, online webinars or online and on demand courses, will feature icons and information about the schedule and fees for all platforms.

CATALOG KEY
You will see the following icons with the course descriptions.

These icons indicate:
• Delivery formats available for the course
• That the course is part of a certificate program

Many courses are available in multiple formats. In addition to finding courses that fit your technology need, look for courses with icons that fit the way you want to learn.

CLASSROOM indicates that course is an instructor-led seminar or workshop offered in a classroom setting

LIVE, ONLINE indicates this course is an instructor-led webinar offered live and online via telephone and internet connection

ONLINE, ON DEMAND These offerings are available online anytime the participant would like to access the course through the internet

CERTIFICATE This icon indicates that this course is part of an SAE International curriculum-based, multi-course certificate. See a list of the multi-course certificates on page 82.

As an IACET Authorized Provider, SAE International offers CEUs for its programs that qualify under the ANSI/IACET Standard.
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We do our best to schedule live learning offerings as far in advance as possible to help you better plan your training needs. The information in this resource guide reflects the most accurate information available at the time of publication. Rarely, unforeseen circumstances may force a change in the live learning schedule. For the most up-to-date listing of scheduled offerings visit training.sae.org/all/bydate. SAE International reserves the right to cancel courses and cannot be held responsible for costs incurred beyond registration fees.
An efficient, robust, and quiet running drivetrain is as essential to customer satisfaction as styling and interior creature comforts. In this seminar, you will be exposed to various methods that can be used to accomplish this goal. Designed to help you visualize both individual components and the entire drivetrain system, this seminar focuses on the terms, functions, nomenclature, operating characteristics and effect on vehicle performance for each of the drivetrain components. Attendees will receive an introduction to the various components of the drivetrain. This course also provides insight into: the structure and function of each component; vehicle integration; and related noise, vibration and harshness issues. You will be equipped to evaluate the space requirements, mounting needs, clearances required, and effect on vehicle response for each component. Attendees will receive a copy of James Halderman’s book, The Automotive Technology, 4th Ed.

**LEARNING OBJECTIVES**

By attending this seminar, you will be able to:

- Discuss both practical and technical aspects of smoothing clutch operation by incorporating cushion and torsional dampers.
- Compare different types of transmission synchronizers, automatic transmission torque converters, hydraulic clutch operation and epicyclic gear trains.
- Describe the interaction of gear ratios and vehicle performance as related to engine horsepower and torque curves.
- Explain phasing and mounting of propeller shafts as related to torsional excitation and secondary couple loads.
- Review different types of differentials.
- Compare common misconceptions of limited slip devices to their actual performance.
- Recognize four-wheel drive systems and the need for an inter-axle differential.
- Appraise electronic control of torque through braking and clutching devices.
- Evaluate the total drivetrain package as a system.

**WHO SHOULD ATTEND**

This seminar is intended for engineers now working with passenger car, sport utility, truck, bus, industrial, and off-highway vehicles who have had minimal prior experience with the total drivetrain.

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**A FAMILIARIZATION OF DRIVETRAIN COMPONENTS**

“Excellent overview of the entire drivetrain, but includes some detail and practical insight instead of being too broad and overgeneralized.”

Scott A. Van Luvender
Applications Engineer
Acadia Polymers

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"Excellent overview of the entire drivetrain, but includes some detail and practical insight instead of being too broad and overgeneralized.”

Scott A. Van Luvender
Applications Engineer
Acadia Polymers
CONTENT HIGHLIGHTS

- Clutch (dry/wet)
- Transmission
- Propshaft
- Axle
- Rigid
- Steering
- Transfer Case
- Wheel Ends
- Brakes
- Disc
- Drum
- Hydraulics
- Electronic Control of Brakes and Torque
- Anti-Lock Brake Systems

INSTRUCTOR

Joseph Palazzolo
Chief Engineer – Geared Products, GKN Driveline Torque Technology Group

I.D.# 98024

SCHEDULE
December 2-3, 2014
Troy, Michigan

FEES

List: $1,415
Members
Classic: $1,275
Premium: $1,205
Elite: $1,135

TWO-DAYS/1.3 CEUS

Get the complete course information and register:
training.sae.org/seminars/98024

ALSO AVAILABLE AS AN ONLINE ON DEMAND COURSE.

A Familiarization of Drivetrain Components e-Seminar

Convenient, portable, and with core content from the instructor-led seminar, this five and a quarter hour e-seminar option offers an alternative way to receive the same instruction without the expense of travel and time away from the workplace. This e-seminar is divided into seven video modules and a coordinated handbook.

ID# PD1305550N

FEES

List: $295
Members
Classic: $266
Premium: $251
Elite: $236

5.25 HOURS/.60 CEUS

View the complete course description and a video demo:
training.sae.org/eseminars/drivetraincomponents

TRANSMISSION/DRIVETRAIN CERTIFICATE PROGRAM

This program familiarizes you with key drivetrain components and how those components function as a system. Complete this certificate to increase your expertise within the drivetrain body of knowledge and, at the same time, earn the SAE Certificate of Achievement.

Complete the Transmission/Drivetrain Certificate to earn seven graduate credits towards the SAE/Kettering University 20-credit Certificate in Automotive Systems and Kettering’s 40-credit M.S. in Mechanical Engineering. training.sae.org/collegecredit

View the list of required and elective courses and more information on enrolling in this or any SAE certificate program--training.sae.org/certificate/transmission_drivetrain
FUNDAMENTALS OF MODERN VEHICLE TRANSMISSIONS

This seminar covers the latest transmission systems designed to achieve the most efficient engine operation. Discussion includes current designs, components and sub-systems, functionality, operation, and inter-relationships between components and systems. Using a manual transmission display, the instructor explains ratios and their function in the driveline. Automatic transmission design will illustrate automatic control and hydro-mechanic decision theory and implementation. “Hands-on” exercises using transmission models and components will supplement theoretical concepts. Mechatronics, toroidal transmission functions, and the future of the automatic transmission will also be discussed. Continuously Variable Transmission (CVT) systems will be the focus on the third day of this seminar.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

• Explain the development, operational aspects and design principles of passenger vehicle and light truck transmission systems, their major components and sub-systems
• Describe the operational parameters and inter-relationships of each of the sub-systems
• Apply basic design synthesis and analysis techniques for each of the major components and sub-systems
• Compare and contrast ‘stepless’ to ‘stepped’ transmission technology
• Identify and describe the function and operation of all major components and sub-systems by participating in hands-on demonstrations
• Recognize the limitations, technological trends, and potential new products under consideration
• Summarize the direction of new passenger car transmission designs and systems

WHO SHOULD ATTEND

This seminar is intended for anyone not familiar with modern vehicle transmission systems.

“Mark is an excellent instructor and his passion for transmission technology really comes through in the course materials and presentation.”

Joseph Carroll
Senior R&D Scientist
Afton Chemical

CUSTOMIZE A LEARNING EXPERIENCE TO ADDRESS YOUR SPECIFIC BUSINESS NEEDS.

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CONTENT HIGHLIGHTS

- Overview of Mechanical Power Transmission
- Theory, Function and Operation of Manual Transmission
- Vehicle Powertrain Requirements and Specifications Assessment
- Shift Strategy Analysis and Control System Implementation
- Components and Sub-systems
- Basic Gear Theory and Application Development
- Powerflow Analysis
- Synchronizer Operation and Analysis
- Lubrication and Cooling Requirements Review
- Development and Layout of the “Automatic”
- Functionality
- Extension of Gear Theory to Epicyclic Gear-trains
- Design and Operation of Clutches and Bands
- Application of One-Way/Over-Riding Clutches
- Powerflow Analysis of Torque Converters, Epicyclic Gear Sets
- Review of Shift Strategy
- Implementation of Shift Strategy Through Hydro-Mechanical Control Systems
- Simple Shift Model Analysis
- Lubrication and Cooling Requirements Review
- CVT Design and Operation
- Basic Theory of Friction Drives
- Toroidal Drive Technology
- Functionality and Characteristics of CVT Components, Sub-systems
- CVT Power-Flow
- Mechatronics
- CVT Manufacturing; Future Technologies

INSTRUCTOR

W. Mark McVea
Chief Technology Officer, Torvec

I.D.# 99018

SCHEDULE
July 28-30, 2014
Troy, Michigan

FEES
List: $1,685
Members
Classic: $1,515
Premium: $1,425
Elite: $1,345

THREE-DAYS/2.0 CEUS

Get the complete course description and register:
training.sae.org/seminars/99018

ALSO AVAILABLE AS AN ONLINE ON-DEMAND COURSE.

Fundamentals of Modern Vehicle Transmissions e-Seminar

Convenient, portable, and with core content from the instructor-led seminar, this 4.5-hour e-seminar option offers an alternative way to receive the same instruction without the expense of travel and time away from the workplace. It is an excellent follow-up to SAE’s A Familiarization of Drivetrain Components e-Seminar (which is designed for those who have limited experience with the total drivetrain).

ID# PD130419ON

FEES
List: $695
Members
Classic: $626
Premium: $591
Elite: $556

14-HOURS/1.4 CEUS

View the complete course description and a video demo:
training.sae.org/eseminars/fmvtrans
INTRODUCTION TO GEARS

This seminar is designed to provide gear novices with a general understanding of gear nomenclature, geometry, and arrangements. Starting with the basic definition of gears, conjugate motion and the “Laws of Gearing”, you will gain a solid understanding of gearing and the fundamentals of rotary motion transfer through gear-trains. Gear classifications, tooth forms and geometry, and very high-level application considerations, manufacturing processes, and inspection techniques will be covered.

Attendees will receive a copy of the book, Gear Design Simplified, by Franklin D. Jones & Henry H. Ryffel.

LEARNING OBJECTIVES

By attending this seminar you will be able to:

• Describe the “Law of Gearing”, conjugate action and involute profiles
• Identify the various gear types and configurations
• Articulate the various definitions and terms used in gearing
• Identify the function and operation of all gear arrangements
• Articulate basic design considerations, nomenclature and inter-relationship of gear forms and motions
• Describe the various manufacturing processes and inspection techniques commonly used in industry today

WHO SHOULD ATTEND

Engineers new to the field of gearing, sales and marketing people responsible for interacting with gear engineers, component suppliers, and vehicle platform powertrain development specialists who have not been previously involved in gear system specification or design will benefit from this course.

CONTENT HIGHLIGHTS

• Principles and Purpose of Gears
• Classification of Gears
• Definitions and Terms Used in Gearing
• Gear Tooth Action
• Conjugacy
• Gear Geometry and Nomenclature
• Gear Arrangements
• Ratios: What They Mean and How to Calculate
• Epicyclic
• Gear Measurement and Inspection
• Charts - Involute, Lead, and Red Liner
• Dimension Sheet

INSTRUCTOR

W. Mark McVea
Chief Technology Officer, Torvec

You will gain a solid understanding of gearing and the fundamentals of rotary motion transfer through gear-trains.

I.D.# C0822

SCHEDULE

October 7, 2014
Troy, Michigan

FEES

List: $785
Members
Classic: $715
Premium: $675
Elite: $635

ONE-DAY/0.7 CEUS

Get the complete course description and register:

training.sae.org/seminars/c0822
SAE CREDENTIALING

GAIN RECOGNITION FOR YOUR PROFESSIONAL EXPERTISE.
SAE International is pleased to provide focused credentialing opportunities for engineers and other professionals. Through SAE Credentialing, you can earn an SAE Certificate of Competency or full Professional Certification.

Certificate of Competency
Designed to validate mastery of knowledge in a focused content area, this program involves completing a single course and passing an industry-vetted exam that verifies your command of the material.

Certified Professional
Designed to validate a mastery of knowledge essential to the profession, certification involves completing established eligibility requirements (typically educational background and work experience), and passing an industry-developed and proctored exam that tests mastery of an industry-defined body of knowledge.

FOR MORE INFORMATION: sae.org/credentialing
All Powertrain Product Development engineers must know how their area of subsystem responsibility could affect vehicle Driveability. This 3-hour Ford online course will provide knowledge of Driveability fundamentals. With this knowledge, you can better determine actions to improve the customer’s perception of Driveability. Although the focus of this course (including all examples and animations) is on vehicles with gasoline engines and automatic transmissions, it should be noted that vehicles with other powertrains (e.g., diesel engine, manual transmission, front-wheel drive) share the same customer attributes and general characteristics of Driveability. While certain Ford proprietary information has been removed from the course, it contains essentially the same content that engineers from Ford and select suppliers have benefitted from taking.

LEARNING OBJECTIVES
By connecting with this course, you will be able to:

• Listen to the Voice of the Customer (VOC)
• Describe how the customer defines good driveability, how customer driveability concerns are researched, and how customer wants cascade to vehicle performance characteristics
• Discuss the vehicle reaction that causes customer driveability concerns and the vehicle systems and interfaces that are involved
• Appreciate driveability from an engineering perspective
• List subsystems that affect driveability
• Highlight the impact of future technologies
• Explain how driveability is measured and how these measurements are correlated back to customer concerns

WHO SHOULD ATTEND
This course is geared toward quality, manufacturing, and product development engineers. It is recommended that you have an engineering degree and experience in the automotive engineering field.

CONTENT HIGHLIGHTS
• The Customer’s Perspective
• Systems and Interfaces that Impact Driveability
• Evaluating a Vehicle’s Driveability Performance

I.D.# PD111016ON

SCHEDULE
Online, on demand/3-month access

FEES
List: $115
Members
Classic: $104
Premium: $98
Elite: $92

3-HOURS

Get the complete course description and register: training.sae.org/ford/pd111016on
In addition to NVH, Driveability, and Shift Quality, Performance Feel is among the four Powertrain attributes that directly influence customer satisfaction. It is defined in terms of the availability of power to the end customer and is the customer perception of performance that includes the effects of vehicle acceleration, accelerator control characteristics, shift character, and sound quality.

This 3.5-hour Ford online course is intended to increase the awareness of vehicle Performance Feel issues, target setting process, and the interactions and controls that affect Performance Feel. Improvement in Performance Feel is identified as high priority. Powertrain engineers can improve Performance Feel by taking action in their own subsystem and/or cascading to other engineers how their systems affect it. While certain Ford proprietary information has been removed from the course, it contains essentially the same content that engineers from Ford and select suppliers have benefitted from taking.

LEARNING OBJECTIVES
By connecting with this course, you will be able to:

• Define Performance Feel and describe the elements of the Performance Feel attribute from the customer’s perspective
• Identify the vehicle systems and subsystems and the interfaces that affect Performance Feel
• Outline the analytical and test-based metrics, tools, and methodologies used to measure and enhance Performance Feel

WHO SHOULD ATTEND
This course is geared toward powertrain, product development, quality, and manufacturing engineers. It is recommended that you have an engineering degree and experience in the automotive engineering field.

CONTENT HIGHLIGHTS
• Performance Feel from the Customer’s Perspective
• Performance Feel from an Engineering Perspective
• Metrics and Targets of Performance Feel
• Performance Feel Design Considerations

I.D.# PD111017ON

SCHEDULE
Online, on demand/3-month access

FEES
List: $125
Members
Classic: $113
Premium: $106
Elite: $100

3.5-HOURS

Get the complete course description and register: training.sae.org/ford/pd111017on
This 8-hour course describes the function and major interfaces of powertrain as-installed driveline subsystems. It also discusses Design Verification System (DVS) metrics/performance requirements for each subsystem and how each subsystem affects others. This course increases your awareness of the system-level interactions and tradeoffs related to your design and release actions and your ability to make informed decisions.

**LEARNING OBJECTIVES**

By attending this seminar, you will be able to:

• Describe the four generic configurations of vehicle drivelines

• Explain the fundamental functions of each driveline and the additional functions that power all four wheels

• Describe the hardware that delivers the driveline functions

• Describe the design, hardware, and types of drive axles

• Describe the primary functions of the drive axle subsystem and explain important interfaces of the drive axle, including attribute interfaces

• Describe driveshaft and halfshaft hardware, design, and primary functions and explain important driveshaft and halfshaft hardware interfaces and attribute interfaces

• Describe the design, identify the hardware, types of design, primary functions, and important interfaces of the transfer case, power transfer unit (PTU), coupling, and rear drive unit (RDU)

• Identify important Design Verification System (DVS) metrics and performance requirements for the drive axle subsystem, driveshafts and halfshafts, and the transfer case, PTU, coupling, and RDU; analyze design scenarios to identify the most practical resolution action

**WHO SHOULD ATTEND**

This course is geared toward quality, manufacturing, and product development engineers.

**CONTENT HIGHLIGHTS**

• Introduction to Driveline

• Drive Axles

• Driveshafts/Halfshafts

• Transfer Case/PTU/Coupling/RDU

**I.D.# PD111014ON**

**SCHEDULE**

Online, on demand/3-month access

**FEES**

List: $275

Members

Classic: $248

Premium: $234

Elite: $220

8-HOURS

Get the complete course description and register: training.sae.org/ford/pd111014on

*Powertrain as-installed subsystems have a common fundamental function to perform in harmony, enabling the engine to power the vehicle and/or accessories. There is a need to avoid issues such as idle roughness and to realize these are system interaction issues.*
This 12-hour course discusses hardware design, function, and major interfaces of powertrain as-installed stationary subsystems and Design Verification System (DVS) metrics/performance requirements for each subsystem and how each subsystem affects others. This course increases your awareness of the system-level interactions and tradeoffs related to your design and release actions and your ability to make informed decisions.

LEARNING OBJECTIVES

By connecting with this course, you will be able to:

- Describe the design, hardware, and primary functions of the accelerator controls subsystem & identify the types of accelerator controls; Explain important accelerator controls hardware and attribute interfaces
- Describe the air induction subsystem design, hardware, and primary functions; explain important interfaces of the the subsystem, including hardware and attribute interfaces
- Describe the design, hardware, and primary functions of the engine and transmission cooling subsystem; explain important interfaces of the subsystem, including hardware and attribute interfaces
- Describe exhaust subsystem design, hardware and primary functions; explain important interfaces subsystem, including hardware and attribute interfaces
- Describe fuel system design, hardware, and primary functions; explain important fuel system hardware and attribute interfaces
- Describe the types and design of powerplant mounts and identify the hardware, primary functions, and attribute interfaces of the powerplant mounts subsystem
- Identify important Design Verification System (DVS) metrics and performance requirements for the these subsystems; analyze design scenarios to identify the most practical resolution action

WHO SHOULD ATTEND

Quality, manufacturing, and product development engineers.

CONTENT HIGHLIGHTS

- Accelerator Controls
- Air Induction
- Engine and Transmission Cooling; Exhaust
- Fuel
- Powerplant Mounts

Powertrain as-installed subsystems have a common fundamental function to perform in harmony, enabling the engine to power the vehicle and/or accessories. There is a need to avoid issues such as idle roughness and to realize these are system interaction issues.

I.D.# PD111015ON

SCHEDULE

Online, on demand/3-month access

FEES

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12-HOURS

Get the complete course description and register:

training.sae.org/ford/pd111015on
This online course introduces the critical role played by the powertrain controls system in vehicle performance, fuel economy, driveability, and emissions. The course describes the powertrain controls system components and stimulates systems interaction thinking by emphasizing powertrain controls interactions with internal and external interfaces; and helps you understand powertrain control systems, prevent late design changes, reduce warranty costs, and improve customer satisfaction. This course contains essentially the same content that has benefitted engineers from Ford and select suppliers.

LEARNING OBJECTIVES
By connecting with this course, you will be able to:
• Identify the powertrain controls system and its components and describe powertrain controls hardware and software
• Explain powertrain controls system fundamentals, functions, and interactions; describe interfacing activities with other organizations
• Explain the impact of powertrain controls changes to interfacing activities; Describe powertrain controls system modes of operation
• Identify customer and government attributes affected by powertrain controls system performance
• Identify requirements and metrics for powertrain controls systems; optimize driveability, performance, fuel economy, emissions, and diagnostics
• Evaluate p-diagrams and boundary diagrams to identify potential adverse powertrain controls system interactions with surrounding systems; describe and access powertrain controls documentation and lessons learned

WHO SHOULD ATTEND
Powertrain, product development, quality, and manufacturing engineers.

CONTENT HIGHLIGHTS
• Powertrain Controls Overview, Hardware, and Interfaces, & Modes of Operations
• Powertrain Controls Software/Calibration and Diagnostics
• Powertrain Controls Reliability and Robustness
• Sensors and Actuators

“For someone relatively new to Powertrain Controls, this course gives a good general understanding of the system at a reasonable cost.”

Sebastian Szamiel
Quality Engineer
Robert Bosch LLC

I.D. # PD111013ON

SCHEDULE
Online, on demand/3-month access

FEES
List: $215
Members
Classic: $194
Premium: $183
Elite: $172

6-HOURS

Get the complete course description and register:
training.sae.org/ford/pd111013on
The improved efficiencies of the modern diesel engine have led to its increased use within the mobility industry. This seminar begins with a review of the basic principles of diesel engines and fuel injection systems and discusses diesel and alternative fuels, followed by current and emerging diesel engine applications. The majority of the course is dedicated to the common rail system itself, including a comprehensive overview of the complete system. The instructor introduces the main subsystems, including hydraulics and controls, and breaks down the subsystems into their respective components.

**LEARNING OBJECTIVES**

By connecting with this course, you will be able to:

• Identify the basic principles of diesel engines and diesel fuel injection
• Distinguish the main properties of diesel and diesel alternative fuels
• Compare and evaluate various diesel engine applications
• Describe the main systems and sub-systems of common rail diesel fuel injection and how these systems interact
• Identify the main design features of the common rail components
• Discuss basic common rail control strategies

**WHO SHOULD ATTEND**

Engineers and other individuals involved in the design, application, and service of common rail diesel engines utilized in mobility.

**CONTENT HIGHLIGHTS**

• Basic Principles of Diesel Engines & Diesel Fuel Injection
• Diesel and Alternative Fuels
• Applications -- Passenger car; Light- & Heavy-duty; Off-highway
• Common Rail System Overview
• Hydraulic Components; Controls;
• Diesel Engine Overview

**INSTRUCTOR**

Vincent Placenti
Senior Manager, Robert Bosch LLC

“Great broad, yet basic, overview course of the diesel common rail fuel system.”

Glenn Guire
Senior Engineer
L-3 Combat Propulsion Systems

**I.D.# C0920**

**SCHEDULE**

November 7, 2014
Troy, Michigan

**FEES**

List: $755
Members
Classic: $685
Premium: $645
Elite: $605

**TWO-DAYS/1.3 CEUS**

Get the complete course description and register: training.sae.org/seminars/c0920
Rapid advances have been made in the range of available designs and operational parameters as well as in the fundamental understanding of compact heat exchangers (CHEs). Since the majority of modern heat exchangers used for heating and cooling systems for vehicular applications are CHEs, keeping up to date with these advances is essential. This seminar will help you understand and be able to apply comprehensive information about the intricacies of CHE design, performance, operating problems and state-of-the-art-technology for car and truck applications.

**LEARNING OBJECTIVES**

By attending this seminar, you will be able to:

- Describe current state-of-the-art vehicular heat exchangers and how they relate to the current heat exchanger technology of other industries
- Explain the interaction, feedback and importance of problem specifications, thermal-hydraulic design, mechanical design, manufacturing and cost considerations and trade-offs based on the component and system design approaches for vehicular heat exchanger design
- Assess in-depth -NTU, P-NTU and MTD methods of heat exchanger analysis and articulate advantages and limitations of each method
- Perform exchanger pressure drop analyses, taking into account pressure drop associated with the core (entrance, exit, friction, form drag and momentum effects) and flow distribution devices (manifolds, headers, tanks, bends, fittings, etc.)
- Explain theoretical solutions for developed and developing laminar and turbulent flows in heat exchangers
- Apply empirical correlations for various fin and surface geometry’s used in vehicular heat exchangers
- Utilize theoretical solutions to extend the applicability range of empirical solutions
- Describe and implement detailed, step-by-step procedures for the design and performance of single-phase heat exchangers -- radiators, heaters, oil coolers and charge air-coolers
- Determine how to choose specific fin or surface geometry’s for vehicular applications
- Optimize heat exchanger designs to work with a large number of variables associated with the design
- Computerize heat exchanger design and performance calculations
- Describe the engine cooling system from the radiator and heater design point of view

"Every engineer involved in automotive heat exchanger design needs to be exposed to this course if possible at the early stage in their career."

Dr-ing Dele Josiah Ajele PE
Engineering Manager
Dura-Lite Heat Transfer Products, Ltd.
• Describe the components of the air-conditioning system and implications for the design of condensers and evaporators
• Utilize basic principles of vaporization and condensation for the design of condensers and evaporators
• Articulate design and rating procedures for condensers and evaporators
• Describe system design considerations for the design of engine cooling and air-conditioning heat exchangers
• Discuss future trends and technology developments of vehicular heat exchangers

WHO SHOULD ATTEND
Product and design engineers and academicians seeking the latest developments in the field, and engineers involved in software development for heat exchanger design and heating and cooling systems.

CONTENT HIGHLIGHTS
• Automotive Heat Exchangers - Functions and Types
• Heat Exchanger Design Logic/Procedure
• Single-Phase Heat Transfer and Pressure Drop Analysis
• Heat Transfer/Flow Friction Characteristics and Correlations
• Plate-Fin and Tube-Fin Rating and Sizing Procedures
• Vaporization and Condensation Principles
• Condenser and Evaporator Design
• Automotive Air-Conditioning System
• Engine Cooling System
• Auto A/C Heat Exchangers Performance Testing
• Charge Air and Exhaust Gas Cooling
• Heat Exchanger Design from System Design Considerations
• State of the Technology and Future Trends in CHEs

INSTRUCTOR
Joe Borghese
Staff Engineer, Honeywell Intl.

I.D.# 97002

SCHEDULE
September 25-26, 2014
Troy, Michigan

FEES
List: $1,275
Members
Classic: $1,145
Premium: $1,085
Elite: $1,015

TWO-DAYS/1.3 CEUS

Get the complete course description and register: training.sae.org/seminars/97002
This webinar provides an in-depth overview of diesel engine noise including combustion and mechanical noise sources. In addition, the instructor will discuss a system approach to automotive integration including combining sub-systems and components to achieve overall vehicle noise and vibration goals.

LEARNING OBJECTIVES
By connecting with this webinar, you will be able to:
• Identify and analyze commonly occurring diesel engine noise sources
• Understand how analytical and experimental techniques can be used to solve diesel noise issues
• Prescribe appropriate noise control analysis and solutions for specific diesel engine NVH issues

WHO SHOULD ATTEND
This webinar is ideal for those want to understand the root causes of many diesel engine noise issues, and how to use this understanding to better diagnose and control diesel engine-related noises.

CONTENT HIGHLIGHTS
• The Basics of Diesel Engine Noise
• Combustion Noise Forcing Functions
• Combustion Mode Switching
• Mechanical Forcing Functions in Diesels
• Separating Combustion and Mechanical Noise Sources
• Strategies for Reducing Forcing Functions
• Surface Radiated Noise
• Exterior Covers: Radiated Sound and Simulation Modeling
• Gear Train Noise Issues and Countermeasures
• Drive-By Noise Contribution
• Diesel Engine Design Considerations for Low Noise
• Application Noise Issues

INSTRUCTOR
Thomas Reinhart
Program Manager, Southwest Research Institute

“Good course which is very worthwhile for those who possess some knowledge of engines and general NVH.”

Kyle Taylor
Engineer
Hyundai-Kia America Technical Center Inc.
As diesel engines become more popular, a fundamental knowledge of diesel technology is critical for anyone involved in the diesel engine support industry. This course will explain the fundamental technology of diesel engines starting with a short but thorough introduction of the diesel combustion cycle, and continue with aspects of engine design, emission control design, and more. An overview of developing technologies for the future with a comprehensive section on exhaust aftertreatment is also included. The instructor’s book, Diesel Emissions and Their Control, co-authored with W. Addy Majewski, is included with the seminar.

LEARNING OBJECTIVES
By attending this seminar, you will be able to:

• Summarize the technological advances in modern diesel engines
• Evaluate the sources of emissions from diesel engines and the influence of engine component design on curbing these emissions
• Explain diesel exhaust aftertreatment systems and their effectiveness in reducing emissions
• Recognize the importance of fuel injection parameters to performance and emission control

WHO SHOULD ATTEND
You should attend this seminar if you are involved in diesel engine support industries such as catalytic converters, lube oils, gaskets, and turbocharger suppliers, and if you are not well versed with diesel engines although they play a major role in your career’s survival.

CONTENT HIGHLIGHTS
• The Case for the Diesel Engine
• The Diesel Combustion Process
• Basic Types of Diesel Engines
• General Characteristics of DI & IDI Engines
• The Diesel Fuel Injection System
• Air Management - Supercharging & Turbocharging
• Emissions Formation in Diesel Engines
• Emission Standards—Europe; North America
• Steps Towards the Modern Diesel Engine
• Current and Future Technologies

INSTRUCTOR
Magdi Khair (retired)
Chief Technologist, Diesel Emission Space
Watlow Electric

“This was a great course for understanding the basic principles of diesel engine design and operation and its affect on exhaust gas emissions.”

Scott Ringlein
Chief Engineer
Tenneco Automotive

I.D.# 93014

SCHEDULE
July 21-22, 2014
Norwalk, California

October 6-7, 2014
Rosemont, Illinois

Held in conjunction with SAE 2014 Commercial Vehicle Engineering Congress

FEES
List: $1,585
Members
Classic: $1,425
Premium: $1,345
Elite: $1,265

TWO-DAYS/1.3 CEUS

Get the complete course description and register:
training.sae.org/seminars/93014

ALSO AVAILABLE AS AN ONLINE, ON DEMAND COURSE.

Diesel Engine Technology e-Seminar
Convenient, portable, and with core content from the instructor-led seminar, this e-Seminar option offers an alternative way to receive the same instruction without the expense of travel and time away from the workplace.

I.D.# PD130812ON

FEES
List: $645
Members
Classic: $581
Premium: $548
Elite: $516

13-HOURS/1.3 CEUS

View the complete course description and a video demo:
training.sae.org/eseminars/det
This Academy covers the diesel engine engineering principles and practices necessary to effectively understand a modern diesel engine. Types of engines addressed include naturally aspirated, turbocharged, pre-chamber, open chamber, light duty, and heavy duty. It is an intensive learning experience comprised of lecture and structured practical sessions, including a team-solved case study problem. Evening sessions are included. Attendees will receive a copy of the textbook, *Diesel Emissions and Their Control*, by lead instructor Magdi K. Khair and W. Addy Majewski.

**Practical Component**
This Academy includes several practical activities, including a team-solved case study and a technical facility tour.

**Pre-Academy Activity**
Prior to the Academy, you will be asked to complete a pre-assessment. Results will be shared with the lead instructor to help customize the learning experience to specific attendee needs.

**LEARNING OBJECTIVES**
By attending this seminar, you will be able to:

- Articulate basic diesel engine terminology and principles
- Describe the key features of the basic types of diesel engines
- Compare various diesel fuel injection systems and their components
- Analyze the effects of different fuels on engine performance and longevity
- Compare the function and applicability of various air management systems
- List the various emission standards and testing requirements
- Detail the elements of post-combustion emission control devices
- Discuss emerging diesel engine technologies

**WHO SHOULD ATTEND**
This academy will be especially valuable for engineers who design diesel engines in passenger cars, light and heavy trucks, off-highway vehicles, and farm machinery.

“This academy has filled in the many gaps I had in my knowledge of diesel engines, as well as those I didn’t know I had. Fantastic!”

Chad Mollin
International Truck & Engine Corporation
CONTENT HIGHLIGHTS

- Terminology and Performance Parameters
- The Case for the Diesel Engine
- Thermodynamics
- Fuel Injection Systems
- Fuels Technologies
- Thermodynamics II: Combustion in Diesel Engines
- Diesel Combustion & Emissions in DI Engines
- The Role of Lube Oil in Modern Diesel Engines
- Modern Fuel Systems & Their Applications
- Air Management Systems
- Engine Controls
- On-Board Diagnostics
- In-Cylinder Measures to Control Emissions
- Diesel Exhaust Aftertreatment
- Engine Performance Simulation
- Emerging Technologies
- Case Study Team Sessions
- Diesel Facility Tour

INSTRUCTORS

See the course web page for a complete list of instructors.

SAE DIESEL TECHNOLOGY CERTIFICATE PROGRAM

Designed to equip you with a solid understanding of diesel engines, emissions and aftertreatment strategies, and related components, the program requires completion of courses that address these areas and then facilitates further depth in aftertreatment technologies through a menu of electives.

Complete the Diesel Technology Certificate and earn eight graduate credits towards the SAE/Kettering University 20-credit Certificate in Automotive Systems and Kettering’s 40-credit M.S. in Mechanical Engineering. Visit training.sae.org/collegecredit for more information.

View the list of required and elective courses and more information on enrolling in this or any SAE certificate program—training.sae.org/certificate/dieseltech.

I.D.# ACAD03

SCHEDULE

June 2-6, 2014
Troy, Michigan

FEES

List: $3,345
Members
Classic: $3,011
Premium: $2,843
Elite: $2,676

FIVE-DAYS/4.0 CEUS

Get the complete course description and register:
training.sae.org/academies/acad03
NEW! ENGINE FAILURE INVESTIGATION AND ANALYSIS

This comprehensive seminar introduces participants to the methods and techniques used to determine the most likely cause of an individual engine or group of engine failures in the field.

The seminar begins with a review of engine design architecture and operating cycles, integration of the engine into the vehicle itself, and finally customer duty cycles and operating environments. Special emphasis is placed on the number and type of subsystems that not only exist within the engine but are used to integrate the engine into the overall vehicle package. Following this review, participants learn about failure types, investigation techniques, inspection methods, and how to analyze the available evidence using their own knowledge of engine and vehicle operating characteristics to determine the most likely cause of an engine(s) failure. The seminar concludes with a review of actual engine failure case studies that were investigated and resolved using the same process and methods taught during the course.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

• Analyze engine failure claim narratives
• Analyze and interpret engine and/or vehicle warranty data
• Determine what physical evidence to gather and review when investigating an engine failure claim(s)
• Evaluate the physical evidence associated with an engine failure claim(s)
• Reconcile the physical evidence with the narrative and warranty evidence
• Determine the most likely cause of engine failure based on the available evidence

WHO SHOULD ATTEND

This course has been developed for engineers and technical professionals in all fields related to the investigation, analysis, and root cause determination of engine failures in various types of vehicles and equipment used in both on road and off road applications. Individuals directly involved in the investigation of engine failure and failure related issues will benefit most from this material.
CONTENT HIGHLIGHTS

• Engine Design Overview
  • Operating Cycles - compression ignition and spark ignition
  • Architecture
  • Subsystems - Turbo/supercharger, oil supply, cooling, emissions
  • Subsystem crossover and interaction

• Vehicle Integration and Packaging
  • Mounting
  • Fuel supply; Air supply
  • Emissions; Cooling
  • Controls

• Operational Profile
  • Climate; Environment
  • Duty Cycle
  • Operator Specific Habits

• General Failure Classification
  • Thermal; Lubrication
  • Fuel/Air Combustion
  • Mechanical
  • Diesel Runaway

• Failure Points
  • Joints and Gaskets
  • Vehicle Systems; Subsystems and Components
  • Evidence and Indicators

• Investigation
  • Reviewing the claim
  • Service history/fleet maintenance
  • Warranty histories
  • Data mining

• Analysis
  • Customer Duty Cycle vs. Manufacturer intent
  • Analysis without inspecting the failed engines
  • Vehicle package and integration review

INSTRUCTOR

Robert Kuhn
Managing Engineer, Exponent - Vehicle Engineering Practice

I.D.# C1344

SCHEDULE
September 29-30, 2014
Troy, Michigan

FEES
List: $1,265
Members
Classic: $1,135
Premium: $1,075
Elite: $1,005

TWO-DAYS/1.3 CEUS

Get the complete course description and register:
training.sae.org/seminars/c1344

fees
List:
Classic: $1,135
Premium: $1,075
Elite: $1,005
two-days/1.3 ceus
get the complete course description and register:
training.sae.org/seminars/c1344
GASOLINE DIRECT INJECTION (GDI) ENGINES

The quest for more efficient, smarter, and environmentally cleaner liquid-fueled spark ignition (SI) reciprocating engines is more alive and intense now than ever before. GDI SI engines have overcome many of the original limitations and are now becoming commonplace. This seminar will provide a comprehensive overview of GDI engines. Mixture preparation and the combustion process, with an emphasis on strategies for both homogenous and stratified charge operation and control, including issues related to the direct injection of gasoline into the combustion chamber, and fuel injection system requirements for optimal spray characteristics will be explored. Emission of pollutants, fuel economy and effects of some key design and operating parameters will also be covered. The seminar concludes with an overview of a select list of production and prototype GDI engines.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

• Describe the rationale behind the GDI engine operation
• Analyze the important processes in GDI engines
• Explain liquid atomization, sprays, and injector requirements for successful GDI operation
• Utilize the technology and the logic behind gasoline direct injection
• Estimate and predict effects of key engine design and operating conditions on performance, combustion, and emission in GDI engines
• Communicate effectively with engineers working on fuel injection, combustion and emission aspects of the GDI engine in your firm or with customers
• Effectively contribute to the design of critical components such as combustion chambers, injectors, and emission reduction strategies
• Explain and utilize trade-offs between increasing engine performance and maintaining low emission characteristics

WHO SHOULD ATTEND

This seminar will be especially valuable for engineers, technical and project managers, researchers, and academicians working on the design and development of components for high efficiency and performance of GDI engines as well as those involved in mixture preparation and emission reduction of pollutants from these engines. Environmental engineers desiring to expand their understanding of fuel spray formation and combustion and emissions from GDI engines will benefit.

“IT covers every possible attendee, from the one that wants only an overview to the one that needs the most deep detail of GDI engine. Worth the trip I made from Greece.”

Savvas Savvakis
PhD Researcher
Aristotle University of Thessaloniki
CONTENT HIGHLIGHTS

- Combustion Systems
- Fuel Injection System
- Fuel Spray Characteristics
- Mixture Formation
- Combustion Process and Control Strategies
- Engine Operating Modes and Fuel Injection Strategies
- Split Injection Strategy
- Combustion characteristics
- Effects of Engine Operating and Design Parameters on GDI Combustion
- Injector, Combustion Chamber, and Intake Valve Deposits
- Emissions of Pollutants - Reduction Approaches
- Fuel Economy
- Select Gasoline Direct-Injection Engines
- GDI Fuel Rail Technology
- Benefits of Turbocharging a GDI engine

INSTRUCTOR

Bruce Chehroudi
Chief Scientist and Group Leader, Advanced Technology Consultants

SI ENGINE CERTIFICATE PROGRAM

Designed to familiarize you with key spark ignition engine components and technologies and how they function as a system, completing this certificate delivers a fairly deep level of engine expertise and, at the same time, an SAE credential.

Complete the SI Engine Certificate and earn seven or eight graduate credits towards the SAE/Kettering University 20-credit Certificate in Automotive Systems and Kettering’s 40-credit M.S. in Mechanical Engineering. training.sae.org/collegecredit

View the list of required and elective courses and additional information on enrolling in this or any SAE certificate program—training.sae.org/certificate/siengine

I.D.# C1009

SCHEDULE

May 19-21, 2014
Troy, Michigan

August 25-27, 2014
Troy, Michigan

FEES

List: $1,685
Members
Classic: $1,515
Premium: $1,425
Elite: $1,345

THREE-DAYS/2.0 CEUS

Get the complete course description and register:
training.sae.org/seminars/c1009
INTERNAL COMBUSTION SYSTEMS: HCCI, DOD, VCT/VVT, DI AND VCR

This seminar exposes you to the emerging technologies in engine design and operation that can improve operational efficiencies and presents the fundamental science and implementation technology of the various internal combustion engine systems. Attendees will learn how the Engine Control Module (ECM) uses information related to the operational status to implement real-time running efficiency of the engine. You will also learn how the ECM effects changes in the operation of the engine through the control systems that manage its operation. With this understanding, you will be able to derive your own set of improvement criteria that could be made to address the limitations of current engine technology.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

• List the typical sensors, the sensory information they collect and describe the use of that information as it addresses improved fuel economy and reduced combustion emissions

• Describe the significance, technology, and application of:
  • Direct Injection (gasoline and diesel)
  • Homogenous Charge Compression Ignition (HCCI)
  • Displacement on Demand Systems
  • Variable Cam Timing & Variable Valve Timing
  • Variable Compression Ratio engine designs

• Explain the fundamental physics of the various technologies

• Specify the operational parameters and inter-relationships of each of the sub-systems of the enabling hardware

• Describe the basic design synthesis and analysis techniques for each of the major operational improvement technologies

WHO SHOULD ATTEND

This intermediate level seminar is appropriate for a number of design and engineering disciplines including: automotive engine design and development engineers, engine test engineers, design service managers, engineering managers, and others who use technical knowledge to meet job expectations.

“SAE [International’s] Internal Combustion Systems course is a perfect overview of available and upcoming engine technologies for design, testing and quality engineers and managers.”

Eric Sauck
Product Quality Engineer
Kia Motors America
CONTENT HIGHLIGHTS

• Operation of ECM and Sensor Systems
• Direct Injection (DI) of Both Gasoline and Diesel Fuels
• Homogeneous Charge Compression Ignition (HCCI) Technologies
• Displacement on Demand (DoD) Systems
• Variable Cam and Valve Timing (VCT, VVT)
• Variable Compression Ratio (VCR) Engine Designs
• Use of alternative fuels; dual fuel & multi-fuel engines
• Emerging and New technologies

INSTRUCTOR

W. Mark McVea
Chief Technology Officer, Torvec, Inc.
This webinar introduces many airflow integration issues and vehicle-level trade-offs that effect system performance and drive the design. The goal of this six-session webinar is to introduce engineers and managers to the basic principles of diesel cooling airflow systems for commercial and off-road vehicles. Participants will learn about vehicle/product constraints, integration issues, cooling airflow, system resistance, fans, shrouds, radiators, coolers, estimating heat rejection, thermal recirculation, and overall system performance. Basic concepts will be reinforced with examples and a cooling performance calculation of a diesel cooling system. SAE Papers 2002-01-0256, 850281, 900001 and 740691 are included as references in the course materials.

LEARNING OBJECTIVES
By connecting with this webinar, you will be able to:

• Define vehicle requirements and many cooling airflow system integration issues
• Describe heat exchanger sizing considerations, design alternatives, and thermal effectiveness
• List fan/shroud aerodynamic design parameters, guidelines, and installation effects
• Apply the fan laws to evaluate alternative designs
• Calculate fan operating point and airflow using component pressure-loss coefficients
• Estimate engine heat rejection to coolant, including Exhaust Gas Recirculation (EGR)
• Calculate steady-state thermal performance of a diesel cooling airflow system

WHO SHOULD ATTEND
OEM and supplier engineers and managers who are involved with vehicle cooling systems, or who interface with vehicle program management on these issues, will benefit from this seminar. Graduate-level students interested in cooling systems will also find it instructive.

"This webinar gives key-concepts and a big picture of the design process of a vehicle airflow system, in a clear and detailed manner. It’s perfect to understand the basics!"

Marc-Olivier Lacerte
Mechanical Engineer
TM4 Electrodynamic Systems

CUSTOMIZE A LEARNING EXPERIENCE TO ADDRESS YOUR SPECIFIC BUSINESS NEEDS.
SAE Corporate Learning Solutions
1-724-772-8529 • training.sae.org/corplearning
CONTENT HIGHLIGHTS

• Overview Typical Cooling Airflow Systems
• Design Drivers
• A Classification of Vehicle Cooling Systems
• Impact of System & Sub-system Requirements
• Thermal Recirculation
• Design Challenges
• 1st Law of Aerodynamics
• Radiator Heat Transfer Equation
• Definition of Standard Air
• Bernoulli’s Equation and Ram Pressure
• Pressure Loss Coefficient
• Vehicle Air Flow Restrictions - Flow Energy Losses
• Construct a System Pressure Loss Curve
• Air Performance Test Chambers (AMCA)
• Exercise the Fan Laws to Evaluate Design Alternatives
• Shroud Design Considerations
• Vehicle Installation Effects - Fan Position, Tip Clearance, Radiator Proximity
• Ram Airflow; Fan Operation with Ram
• Ram Total-Pressure Recovery
• Thermal Classification of Heat Exchangers
• Compact Heat Exchangers in Vehicle Applications
• Radiator Effectiveness and Louvered Fins
• Charge Air Coolers, Performance Calculation Against Requirements
• Air-Side Fouling Study and Heat Exchanger Design Considerations
• Dynamometer Data on Engine Heat Rejection
• Specific Heat Rejection (SHR) Characteristic Curve
• EGR Heat Rejection to Coolant
• Evaluation of Diesel Cooling Systems

INSTRUCTOR

Jack Williams
Independent Consultant, Design and Development of Thermal Management Systems and Vehicle Aerodynamics

I.D.# WB1240

SCHEDULE
October 20-31, 2014
Live Online

FEES

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SIX, 2-HOUR SESSIONS/1.2 CEUS

Get the complete course description and register:
training.sae.org/webinars/wb1240

ACCESS THIS COURSE ONLINE AND ON DEMAND AS A WEBINAR RECORDING.

SAE Webinar Recordings are audio/visual captures of live webinars. The sessions are unedited and include participant interaction including question and answer periods with the instructor. A learning assessment is available at the end of the course to reinforce learning and retention and gauge your understanding of the topic.

I.D.# PD3312400N

FEES

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30-DAY ACCESS/12-HOURS/1.2 CEUS

Get more information about the webinar recording:
training.sae.org/webrecordings/pd3312400n
Developing vehicles that achieve optimum fuel economy and acceleration performance is critical to the success of any automotive company yet many practicing engineers have not received formal training on the broad range of factors which influence vehicle performance. This seminar provides this fundamental understanding through the development of mathematical models that describe the relevant physics and through the hands-on application of automotive test equipment.

**LEARNING OBJECTIVES**

By attending this seminar, you will be able to:
- Explain the basic operation of the components in an automotive powertrain
- Calculate road loads on a motor vehicle
- Select appropriate gear ratios for a given engine/chassis combination
- Predict the effect of gear selection, body design, and weight on the fuel economy of a vehicle
- Explain and utilize the mathematical models for predicting the acceleration of an automobile
- Explain and utilize the mathematical models for predicting the fuel economy of an automobile
- Use computer software for predicting vehicle fuel economy and performance

**WHO SHOULD ATTEND**

This seminar is designed for automotive engineers involved in the design and development of automotive powertrains.

**CONTENT HIGHLIGHTS**

- Powertrain Configuration
- Road Load Forces and Power
- Vehicle Coastdown Test
- Vehicle Tractive Effort
- Drivetrain Selection
- Analysis of Power and Torque Flow in Drivetrain Components
- Acceleration Performance Prediction
- Road Load and Acceleration Power Testing Laboratory
- Fuel Economy Prediction
- Demonstration of Vehicle Performance Software

**INSTRUCTORS**

**Dr. Craig J. Hoff**
Associate Professor of Mechanical Engineering, Kettering University

**Dr. Gregory Davis**
Professor of Mechanical Engineering, Kettering University

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“Very good introductory course on the parameters that effect vehicle performance and fuel economy and how to optimize them.”

Brian Mace
Senior Engineer
Honda R&D Americas, Inc.
The purpose of this course is to provide an overview of the factors in the cylinder kit assembly of natural gas, gasoline, and diesel engines that affect oil consumption, ring and cylinder bore wear, and blow-by. This course includes background and the evolution of designs and materials currently employed in modern engines as well as providing an overview of computer models, designs, and material systems that can be utilized to optimize the performance of new engines. An overview of the trends in materials and designs employed in U.S., European and Japanese engines will be presented.

LEARNING OBJECTIVES
By attending this seminar, you will be able to:

• Describe the function of each ring and its interaction with other components within the cylinder kit to provide oil consumption and blow-by control

• Identify available computer models and instrumentation that is available to predict and measure the function of each of the components in the cylinder kit on oil consumption and blow-by control

• Compare the base systems and facing material systems and the trade-offs associated with each of the material systems, i.e., wear rate, scuff resistance, etc.

WHO SHOULD ATTEND
If you are an engineer associated with engine design and development and interested in understanding the function and design considerations within the cylinder kit system, you would benefit from attending.

CONTENT HIGHLIGHTS
• Evolution of piston ring designs/materials -- diesel and gasoline engines

• Outline of Nomenclature & Ring Design Methodology, including Standards - SAE, DIN, ISO

• Systems Parameters & Their Interaction with Piston Rings to Cause Variations in Performance

• Typical Procedures/Equipment Employed to Measure Dimension Properties of Piston Rings

• Developed Models Aiding in Cylinder Kit Design

• Determining the Effect of Design Parameters on Oil Consumption, Ring Function, Cylinder Bore Distortion, Friction & Wear Rates

INSTRUCTOR
Harold E. McCormick
President, C-K Engineering Inc.

“This was an invaluable opportunity to interact with one of the acknowledged masters of piston ring technology.”

Russ McDonald
Senior Design Engineer
Chrysler - STE
This short course focuses on race car data acquisition, highlighting cornering speeds, engine acceleration rates, gear selection, engine RPM curves, shift times, engine acceleration, brake lock, cornering speed, ignition cutout and much more. You will find the components of this course fundamental to successful data analysis in the real world. From hardware installation to software interpretation, this course gives you confidence and additional insight into these key pieces of data analysis.

LEARNING OBJECTIVES
By connecting with this course, you will be able to:

• Why data acquisition and analysis are so beneficial for all types and levels of racing and racers
• The most common set-ups for Engine RPM and Speed/MPH data acquisition
• The procedures for acquiring and analyzing Engine RPM and Speed data
• How to interpret the most common data logger outputs for both Engine RPM and Speed data
• Alternative analyses that may be necessary for certain racing applications

IS THIS COURSE FOR YOU?
This course is designed for the racer or the engineer who is incorporating data acquisition into their race team strategy and wants to maximize the abilities of their system as quickly as possible. The knowledge gained in this course can be applied the next day at any level of racing without any additional training or experience.

CONTENT HIGHLIGHTS
• Set-up for Acquiring Engine RPM Data
• Acquiring and Analyzing Engine RPM Data
• Interpreting RPM Results
• Set-up for Acquiring Speed/MPH Data
• Interpreting Speed/MPH Results
• Alternative Analysis Strategies

INSTRUCTOR
Dave Scaler
Owner, AdvantageMotorsports.com

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**I.D.# PD230834ON**

**SCHEDULE**
Online, on demand/3-month access

**FEES**
- List: $149
- Members: $134
- Classic: $127
- Premium: $119
- Elite: $119

**81-MINUTES**

Get the complete course description and register:
training.sae.org/fasttracks/pd230834on
The instructor provides a practical introduction to the ECM or on-board computer, including the uses for the various sensors, and discusses the specific methods used to incorporate the various sensor signals into the ECM’s control systems. This course improves any engineer’s understanding of the functions of the ECM for race engines as well as production engines. Based on the popular classroom seminar, this course includes more than two hours of bonus material, software demonstrations, and a glossary of acronyms. This e-Seminar does not have a classroom option.

LEARNING OBJECTIVES

By connecting with this course, you will be able to:

• Describe the functions of the crank position sensor, cam position sensor, intake air temperature sensor, manifold air pressure sensor, mass air flow sensor, exhaust “oxygen” or lambda sensor, throttle position sensor, engine coolant temperature sensor, and knock sensor

• Explain how the ECM controls the fuel injection rate, fuel injection timing, and ignition timing

• Interpret base look-up tables, multipliers, and adders

• Develop base look-up tables, multipliers, and adders

IS THIS COURSE FOR YOU?

This e-Seminar is intended for anyone interested in engine calibration/programming the on-board computer, especially for race engines.

CONTENT HIGHLIGHTS

• Basic Engine Theory

• ECM, Sensors, and Actuators

• Air/Fuel Ratio Control

• Ignition Timing

• The Calibration Process

• Bonus Material: WAVE Software demonstration including generating Base Fuel Look-up Tables; Engine Control Units Demonstration

INSTRUCTOR

Ron Matthews
Head of the General Motors Foundation Engines Research Laboratory

“The dynamics of the program and the competence of the presentation were a tribute to the core values of SAE and the engineering community commitment.”

Rodger Marx
Principal Advisor Fuel Management
Rio Tinto

I.D.# PDI307010N

SCHEDULE

Online, on demand/1-year access

FEES

List: $265

Members

Classic: $239

Premium: $225

Elite: $212

7-HOURS

Get the complete course description and register: training.sae.org/eseminars/raceenginecalibration

33
THE BASICS OF INTERNAL COMBUSTION ENGINES

In your profession, an educated understanding of internal combustion engines is required, not optional. This two-day technology survey seminar covers the most relevant topics - ranging from the chemistry of combustion to the kinematics of internal components of the modern internal combustion engine - for maximum comprehension. You will gain a practical, hands-on approach to the basics of the most common designs of internal combustion engines, as they apply to the gaseous cycles, thermodynamics and heat transfer to the major components, and the design theories that embody these concepts.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

• Discuss in detail the basic functioning and component interaction in a modern internal combustion engine, specifically; two and four-stroke cycles as they relate to reciprocating and rotary engine designs

• Describe the general thermodynamic concepts governing the operation of an internal combustion engine and its various cycles

• Compare the principle operational differences of the various fuels used in internal combustion engines, their availability, and understand the applicability of each

• Discuss the function and operation of all major components and systems within a modern internal combustion engine

• Identify the operational principles behind the timing and working relationships among all internal components, and articulate the importance of this inter-relationship

• Recognize the limitations of the current designs and implementations of the modern internal combustion engine

• Perform a basic assessment and evaluation of new, cutting-edge designs and new powertrain initiatives as they apply to the mobility industry

WHO SHOULD ATTEND

This course is designed for powertrain engineers, component suppliers, vehicle platform powertrain development specialists, and those involved in the application, design and discussion of engines.

"The course is well-designed and expertly taught. It far exceeded my expectations and is a great introduction to internal combustion engines."

Matt Jackson
Manager
Southwest Research Institute
## CONTENT HIGHLIGHTS
- Fundamental Operating Procedures
- Engine Technology
- Fuel Delivery Systems
- Valve Train
- Component and Event Timing
- Fuels & Combustion
- Ignition
- Emissions & Controls
- Thermodynamics
- Energy Conversion Kinematics and Mechanisms

## INSTRUCTOR
**W. Mark McVea**
Chief Technology Officer, Torvec, Inc.

### I.D.# CO103

#### SCHEDULE
September 8-9, 2014
Troy, Michigan

#### FEES
- **List:** $1,295
- **Members**
  - Classic: $1,165
  - Premium: $1,105
  - Elite: $1,035
- **TWO-DAYS/1.3 CEUS**

Get the complete course description and register:
training.sae.org/seminars/c0103

### ALSO AVAILABLE AS AN ONLINE, ON DEMAND COURSE.

#### The Basics of Internal Combustion Engines e-Seminar
Convenient, portable, and with core content from the instructor-led seminar, this more than ten hour e-seminar option offers an alternative way to receive the same instruction as the live classroom learning without the expense of travel and time away from the workplace. The course offers ten video modules accompanied by a handbook.

### I.D.# PD130944ON

#### FEES
- **List:** $565
- **Members**
  - Classic: $509
  - Premium: $480
  - Elite: $452
- **10-HOURS/1.0 CEUS**

View the complete course description and a video demo:
training.sae.org/eseminars/ic_engines

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### SI ENGINE CERTIFICATE PROGRAM

Designed to familiarize you with key spark ignition engine components and technologies and how they function as a system, completing this certificate delivers a fairly deep level of engine expertise and, at the same time, an SAE credential.

Complete the SI Engine Certificate and earn seven or eight graduate credits towards the SAE/Kettering University 20-credit Certificate in Automotive Systems and Kettering’s 40-credit M.S. in Mechanical Engineering.

View the list of required and elective courses and additional information on enrolling in this or any SAE certificate program-- training.sae.org/certificate/siengine
Turbocharging is already a key part of heavy duty diesel engine technology. However, the need to meet emissions regulations is rapidly driving the use of turbo diesel and turbo gasoline engines for passenger vehicles. Turbocharging is critical for diesel engine performance and for emissions control through a well-designed exhaust gas recirculation (EGR) system. In gasoline engines, turbocharging enables downsizing which improves fuel economy by 5-20%.

This webinar will explore turbocharging for gasoline and diesel (heavy and light duty) engines, including the fundamentals of turbocharging, design features, performance measures, and matching and selection criteria. It will discuss the interaction between turbocharging and engine systems and the impact on performance, fuel economy and emissions. Developments in turbocharging technology such as variable geometry mechanisms, two-stage and sequential (series & parallel) turbocharging, EGR including low pressure loop, high pressure loop and mixed mode systems and novel turbocharging systems will be described using figures and data.

**LEARNING OBJECTIVES**

By connecting with this webinar, you will be able to:

- Identify the basics of how a turbocharger works, how to measure the appropriateness of a turbocharger, and how to select and match a turbocharger to the needs of your powertrain
- Estimate the impact of turbocharging on performance and emissions
- Anticipate potential issues such as packaging, noise, driveability, reliability, and durability
- List the latest developments in turbocharging technology, their impact on engine performance and emissions, and the use of turbocharging world-wide

**WHO SHOULD ATTEND**

This course will be beneficial to powertrain development & component development engineers, service engineers, engineering managers, product planners, and those developing product strategy. Heavy duty diesel engine development engineers may find the course helpful by increasing their knowledge of turbocharging and EGR systems.

"The content of the webinar was well rounded, giving an overview of the basics, a detailed explanation of current designs, and a look into the future of turbochargers."

Laura Peleh  
Engine Performance Analyst  
Caterpillar Inc.
CONTENT HIGHLIGHTS

Introduction to Turbocharging

• Fundamentals, Functionality, and Basic Design Features of Turbochargers

• Impact of Turbochargers on Engine Performance, Emissions, and Fuel Economy

• Performance Maps, Selection Criteria, Comparison and Matching of Turbochargers to Engine and Powertrain Needs

Advanced Issues and Technology

• Turbocharger Noise, Reliability, and Durability Considerations

• Advanced Technology Developments Including Variable Geometry, EGR Systems, and Multi-Stage Turbocharging

• Worldwide Growth in Application of Turbocharging

INSTRUCTORS

S.M. Shahed
Corporate Fellow, Honeywell Turbo Technologies

Arjun Tuteja
Independent Consultant, Advanced Development of Diesel Engine Systems

I.D.# WB1018

SCHEDULE
December 3-5, 2014
Live Online

FEES
List: $415
Members
Classic: $374
Premium: $353
Elite: $332

TWO, 2-HOUR SESSIONS/.4 CEUS

Get the complete course description and register:
training.sae.org/webinars/wb1018

ACCESS THIS COURSE ONLINE AND ON DEMAND AS A WEBINAR RECORDING

SAE Webinar Recordings are audio/visual captures of live webinars. The sessions are unedited and include participant interaction including question and answer periods with the instructor. A learning assessment is available at the end of the course to reinforce learning and retention and gauge your understanding of the topic.

I.D.# PD331018ON

FEES
List: $415
Members
Classic: $374
Premium: $353
Elite: $332

4-HOURS/.4 CEUS

Get more information about the webinar recording:
training.sae.org/webrecordings/pd331018ON
TURBOCHARGING INTERNAL COMBUSTION ENGINES

This seminar covers the basic concepts of turbocharging of gasoline and diesel engines, including turbocharger matching and charge air and EGR cooling, as well as associated controls. The limitations and future possibilities of today’s systems will be covered, as well as details on how emerging technologies will impact engine/vehicle performance. The seminar’s primary focus is on the turbocharger-engine interface rather than detailed turbocharger aerodynamics and design. Advanced technologies such as variable geometry and multi-stage turbocharging, high and low pressure loop EGR systems, assisted turbocharging and turbocompounding are discussed. You will have the opportunity to perform hands-on exercises to gain an appreciation of parametric effects in a wide range of engines.

Need more background? Register for Diesel Engine Technology (ID# 93014) or The Basics of Internal Combustion Engines (ID# C0103). See course descriptions on pages 17 and 32.

LEARNING OBJECTIVES
By attending this seminar, you will be able to:
• Describe the thermodynamic principles governing the turbocharging of internal combustion engines
• Articulate the critical contribution of turbocharging to modern day diesel engine performance and emission control
• Determine the possible benefits of turbocharging for specific gasoline and heavy and light duty diesel engine applications
• Estimate the appropriate turbocharger characteristics for specific applications based on engine system requirements
• Describe the limitations of current technologies and evaluate new technologies and their possible role in meeting future engine/vehicle system challenges
• Apply the basic principles of matching turbocharger with engine and optimizing overall system for desired performance and emissions

WHO SHOULD ATTEND
This seminar is designed for engineers, managers, and other technical personnel from OEM and support industries concerned with the design and development of optimized diesel and spark ignition engine systems, including performance, fuel economy and emissions for passenger car, light truck and heavy duty engines.

“This seminar met and exceeded my expectations. The material was very relevant and practical, and presented in a very clear and concise manner.”

David Heitzmann
Chief Engineer
MOR/ryde International
CONTENT HIGHLIGHTS

• Engine-Turbocharger Basics
• Turbocharger Design Features
• Free-floating, Wastegate, Variable Area or Variable Geometry Turbochargers and Controls
• Compressor and Turbine Aerodynamics
• Engine Air and EGR Flow Requirements
• Turbocharger Matching
• Turbocharger Selection Based on Engine System Requirement
• Transient Response Considerations
• Basic Spreadsheet Tools for Engine and Turbocharger Parametric Explorations
• Impact of Turbocharging on Gasoline and Diesel Engine Performance and Emissions
• Charge (Air and EGR) Cooling Systems
• Advanced Concepts in Turbocharging including Design Features of Advanced Concepts

INSTRUCTORS

Arjun Tuteja
Independent Consultant, Advanced Development of Diesel Engine Systems

S.M. Shahed
Corporate Fellow, Honeywell Turbo Technologies

I.D.# C0314

SCHEDULE
NEW DATE! August 20-22, 2014
Troy, Michigan
November 10-12, 2014
Troy, Michigan

FEES

List: $1,765
Members
Classic: $1,595
Premium: $1,505
Elite: $1,415

THREE-DAYS/2.0 CEUS

Get the complete course description and register:
training.sae.org/seminars/c0314
NEW! VARIABLE VALVE ACTUATION: DESIGN AND PERFORMANCE IMPACT ON ADVANCED POWERTRAINS

Engine valvetrain systems have become more capable and increasingly more compact in the quest to improve efficiency. Valve control plays a strong role in a number of key areas: turbocharger systems, allowing for better optimization matching across wide engine operating flows; enabling advanced combustion strategies where control over the charge mass and temperature are important; and cold start, where valve timing can be extremely effective for engine warm up compared with other strategies that rely on additional fueling.

This seminar will cover the range of Variable Valve Actuation technologies present in the market, their operation principles, and their effect on engine performance. Both gasoline and Diesel applications will be covered including how they impact the in-cylinder combustion as well as the aftertreatment. Participants will have the opportunity to perform hands-on exercises to examine the effects of the engine valve profiles on performance.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

• Describe and differentiate the variable valve actuation technologies present in the automotive industry

• Describe the defining features of each of these technologies, their requirements for engine design layouts, required actuators, lube oil, and need for control and ECU interface

• Apply basic tools to gage the thermodynamic impact effected by varying the valve profiles: impact on pumping efficiency, resulting charge mass trapped in cylinder, estimated bulk and adiabatic flame temperatures

• Articulate the contribution of valve timing and control over the engine performance and aftertreatment in modern engines in the context of today’s emissions standards

• Describe the limitations of current technologies towards more efficient and cleaner engines and the future role of valve actuation and its integration aspects with other advanced powertrain components

“This seminar was an excellent opportunity to get valuable insight into the latest technologies developing in the auto industry.”

Abhijit Ramuhalli
Team Lead,
Engine Calibration
Navistar Inc.
WHO SHOULD ATTEND
This seminar is designed for engineers, managers, and other technical personnel from OEMs and support industries concerned with the design and development of optimized diesel and spark ignition engine systems, including calibration, performance, fuel economy and emissions for passenger car, light truck and heavy duty engines. It will be particularly interesting to Diesel engineers who will likely adopt some of the technologies developed in the gasoline sector for further improvements in emissions control and gains in fuel economy.

CONTENT HIGHLIGHTS
• VVA Design – Motivation and Objectives
• VVA Timeline
• Basic Engine Definitions
• Variable Valve Actuation Designs
• VVA Case Studies and Impact on Gasoline Engine Performance
• VVA Case Studies and Impact on Diesel Engine Performance
• Engine Brake Systems
• Transient Performance
• Modeling and Controls
• Future Trends

INSTRUCTOR
William de Ojeda
Manager, Advanced Powertrain Group, Navistar

I.D.# C1332

SCHEDULE
November 20-21, 2014
Troy, Michigan

FEES
List: $1,265
Members
Classic: $1,135
Premium: $1,075
Elite: $1,005

TWO-DAYS/2.0 CEUS

Get the complete course description and register:
training.sae.org/seminars/c1332

41
SURFACE TEXTURE: SPECIFICATION AND CONTROL

Every moving component on a vehicle or engine is influenced by surface texture in one or more of the following ways: vibration, sealing, adhesion, traction, emissions, safety, durability, wear/failure analysis. Many of the industry’s top warranty issues are a direct result of surface texture implications. Rather than focus on the theories of surface texture, this course will focus on the applications of these concepts to automotive applications - thereby giving you tools you can immediately use to solve automotive problems such as cylinder bores and emissions control, crankshafts, camshafts and early engine failures, brakes and NVH, wheel bearings and vibration, gaskets and sealing, bearings and durability, pistons and durability, and shaft straightness and vibration.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

• Communicate clear descriptions of surface texture in reports and product documentation
• Recognize roughness and waviness impacts on components
• Recognize measurement errors and avoid misinterpretations of results
• Specify surface texture according to ISO 1302
• Identify and specify functional wavelength regimes for surface texture

WHO SHOULD ATTEND

This topic bridges all fields within the automotive industry and is designed for professionals involved in: the specification of mechanical systems and components; failure analysis and warranty; quality control and measurement functions, manufacturing and process development.

CONTENT HIGHLIGHTS

• The Language of Surfaces
• The Measurement of Surfaces
• Describing Wavelength Regimes
• Surface Texture Interactions with other Tolerances like GD&T
• Parameters
• Specifying Surface Texture

INSTRUCTOR

Mark Malburg
President, Digital Metrology Solutions, Inc.

Every moving component on a vehicle or engine is influenced by surface texture.

I.D.# C1110

SCHEDULE

June 24, 2014
Troy, Michigan

FEES

List: $755
Members
Classic: $685
Premium: $645
Elite: $605

ONE-DAY/0.7 CEUS

Get the complete course description and register: training.sae.org/seminars/c1110

42
EMISSIONS-RELATED OBD SYSTEMS: A DESIGN OVERVIEW

On-board diagnostics, required by governmental regulations, provide a means for reducing harmful pollutants into the environment. Since being mandated in 1996, the regulations have continued to evolve and require engineers to design systems that meet strict guidelines. This one day seminar is designed to provide an overview of the fundamental design objectives and the features needed to achieve those objectives for generic on-board diagnostics. The basic structure of an on-board diagnostic will be described along with the system definitions needed for successful implementation.

LEARNING OBJECTIVES
By attending this seminar, you will be able to:

• Articulate the underlying design objectives of on-board diagnostic systems
• Apply the design features that all diagnostics need for successful implementation
• Apply basic design techniques to deal with variation
• Use a diagnostic design template in the development of an on-board diagnostic

WHO SHOULD ATTEND
Engineers involved in engines and transmissions especially the design or control of on-board diagnostic systems for engines or transmissions; engineers new to the area of OBD system design and engineers involved in the design of control systems.

CONTENT HIGHLIGHTS
• Fundamental Design Objectives for OBD Systems
• Basic Design Features for OBD Systems
• Defining “Good” vs. “Bad” Systems
• Exercise: Defining Good vs. Defective Systems
• Anatomy of an On-Board Diagnostic
• Diagnostic Modeling
• Understanding and Dealing with Variation

INSTRUCTOR
John Van Gilder
Technical Fellow, OBD II Development, General Motors Powertrain Group

I.D.# C0708
SCHEDULE
September 8, 2014
Anaheim, California

Held in conjunction with the SAE 2014
On-Board Diagnostics Symposium

FEES
List: $715
Members
Classic: $735
Premium: $695
Elite: $655

ONE-DAY/0.7 CEUS
Get the complete course description
and register:
training.sae.org/seminars/c0708

Provides an overview of the fundamental design objectives and the features needed to achieve those objectives.
ADVANCED DIESEL PARTICULATE FILTRATION SYSTEMS

As regulations become more and more stringent, diesel particulate filters (DPF) become possibly the most important and complex diesel aftertreatment device. This seminar covers many DPF-related topics and provides you with both a theoretical and applications-oriented approach to enhance the design and reliability of aftertreatment platforms. Topics covered include structure, geometry, composition, performance, applications and optimizations of DPFs. Computer simulation techniques for analysis and optimization of DPF performance are also demonstrated.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

- Discuss fundamental, moderate and advanced topics on DPF structure, geometry, composition, performance, applications and optimizations
- Formulate porosity, permeability, inertial loss coefficient, flow resistance descriptors, different particulate transport modes (diffusional, interceptive), etc. to develop models for predicting backpressure of DPF
- Recognize different modes of particulate filtration regimes in DPF
- Select, design, utilize and optimize DPF for various light duty and heavy duty aftertreatment applications
- Predict, via modeling and simulations, various important DPF performance features (backpressure, peak regeneration temperature, etc.) as well as to analyze their failure modes and thus enhance the reliability of diesel exhaust aftertreatment platform designs

WHO SHOULD ATTEND

This seminar is designed for engineers, scientists, investigators and consultants involved in researching, developing, applications, designing or optimizing diesel exhaust aftertreatment components and systems. Individuals from technical and regulatory institutions as well as individuals from OEMs, suppliers, emissions service companies, research facilities and universities will gain modern knowledge of diesel filter performance.

“Excellent coverage of an emerging technology by a real expert in the area.”

Henry Gysling
Technology Director
Air Flow Catalyst Systems
CONTENT HIGHLIGHTS
• Porous Media Basics for Diesel Particulate Filters
• Pore space and structure definitions
• Simplified representations of structures
• Flow resistance descriptors
• Filtration Concepts for Diesel Particulate Filters
• Particle transport and deposition phenomena
• Continuum filtration theory
• True-to-the-geometry representations
• Diesel Filter Types: Materials and Configurations in Practice
• Applications, Performance Optimization and Modeling of Diesel Particulate Filters
• Filter backpressure/particulate loading
• Filter Regeneration
• Soot reactivity and structure
• Simulation Techniques for Diesel Particulate Filters

INSTRUCTORS
Athanasios G. Konstandopoulos
Aerosol and Particle Technology Laboratory

Mansour Masoudi
Advanced Powertrain Technology, Paccar Technical Center

I.D.# C0502

SCHEDULE
October 1-2, 2014
Troy, Michigan

FEES
List: $1,325
Members
Classic: $1,195
Premium: $1,125
Elite: $1,065

TWO-DAYS/1.3 CEUS

Get the complete course description and register:
training.sae.org/seminars/c0502
EXHAUST FLOW PERFORMANCE AND PRESSURE DROP OF EXHAUST COMPONENTS AND SYSTEMS

Designing more efficient and robust emission control components and exhaust systems results in more efficient performance, reduced backpressure and fuel penalty, and higher conversion efficiency. This course will help you to understand the motion of exhaust flow in both gasoline and diesel emission control components including flow-through and wall-flow devices such as catalytic converters, NOx adsorbers, diesel oxidation catalysts, diesel particulate filters as well as flow through the overall exhaust system. Discussions will also cover: flow recirculation in inlet cones, flow maldistribution and its effect on conversion efficiency in flow throughs, non-uniform particulate deposit in diesel filters, and roots of non-uniformity in flow distribution due to exhaust system design such as bends.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

• Describe how exhaust stream is distributed in flow-throughs in gasoline or in diesel emission components and in wall-flow components, including in inlet cones, exit cones, bends, elbows, flow constrictions, and in other components of an exhaust system

• Design exhaust systems yielding higher conversion efficiency, lower backpressure, faster light-off, and optimal performance

• Design diesel particulate filter systems yielding more uniform soot distribution in filters, thus lowering both filter backpressure and its peak regeneration temperature

• Describe connections between flow distribution and thermal performance such as light-off and radial and axial temperature gradients

WHO SHOULD ATTEND

This seminar is intended for engineers, managers, designers, researchers and technical associates who wish to gain deeper insight into developments and optimization of exhaust systems and components. This also includes professionals involved with catalyst and emission components and exhaust sensors.

“Class material supports practical applications and real world case studies. Instructor kept the course interesting!

Steven Dropps
Technical Lead EGR, Air, Intake, Exhaust System Design
John Deere
CONTENT HIGHLIGHTS

• Flow-throughs (e.g., catalytic converters or NOx adsorbers)
  • The basics: flow distribution; roots of and various contributors to pressure drop; effect of geometry; effect of surface area, length and diameter; role of catalyst; etc.
  • How to optimize the performance
  • How to measure the pressure drop
• Wall-flows (e.g., diesel particulate filters)
  • The basics: flow distribution; roots of and various contributors to pressure drop; effect of geometry such as wall thickness, cell density, plugs, and aspect ratio; transport and deposit of particulate in filters and its effect on the filter performance; role of exhaust flow on regeneration
  • How to optimize the performance
  • How to measure the pressure drop
• Inlet and exit cones: flow recirculation in cones and its effect on backpressure and performance (e.g., conversion efficiency, particulate deposit, light-off, etc.)
  • Similar analysis of other exhaust system components such as pipes, bends, elbows, and constrictions and expansions in the path of the exhaust flow

INSTRUCTOR

Mansour Masoudi
Manager, Advanced Powertrain Technology, Paccar Technical Center
This three session webinar will examine the various catalytic processes for lean burn applications, including Selective Catalytic NOx Reduction (SCR), NOx Trap Technologies (i.e. LNT, NSR), and the combination of SCR, NOx Trap and Hydrocarbon NOx Reduction (LNC). It will focus in on SCR NOx fundamentals, equipping you with the basic concepts for NOx control and important design parameters for SCR NOx catalyst. The course will examine the system design for SCR in diesel applications including passenger cars and heavy duty trucks, including SCR catalysts, SCR integration with diesel particulate filter, key sensor development catalyst durability issues and urea control.

The Fundamentals of Catalytic Converter Integration for Emission Control Webinar Recording, is a recommended prerequisite for those with less than three years of experience with catalytic converters. See the course information on page 52.

LEARNING OBJECTIVES
By connecting with this webinar, you will be able to:

• Define NOx catalysis and identify key acronyms
• Describe in-use issues
• Cite key elements in NOx catalyst design for diesel applications
• Define SCR design for passenger cars and heavy duty applications
• Identify available sensors for SCR catalyst performance monitoring
• Determine where lean NOx traps may be appropriate versus SCR NOx control

WHO SHOULD ATTEND
This webinar will be especially valuable for mechanical, metallurgical and chemical engineers, materials scientists, and chemists involved in the design, operation and calibration of a NOx emission control system for both mobile and stationary source applications. Sales professionals responsible for emission controls, plant managers concerned about meeting new regulations with catalytic controls, and regulators now involved in transmission technologies will also benefit from this webinar.

Removal of NOx from exhausts is a critical need for emission standards and ambient ozone requirements.
CONTENT HIGHLIGHTS
Lean NOx Catalysis
• NOx reduction catalytic approaches
• Lean NOx reduction fundamentals
• Hydrocarbon NOx reduction (LNC)
• NOx traps technologies (LNT, NSR or NAC)
• SCR Catalytic NOx reduction (ammonia based)
• Combination SCR/NOx traps
• SCR NOx Catalyst
• SCR NOx catalytic approaches (Vanadia and Zeolite)
• Performance characteristics of SCR NOx catalysts (Vanadia and Zeolite)
• Comparison of commercial issues with lean NOx traps and SCR
• SCR Catalyst Design Mobile Applications
• Passenger cars
• Heavy duty systems
• Auxiliary equipment design
• Sensor performance
• Catalyst durability

INSTRUCTOR
Ronald Heck
Independent Consultant

I.D.# WB1237

SCHEDULE
Upcoming open enrollment dates always being scheduled; please visit the course webpage for more information.

FEES
List: $535
Members
Classic: $482
Premium: $455
Elite: $428

THREE, 2-HOUR SESSIONS/.6 CEUS
Get the complete course description and register:
training.sae.org/webinars/wb1237

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SAE Credentialing – Premium and Elite members save 10% on SAE Certificate of Competency training.

www.sae.org/membership
Public awareness regarding pollutants and their adverse health effects has created an urgent need for engineers to better understand the combustion process as well as the pollutants formed as by-products of that process. To effectively contribute to emission control strategies and design and develop emission control systems and components, a good understanding of the physical and mathematical principles of the combustion process is necessary. This seminar will bring issues related to combustion and emissions “down to earth,” relying less on mathematical terms and more on physical explanations and analogies.

LEARNING OBJECTIVES
By attending this seminar, you will be able to:
• Identify and describe the important processes in combustion and emission
• Identify the formation mechanisms and reduction strategies of pollutant species in combustion systems
• Recognize the effects of engine design and operating conditions on combustion and emission
• Explain the technology and the logic behind after-treatment of pollutants
• Identify the underlying laws and principles used in combustion and emission black-boxed computer programs
• Explain the role chemical kinetics plays in the design of low-emission combustion systems
• Identify design trade-offs between increasing engine performance and maintaining low emission characteristics

WHO SHOULD ATTEND
Engineers working on the design of combustion engine components, software development and application for modeling of thermal-fluid, combustion and emissions processes, and those working on the reduction of harmful pollutants emissions will find this course valuable.

“Dr. Bruce Chehroudi successfully blends theoretical and practical explanations of combustion and emissions subjects to maximize comprehension. This course is an excellent way to steepen the learning curve in this complex and fascinating area of Engineering. Highly recommended; bring your questions!”

Jeremy (Jay) Paiko
Engine Systems & Dyno Development Engineer
Chrysler LLC

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SAE Corporate Learning Solutions
1-724-772-8529 • training.sae.org/corplearning
CONTENT HIGHLIGHTS

• Air Composition
• Concept of “Complete Combustion”
• A/F & Stoichiometric (A/F)_{ST} and (Equivalence Ratio)
• Lean, Rich, Stoichiometric Mixture
• First and Second Law and Applications in Combustion Systems
• Adiabatic Flame Temperature, Heat of Reaction (or Heating Value) and Their Usage
• Thermodynamic and Chemical Equilibrium
• Demonstration Applications of Equilibrium Using Computer Simulation (SuperState)
• Chemical Kinetics
• Reaction Between Gas Molecules and a Solid Surface
• Explosion
• Mechanism of H_2O_2 Reaction
• Oxidation of CO
• Explosion Limits of Hydrocarbons (HC)
• Autoignition and Induction Time Using SuperState
• Flame and its Propagation
• Combustion in SI Engines
• Pollutant Formation and Control
• Exhaust Gas Treatments
• Typical Engine Emission Results
• Emission Measurements
• FTP Emission Standards

INSTRUCTOR

Bruce Chehroudi
Chief Scientist, Group Leader
Advanced Technology Consultants

I.D.# 97011

SCHEDULE
August 18-20, 2014
Troy, Michigan

FEES
List: $1,715
Members
Classic: $1,545
Premium: $1,465
Elite: $1,375

THREE-DAYS/2.0 CEUS

Get the complete course description and register:
training.sae.org/seminars/97011

instruCtor
bruce Chehroudi
Chief Scientist, Group Leader
Advanced Technology Consultants
EXHAUST GAS RECIRCULATION (EGR) FOR DIESEL ENGINES

Meeting the requirements of heavy-duty engine emissions regulations is a challenge for all engine manufacturers. Since the introduction of Exhaust Gas Recirculation (EGR) in medium and heavy-duty diesel engines, these systems have become more sophisticated and tightly integrated with emission control systems.

This 2-day seminar will explore the advantages and disadvantages of EGR and the most effective implementation of various EGR systems. This seminar will begin by defining EGR and why it is used in diesel engines, along with an explanation of the mechanisms by which EGR is able to reduce NOx. This seminar will then move into implementation of EGR systems and examples of these systems on medium and heavy-duty diesel engines. In addition, the impact of EGR on various engine components will be discussed and will include EGR coolers, valves and piping. Finally, a section will be devoted to the comparison between EGR and SCR and their future roles in reducing NOx emissions, as well as their impact on fuel efficiency and CO2 emissions. Emphasized in this comparison is the use of EGR in novel combustion systems and its ability to reduce emissions in-cylinder.

LEARNING OBJECTIVES

By attending this seminar you will be able to:

• Define EGR
• Recognize the different types of EGR systems used in diesel engines
• Evaluate the overall advantages and disadvantages of EGR systems in diesel engines
• Identify the impact of EGR on the combustion process
• Identify the impact of EGR on NOx and PM emissions
• Compare and evaluate EGR and SCR systems as a means to meeting emissions regulations

WHO SHOULD ATTEND

This seminar is designed for engineers and managers working in diesel combustion and emissions control technologies.

“Course and instruction: 60% New + 40% Review = 100% Excellent”

David Chekas
Senior Engineer
John Deere Power Systems
CONTENT HIGHLIGHTS

- Fundamentals of Exhaust Gas Recirculation
- Types of EGR Systems and Implementation
- Advantages and Disadvantages
- Impact of EGR
- Opportunities for Unique EGR System Implementations
- EGR System Design
- Controls
- Impact of Turbocharging on EGR Performance
- EGR Coolers and Mixers
- Examples of Production EGR Systems
- Issues and Challenges of EGR Implementation
- Effect of EGR on Diesel Combustion
- EGR and Selective Catalytic Reduction (SCR) Systems Comparison

INSTRUCTOR

Magdi Khair
Chief Technologist, Watlow Electric (retired)

SAE DIESEL TECHNOLOGY CERTIFICATE PROGRAM

Designed to equip you with a solid understanding of diesel engines, emissions and aftertreatment strategies, and related components, the program requires completion of courses that address these areas and then facilitates further depth in aftertreatment technologies through a menu of electives.

Complete the Diesel Technology Certificate and earn eight graduate credits towards the SAE/Kettering University 20-credit Certificate in Automotive Systems and Kettering’s 40-credit M.S. in Mechanical Engineering. Visit training.sae.org/collegecredit for more information.

View the list of required and elective courses and more information on enrolling in this or any SAE certificate program—training.sae.org/certificate/dieseltech.

I.D.# C1214

SCHEDULE
September 15-16, 2014
Troy, Michigan

FEES
List: $1,235
Members
Classic: $1,115
Premium: $1,055
Elite: $995

TWO-DAYS/1.3 CEUS

Get the complete course description and register:
training.sae.org/seminars/c1214

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Catalytic emission controls is a key design element of all commercial engines today, whether for autos, trucks, small engines or lawnmowers. Stringent emissions legislation and the advent of low-sulfur fuels have led to new developments to meet the 120,000 vehicle mile durability for passenger cars and 300,000 vehicle mile durability for trucks and buses. Catalytic converter design has become a high priority issue with the new more stringent regulations worldwide.

This four session webinar will explore the main elements of the catalytic converter: the catalyst, the honeycomb, and the housing. Session One will cover catalyst fundamentals to equip participants with the basic concepts, important design parameters and main elements of the catalyst, the washcoat and the unitary support. The second session will add discussion on catalyst durability and the effects of in-use on the maintenance of catalyst performance. The third and fourth sessions will explore the ceramic honeycomb as an integral part of emissions control device.

The instructors recommend their book with Robert Farrauto, Catalytic Air Pollution Control: Commercial Technology, 3rd Edition, as a supplement to the course content.

**LEARNING OBJECTIVES**

By connecting with this webinar recording, you will be able to:

- Define catalysis and identify catalyst acronyms
- Describe in-use issues
- Question catalyst suppliers
- Interpret basic test procedures for catalyst evaluation and cite key elements in catalyst design
- Define honeycomb substrate, the key properties of honeycomb structure, and the performance parameters in terms of cell dimensions
- Validate performance parameters with measured performance
- Describe test methods relevant to in-use conditions

**WHO SHOULD ATTEND**

This webinar will be especially valuable for engineers and others involved in the design, operation and calibration of an emission control system for both mobile and stationary source applications. This includes automobiles, trucks, buses, ships, locomotives, stationary engines, small engines, etc.
CONTENT HIGHLIGHTS

Catalysis

- Fundamentals of catalysis
- Definition of catalyst and the characteristics of catalysis
- Catalytic reactions
- Catalyst preparation, characterization, and durability
- Reaction controlling mechanisms
- Calculating Onboard Energy Storage Needs

Catalyst Durability

- Aging protocols
- Sintering concept and in-use examples
- Masking concept and in-use examples
- Poisoning concept and in-use examples
- Attrition concept and in-use examples
- Consequences of durability on performance
- Charging Systems for Electric Vehicles

Honeycomb Substrates

- Ceramic substrates
- Metallic substrates
- Geometric properties
- Performance parameters
- Physical properties
- Effect of high surface area washcoat

Honeycomb In-Use Durability

- Canning loads and mechanical stresses
- Temperature gradients in transverse direction
- Thermal stresses in washcoated honeycombs
- Allowable stress for lifetime durability

INSTRUCTOR

Ronald Heck
Independent Consultant

Suresh T. Gulati
Independent Consultant
To help meet emissions requirements, the catalyst industry has developed exhaust emission reduction technologies with impressive levels of performance. These technologies include hydrocarbon selective catalytic reduction (SCR), NOx absorber catalysts, and urea SCR. This seminar covers these technologies and discusses use and implementation.

This seminar will begin with an explanation of NOx formation in diesel engines and in-cylinder methods for reducing these emissions. The aftertreatment systems for NOx reduction will be explained and the advantages and disadvantages of these emission reduction technologies will be discussed.

The primary focus is on urea SCR and its technology will be fully examined. The important chemical reactions and methods for improving SCR performance by encouraging desirable reactions and avoiding undesirable reactions are explained. Additionally, the components and control of a urea SCR system are detailed and the necessary sensors for its control are described. The SAE International paper Laboratory Testing of Urea-SCR Formulations to Meet Tier 2 Bin 5 Emissions is included in the course materials.

**LEARNING OBJECTIVES**

By attending this seminar you will be able to:

- Identify how NOx is formed in diesel engines
- Identify the in-cylinder means for reducing NOx
- Evaluate NOx aftertreatment technologies for diesel exhaust.
- Describe the characteristic of selectivity in catalytic aftertreatment
- Apply selectivity to urea SCR
- Describe the features and components of a complete urea SCR system
- Learn how to optimize the control of a urea SCR
- Distinguish the differences between various catalytic SCR formulations

**WHO SHOULD ATTEND**

This seminar will benefit engineers and technical staff who are developing urea aftertreatment systems for diesel engines, including catalyst engineers who supply NOx aftertreatment systems to the diesel industry. Also benefitting will be suppliers of other NOx reducing technologies, such as EGR components and fuel injection systems, as well as on-highway and off-highway diesel engine technical staff.

“This is a great course for any professional working in the field of diesel emissions controls. The instructor was very knowledgeable, and it was clear he spent much time updating the materials to make sure we got the latest information.”

Ben Sharpe
Researcher
International Council on Clean Transportation
CONTENT HIGHLIGHTS
• Various vehicle diesel emissions regulations
• NOx Formation in Diesel Engines
• In-Cylinder Means for NOx Reduction
• NOx Aftertreatment Systems for Diesel Engines
• Urea SCR Technology
• Components of the Urea SCR System
• System Calibration and Control Considerations
• Regulatory and Market Considerations
• Urea Production and Distribution
• SCR Options and Configurations for Future NOx Limits

INSTRUCTOR
Magdi Khair (retired)
Chief Technologist, Diesel Emission Space Watlow Electric

SAE DIESEL TECHNOLOGY CERTIFICATE PROGRAM
Designed to equip you with a solid understanding of diesel engines, emissions and aftertreatment strategies, and related components, the program requires completion of courses that address these areas and then facilitates further depth in aftertreatment technologies through a menu of electives.

Complete the Diesel Technology Certificate and earn eight graduate credits towards the SAE/Kettering University 20-credit Certificate in Automotive Systems and Kettering’s 40-credit M.S. in Mechanical Engineering. Visit training.sae.org/collegecredit for more information.

View the list of required and elective courses and more information on enrolling in this or any SAE certificate program—training.sae.org/certificate/dieseltech.
Unlike exhaust emissions, which occur only when the engine is operating, evaporative emissions (evap emissions) occur all the time. Controlling evap emissions to PZEV levels is as challenging as controlling exhaust emissions.

This comprehensive seminar introduces the participants to the principles of gasoline evaporative fuel vapor generation from the vehicle fuel tank, fuel vapor storage in activated carbon canisters, and fuel vapor desorption and consumption in engine combustion. The seminar begins with an analysis of gasoline and gasoline/ethanol blends and estimation of their vapor pressures and vapor generation. In-depth analysis of various vapor generations as a function of fuel properties and ambient conditions will be presented. Activated carbon canister design, OBD II leak detection, hydrocarbon permeation, and CARB and EPA evaporative test procedures will also be covered. Participants will have the opportunity to apply the knowledge gained by designing a sample evaporative and refueling emissions control system in class.

LEARNING OBJECTIVES

By attending the seminar, you will be able to:

• Identify various sources of evaporative fuel vapor emissions
• Predict the effects of ethanol on evaporative emissions
• Estimate diurnal and refueling vapor generation
• Analyze the differences in the test procedures: U.S., Europe, and Asia
• Explain activated carbon canister operation: loading, purging, vapor redistribution, and back-purge
• Identify potential solutions to induction hydrocarbon emissions
• Estimate the effect of altitude on evaporative emissions

WHO SHOULD ATTEND

This course is designed for engineers in all fields related to the design and development of evaporative and refueling emission control systems including platform fuel system design engineers for fuel tanks, onboard refueling vapor recovery systems, evaporative emission control canisters, fuel vapor lines, vapor purge lines, purge and vent valves, etc. Air induction system design engineers dealing with induction hydrocarbon adsorbers, powertrain fuel delivery design engineers responsible for canister purge vapors, powertrain calibration engineers responsible for evaporative canister purge and evaporative emission diagnostics, and environmental engineers who deal with state and federal emission regulations, will all find the seminar valuable.

Constantly changing evaporative regulations require that individuals working in this area have a solid understanding of both regulatory and system design issues for evaporative emissions control.
CONTENT HIGHLIGHTS

• Evaporative and refueling emission control system
• Why and how to control fuel vapor emissions
• Fuel and Fuel Vapor Pressure
• Fuel Vapor Generation
• Carbon Canisters
• Evaporative and Refueling Emission Control System Design
• Hybrid and plug-in hybrid evaporative emission control
• Pressurized/sealed and bladder fuel tank for evaporative emission control
• Evap OBD II leak detection
• Permeation losses - effects of materials, temperature, fuel composition, etc.

INSTRUCTOR

Sam Reddy
Owner, Evaporative Emissions Consulting, Inc.

I.D.# C0928

SCHEDULE
September 18-19, 2014
Troy, Michigan

FEES

List: $1,275
Members
Class: $1,145
Premium: $1,085
Elite: $1,015

TWO-DAYS/1.3 CEUS

Get the complete course description and register:
training.sae.org/seminars/c0928
This seminar will highlight the role of lubricants in improving fuel efficiency and provide strategies for selecting the best oil for a given application. The course begins with a brief overview of the fuel consumption regulations and global perspective of passenger car lubricants and diesel oil specifications in North America, Europe and Asia. Limitations and advantages of various methods to measure fuel consumption in a variety of bench tests, dyno tests and actual vehicles will be presented. Fundamentals of fluid lubrication regimes, as well as detailed aspects of oil formulations which have significant effects on reduction in mechanical friction, such as base oil selection, viscosity grade choice and impact of friction modifiers, will be covered. The performance characteristics of fresh oil versus used oil and lubrication of coated surfaces will also be discussed. Finally, the impact of various emission control devices on overall diesel fuel consumption will be described.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

• Describe the effects of mechanical friction on engine efficiency
• Summarize the pros and cons of various test methodologies used to measure engine friction
• Articulate the limitations in various fuel consumption test methodologies
• Select oils based on frictional control performance
• Describe the role of oil degradation on fuel economy and engine wear
• Evaluate lubricant interactions with low friction surfaces

WHO SHOULD ATTEND

This seminar is designed for engineers, scientists, investigators and consultants involved in designing or optimizing mobile or stationary powertrains. Individuals interested in understanding the role of engine oils in reducing fuel consumption will find the seminar beneficial. Automotive decision makers will also benefit by gaining an understanding of the limitations of fuel economy testing methods.
CONTENT HIGHLIGHTS

• Reducing Fuel Consumption
• Regulations - N. American, Europe and Asia
• GHG emissions and climate change
• Petroleum based fuels - availability
• Biofuels - availability and global trends
• Fundamentals of Engine Friction — Gasoline and Diesel Engine
• Methodology - How to Measure Engine Friction; How to Measure Fuel Consumption in Real Life Conditions
• Fuel Economy Derived Lubricant Specifications —N. America, United Europe, Japan
• Lubrication Fundamentals —Lubrication regimes; Stribeck curve
• Lubricant Components - Effects on Fuel Consumption
• Fuel Economy Retention —Impact of used oil on fuel consumption vs. engine wear protection
• Lubrication of Low Friction Surfaces — Coatings; Engineered surfaces
• Impact of Diesel Emission Control Devices on Overall Fuel Consumption

INSTRUCTOR

Ewa A. Bardasz
Fellow, The Lubrizol Corporation
MODERN FLUIDS FOR CRANKCASE ENGINES: AN OVERVIEW

Fundamentals of crankcase lubrication, including the properties and performance requirements of global base stocks and lubricants will be covered. The seminar will further explore the need for lubricating systems to possess thermal and oxidative stability sufficient to withstand the rigors of low-heat-rejection, high performance diesel engines or other modern engines equipped with various emission control devices. Case studies will be utilized to demonstrate the existence of overlapping phenomena aimed at extending oil life and protecting key mechanical components.

LEARNING OBJECTIVES
By attending this seminar, you will be able to:
• Describe how various classes of additives commonly used in crankcase lubricants impact:
  • wear of bearings, pistons, and piston rings
  • friction and fuel consumption
  • corrosion
  • piston cleanliness
  • swelling of seals
  • hydraulic media in fuel systems, such as hydraulically-actuated electronically-controlled unit injector system (HEUI)
• Recognize the limitations and technical trends in new base stocks and additive technologies
• Compare performance characteristics of lubricants designed for passenger cars manufactured in N. America, Europe or Japan
• Identify key lubricant requirements for protecting heavy duty diesel engines
• Select and optimize fluids for various light duty and heavy duty after-treatment applications
• Recognize differences between API, ACEA, and ILSAC lubricant categories.

WHO SHOULD ATTEND
This seminar is designed for engineers, scientists, investigators and consultants involved in designing or optimizing mobile or stationary powertrains. Individuals interested in understanding the role of crankcase fluids in extending useful life of the overall systems, minimizing emissions and reducing fuel consumption will find the seminar beneficial.
CONTENT HIGHLIGHTS

• Introduction to Engine Lubricant Formulations
• Lubrication Fundamentals
• Base Oils; Additives
• Global Lubricant Specifications
• Extended Service Intervals (ESI)
• Fuel Economy
• Global Trends in Emission Specifications and Exhaust Control Systems
• Examples of Lubricant Interactions with Exhaust Systems

INSTRUCTOR

Ewa A. Bardasz
Fellow, The Lubrizol Corporation

SCHEDULE

August 11-12, 2014
Troy, Michigan

FEES

List: $1,335
Members
Classic: $1,205
Premium: $1,135
Elite: $1,065

TWO-DAYS/1.3 CEUS

Get the complete course description and register:
training.sae.org/seminars/c0704

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SAE members who have completed an SAE training in the last 12-months can get an additional 20% off of additional courses if taken in the same 12-month period. Take a seminar in August; get 20% off two more seminars if taken by next August. Take a seminar in June; get 20% off of a seminar and an e-Seminar if taken by the next June. Some courses and learning products are not eligible. Visit training.sae.org/discounts/ to view exclusions and conditions.

Call SAE Customer Service to register and get your discount! 1-877-606-7323 (1-724-776-4970 outside the U.S. & Canada). Please use promo code FREQUENTPD when registering.
This seminar reviews the fundamentals of motor fuels, combustion and motor power generation. The primary content of the course provides a basic introduction to the technology, performance, evaluation, and specifications of current gasoline, diesel, and turbine fuels.

LEARNING OBJECTIVES
By attending this seminar, you will be able to:
• Describe how fuel compositional variables affect engine performance
• Interpret test data to determine if fuel meets required specifications and regulations
• Determine the purpose and mode of action of performance additives
• List the important processes in motor fuel
• Communicate effectively with others working with motor fuels
• Have a working knowledge of motor fuel composition, properties, and performance

WHO SHOULD ATTEND
Engine design engineers requiring an understanding of the fundamental performance properties of motor fuels and additives; and formulators needing an understanding of the relationships of fuel performance and composition to design fuels and additives to meet needs.

CONTENT HIGHLIGHTS
• Introduction and History of Motor Fuels
• Oxygenated Blend Components and Emissions
• Gasoline Specifications
• Overview of Diesel Fuel; Diesel Specifications
• Alternative Fuels, Future Trends, and Directions
• Gaseous Fuels for Engines
• Racing Fuels
• Future Trends in Fuels

INSTRUCTOR
Kenneth Kipers
Consultant, Certified Lubrication Specialist

“This course will definitely give you an excellent overview of today’s energy concerns and needs.”

Michael Mueller
Head, Chemistry Dept.
Rose-Hulman Institute of Technology

I.D.# 98003

SCHEDULE
June 11-13, 2014
Troy, Michigan

FEES
List: $1,715
Members
Classic: $1,545
Premium: $1,455
Elite: $1,365

THREE-DAYS/2.0 CEUS

Get the complete course description and register:
training.sae.org/seminars/98003

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BASIC HYBRID AND ELECTRIC VEHICLE SAFETY WEBINAR

This webinar reviews safety concerns and precautions related to high-voltage circuits present in alternative-propulsion. HV circuits are discussed in general to provide an understanding of “where the risk lies”. The effects of electrical current on the human body are summarized and existing protective measures, and related standards, are described. Specific issues related to vehicle development, service, and operation are explained, along with onboard fault detection systems used to protect individuals from electrical injury. Part of the Hybrid Fundamentals Webinar Series.

LEARNING OBJECTIVES

- Describe component functions and locations in a typical high-voltage powertrain as well as the onboard safety systems associated with such components
- Explain the general effects of electric current on the human body
- Know which national and international safety standards apply to high-voltage vehicle circuits
- Summarize HV safety working issues that may be present during a vehicle’s development, assembly, service, and operation
- Identify general issues associated with extrication of occupants from vehicles with high-voltage powertrains

WHO SHOULD ATTEND

Professionals who work directly with these vehicles; component suppliers, safety officers and/or personnel who plan to develop high-voltage safety programs or procedures.

CONTENT HIGHLIGHTS

- General high-voltage electrical safety issues in vehicles
- Electrical injury; Industry protection against electrical injury
- On-board vehicle protection against electrical injury
- Powertrain development issues
- Service and repair issues; Vehicle occupant and first responder issues

INSTRUCTOR

Jack Rosebro
Independent Consultant

“This was probably the best web instruction I’ve received. Jack Rosebro was spot on and very up to date and informative.”

John W. Froeb
Senior Product Design Engineer, Parker SSD Drives Division

I.D.# C0904

SCHEDULE

May 15, 2014
Live Online

September 18, 2014
Live Online

FEES

List: $260
Members
Classic: $234
Premium: $221
Elite: $208
ONE, 2-HOUR SESSION/.2 CEUS

Get the complete course description and register:
training.sae.org/webinars/c0904

ACCESS THIS COURSE ONLINE AND ON DEMAND AS A WEBINAR RECORDING.

SAE Webinar Recordings are audio/visual captures of live webinars and offer access to the unedited sessions, including instructor/participant interaction and Q&A. A learning assessment is available at the end of the course to reinforce learning and retention and gauge your understanding of the topic.

I.D.# PD330904ON

FEES

See above

2-HOURS/.2 CEUS

Get more information about the webinar recording:
training.sae.org/webrecordings/pd330904ON
This two-hour webinar will highlight hybrid and electric vehicles that are currently in production, offered for sale, or planned for near-term production. Manufacturers of hybrid and electric vehicles from around the world and Tier 1 suppliers of major hybrid and electric vehicle components will be reviewed.

Part of the Hybrid Fundamentals Webinar Series.

LEARNING OBJECTIVES

By connecting with this webinar, you will be able to:

• List the hybrid and electric vehicles that have been commercialized from 1997 to present
• Identify passenger, light-duty, and heavy-duty hybrid-electric vehicles that are on the market
• Explain the major resource and regulatory drivers of hybrid and electric vehicle development
• Recognize basic layouts of light, medium, and heavy-duty hybrid vehicle powertrains
• Compare advantages and disadvantages of different hybrid architectures
• Summarize upcoming HEV and EV production plans

WHO SHOULD ATTEND

All passenger car and light-duty industry professionals who need a comprehensive overview of past, current, and future hybrid and electric vehicle production. Those unfamiliar with the evolution of hybrid and electric vehicle development, yet whose job will be impacted by hybrid and electric vehicles in the future, will benefit also.

CONTENT HIGHLIGHTS

• Hybrid and electric vehicle production, 1997-present
• Current Asian hybrid vehicle production
• Current US hybrid vehicle production
• Market and regulatory drivers of HEV/EV production
• Planned Asian and planned European hybrid and electric vehicle production
• Planned US hybrid and electric vehicle production
• Commercial hybrid and electric vehicle production
• Tier 1 suppliers and partnerships

INSTRUCTOR

Jack Rosebro
Independent Consultant

“Great means of accomplishing training while travel budgets are tight. I didn’t seem to lose much by being physically absent. (I) liked the session times and ability to stay home to learn the material.”

Jason Osborn
Design Engineer, Sr
Bobcat Company

I.D.# C0906

SCHEDULE
May 22, 2014
Live Online

FEES
List: $260
Members
Classic: $234
Premium: $221
Elite: $208

ONE, 2-HOUR SESSION./2 CEUS

Get the complete course description and register:
training.sae.org/webinars/c0906

ACCESS THIS COURSE ONLINE AND ON DEMAND AS A WEBINAR RECORDING.

SAE Webinar Recordings are audio/visual captures of live webinars and offer access to the unedited sessions, including instructor/participant interaction and Q&A. A learning assessment is available at the end of the course to reinforce learning and retention and gauge your understanding of the topic.

I.D.# PD3309060N

FEES
See above

2-HOURS/.2 CEUS

Get more information about the webinar recording:
training.sae.org/webrecordings/pd3309060N
More than a million hybrids are sold globally per year. Some OEMs estimate that up to 80% of their light-duty vehicles may require some level of hybridization to meet upcoming CAFE regulations in the United States. Hybrids are also starting to make inroads into markets in Europe, and have recently been introduced to Chinese and Indian markets, among others. In this two-hour webinar, energy storage systems, inverters, motor-generators, and DC-DC converters are explained, as well as design considerations for both light-duty and heavy-duty vehicle powertrains and developing trends such as plug-in, flywheel and hydraulic hybrids. Part of the Hybrid Fundamentals Webinar Series.

LEARNING OBJECTIVES
By connecting with this webinar, you will be able to:

• Describe the efficiency improvements that hybrid vehicles achieve with respect to conventional vehicles
• Identify common components of hybrid powertrains
• Recognize basic layouts utilized in light, medium, and heavy-duty hybrid vehicle powertrains
• Compare the advantages and disadvantages of different hybrid architectures
• Summarize hybrid powertrain applications that are on the market today
• Explain upcoming HEV developments

WHO SHOULD ATTEND
Anyone who is unfamiliar with basic hybrid technology, yet whose job will be impacted by hybrid vehicles in the future, will benefit from this webinar.

CONTENT HIGHLIGHTS
• Types of hybrids
• Hybrid-electric powertrain components
• Series hybrid architectures
• Parallel hybrid architectures
• Series-parallel hybrid architectures
• Plug-in Hybrids
• Hybrid vehicle trends and developments

INSTRUCTOR
Jack Rosebro
Independent Consultant
The path to commercialization of plug-in hybrids (PHEVs) is likely to require complex interactions between all stakeholders yet the plug-in hybrid is a still-developing technology. How do PHEVs differ from conventional hybrids? What are the advantages and challenges for stakeholders including manufacturers and end-users? What is the current state of plug-in hybrid development? Those unfamiliar with PHEV or vehicle-to-grid (V2G) technology, yet whose job will be impacted by plug-in hybrid vehicles in the future, will benefit from this two-hour webinar. Part of the Hybrid Fundamentals Webinar Series.

LEARNING OBJECTIVES
By connecting with this webinar, you will be able to:
• Describe the relevant differences between plug-in hybrid (PHEV) and conventional hybrid vehicles
• Identify fundamental charge-discharge strategies
• Explain the performance demands placed on PHEV energy storage systems and development trends in energy storage
• Recognize the enablers and barriers to mass commercialization of PHEVs
• Summarize infrastructure requirements as well as supply-side and demand-side incentives
• Explain the potential energy and emission benefits of PHEV and V2G synergies

WHO SHOULD ATTEND
This webinar will benefit automotive and commercial vehicle industry professionals who want to understand the rapidly-changing development of plug-in hybrids.

CONTENT HIGHLIGHTS
• PHEV architectures: charge-discharge strategies: energy storage systems
• State of PHEV development today
• Interaction between plug-in hybrids and the electrical grid; Vehicle-to-grid (V2G)
• Government incentives toward development of PHEVs

INSTRUCTOR
Jack Rosebro
Independent Consultant

“Great means of accomplishing training while travel budgets are tight. I didn’t seem to lose much by being physically absent.”

Jason Osborn
Design Engineer, Sr
Bobcat Company

I.D.# C0905

SCHEDULE
May 20, 2014
Live Online

FEES
List: $260
Members
Classic: $234
Premium: $221
Elite: $208

ONE, 2-HOUR SESSION/2 CEUS

Get the complete course description and register:
training.sae.org/seminars/c0905

ACCESS THIS COURSE ONLINE
AND ON DEMAND AS A WEBINAR RECORDING.

SAE Webinar Recordings are audio/visual captures of live webinars and offer access to the unedited sessions, including instructor/participant interaction and Q&A. A learning assessment is available at the end of the course to reinforce learning and retention and gauge your understanding of the topic.

I.D.# PD330905ON

FEES
See above

2-HOURS/2 CEUS

Get more information about the webinar recording:
training.sae.org/webrecordings/pd330905ON
INTRODUCTION TO HYBRID AND ELECTRIC VEHICLE BATTERY SYSTEMS

This course introduces the concepts of hybrid vehicles, their missions and the role of batteries in fulfilling those requirements. Topics examined include: limitations, trends in development, customer wants and needs, battery system development timelines, comparison of electrochemistries and safety. Current offerings, cost factors, pack design considerations and testing are also reviewed. You will have an opportunity to perform a battery pack analysis exercise using a real world application and are requested to bring a calculator to class.

LEARNING OBJECTIVES
By attending this seminar, you will be able to:

• Capture customer wants and expectations of the battery system
• Identify factors that drive power and energy requirements
• Determine test program structure
• Compare and contrast the newest relevant battery technologies
• Calculate estimates of electric range and quantify the assumptions
• Critically assess media claims of new battery discoveries

WHO SHOULD ATTEND
Professionals recently assigned to their roles or returning to HEV or EV programs. Those involved in all aspects of hybrid vehicle programs and product planners and program managers will benefit.

CONTENT HIGHLIGHTS

• Review of Common Vehicle Product Offerings; Role of the Battery
• Product Liability / FMEA; Failure Modes
• Safety
• Battery Development Cycle; Battery Pack Design
• Cost Factors and System Considerations; Electrochemistry Selection
• Range Estimation (hybrid vs. electric)
• Real-life Battery Analysis Exercise
• Vehicle Trends; Battery Trends, Warranty, Recycling

INSTRUCTOR
Erik Spek
Chief Engineer for TÜV SÜD Canada

The powertrain components of hybrid vehicles, such as the drive motor, motor controller and cooling system are somewhat familiar to the automotive industry, the battery systems are a relatively unfamiliar aspect.

I.D.# C0626

SCHEDULE
November 24-25, 2014
Troy, Michigan

FEES
List: $1,315
Members
Classic: $1,185
Premium: $1,115
Elite: $1,055

TWO-DAYS/1.3 CEUS

Get the complete course description and register:
training.sae.org/seminars/c0626
NEW! FUNDAMENTALS OF HYBRID AND ELECTRIC VEHICLES

This course will cover the interdisciplinary aspects of electric and hybrid vehicles where engineers of various disciplines have to work together to develop the system. The fundamentals, design philosophies for electric and hybrid vehicles, component selection and sizing, and modeling and control strategies will be covered. Existing electric and hybrid vehicle models will be used as case studies. Participants will learn about the future trends in battery, power electronics and motor drive technologies.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

• Describe the pros and cons of different types of EVs and HEVs
• Perform basic designs of EV and HEV systems using series, parallel and series-parallel architectures
• Size an EV or HEV powertrain
• Size components for EVs or HEVs, including electric motors, power electronics and energy sources
• Develop specifications for EV/HEV systems and components
• Define the testing procedures for EVs and HEVs
• Discuss the emerging technologies, engineering challenges, and development trends in EVs and HEVs

WHO SHOULD ATTEND

Engineers in electrical, mechanical, chemical, automotive, and other related fields who are interested in the EV/HEV design, development, modeling, manufacture and marketing.

SAVE EVEN MORE ON EDUCATION AND TRAINING FROM SAE

SAE Members - have you already taken a Professional Development course in the last few months? You could qualify for an additional 20% off of a future course.

SAE members who have completed an SAE training in the last 12-months can get an additional 20% off of additional courses if taken in the same 12-month period.

Call SAE Customer Service to register and get your discount! 1-877-606-7323 (1-724-776-4970 outside the U.S. & Canada). Please use promo code FREQUENTPD when registering.
CONTENT HIGHLIGHTS

- Introduction to EVs and HEVs
- Vehicle Fundamentals
- Electric Vehicles/Electric Power Transmission Path
- Hybrid Vehicles/System Architectures
- HEV Powertrain Sizing Example
- HEV Control Strategies
- EV/HEV Modeling and Simulation
- Energy Storage Systems
- Electrical Machines and Drives
- Power Semiconductors and Electronics
- High Voltage System
- Motor Drive System Modeling and Simulation
- Controls and Communications
- Current EVs and HEVs
- Off-road vehicles
- Auxiliary Systems for EV/HEVs
- Thermal management
- System integration issues
- Emerging Technologies

INSTRUCTORS

Iqbal Husain
Distinguished Professor, North Carolina State University

Yilmaz Sozer
Faculty, The University of Akron

I.D.# C1232

SCHEDULE
July 21-23, 2014
Troy, Michigan

FEES

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2.5 DAYS /1.7 CEUS

Get the complete course description and register:
training.sae.org/seminars/c1232
HYBRID AND ELECTRIC VEHICLE ENGINEERING ACADEMY

The Hybrid and Electric Vehicle Engineering Academy covers hybrid and electric vehicle engineering concepts, theory, and applications relevant to HEV, PHEV, EREV, and BEV for the passenger car industry. While the theory and concepts readily apply to the commercial vehicle industry as well, the examples and applications used will apply primarily to the passenger car industry.

LEARNING OBJECTIVES

Upon completion of the academy, participants will be able to:

• Define and analyze fundamental electrochemistry of battery operation and performance requirements for HEV, PHEV, EREV and full electric vehicle applications
• Estimate the size of a cell to meet a specific requirement
• Create a cradle-to-grave, or cradle-to-use list of materials used in any type of automotive battery
• Compute the temperature response of battery cell and pack assemblies for a simple model
• Describe the functions performed by a Battery Management System (BMS)
• Explain different approaches to estimating state of charge, state of health, power and energy
• Apply the operation of brushless dc and induction motors to HEV and EV vehicles
• Define the torque speed curves for motors and the application to electric and hybrid electric vehicles
• Describe the features of buck, boost, and Transformer converters
• Compare and contrast the various industry and regulatory standards for hybrid vehicle components, batteries, and charging systems
• Describe the main hybrid and electric vehicle development considerations and performance requirements for various vehicle system
• Identify how to define key vehicle system requirements and select and size system components that best meet those requirements

WHO SHOULD ATTEND

Individuals who already have a basic understanding of hybrid and/or electric vehicles who are seeking to increase their knowledge and understanding of hybrid vehicle system applications, including mechanical and electrical application engineers, design engineers, project managers, and other individuals who are working with or transitioning to hybrid-electric powertrain development, will find this academy particularly helpful.
**CONTENT HIGHLIGHTS**

- Systems Integration and Analytical Tools
- Safety, Testing, Regulations, and Standards
- Thermal Management for Batteries and Power Electronics
- Battery Management Systems
- Electrochemistry and Battery Materials Design
- Power Electronics
- Electric Motors
- High Voltage Battery Charging Methods & Some Aspects of Battery Pack Design
- Lithium-Ion Battery Design
- Lithium-Ion Battery Modeling

**INSTRUCTOR**

See the course web page for a complete list of instructors.

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**I.D.# ACAD06**

**SCHEDULE**

December 1-5, 2014
Troy, Michigan

**FEES**

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**FIVE-DAYS / 3.8 CEUS**

Get the complete course description and register:
training.sae.org/academies/acad06
PLUG-IN VEHICLE CONDUCTIVE CHARGING, SAE J1772 EXPLAINED WEBINAR

SAE J1772 - Electric Vehicle and Plug-in Hybrid Electric Vehicle Conductive Charge Coupler is the first standard in the world reached by industry consensus that provides critical guidelines for safety, charging control and connectors used to charge plug in vehicles. Paving the way for an EV future, the standard accommodates the latest generation of vehicles that need to be plugged in for charging their high-energy batteries.

This course will uncover the details behind the SAE J1772 conductive charging interface. It will discuss overall plug-in vehicle charge strategy, electrical safety strategy, electrical and physical interface requirements and control strategy. Included in the course is background related to the National Electrical Code, third party listing requirements and necessary EMC and regulatory compliance. Upon completion of the webinar, the student will have enhanced knowledge of the properties of the Control Pilot and Proximity circuits and the necessary vehicle and Electric Vehicle Supply Equipment (EVSE) control responses necessary for SAE J1772 compliance.

LEARNING OBJECTIVES

By connecting with this webinar, you will be able to:

• Cite terminology used for plug-in vehicle charging
• Comprehend and apply codes, standards and regulations for plug-in vehicle charging
• Become proficient at the purpose and characteristics of the Control Pilot and Proximity control interfaces
• Implement the required control state transitions and responses for charging
• Comprehend the physical, mechanical, electrical, environmental and EMC requirements for EVSEs, charge connectors and vehicle inlets
• Design vehicle or EVSE electrical interfaces and controls in accordance to the requirements of SAE J1772™

WHO SHOULD ATTEND

Vehicle OEMs, Vehicle Tier 1 suppliers, EVSE/charge coupler equipment suppliers, Code inspectors, Code developers, Third party testing labs, Students, Electric Utilities, National Labs. This webinar will be best suited for individuals with a moderate understanding of plug-in vehicle charging. This webinar will provide details to help assure vehicles and EVSEs are compliant to the intent of SAE J1772™.
CONTENT HIGHLIGHTS

- Scope
- Terminology
- Charging Strategy (AC, DC, Power Levels)
- Codes, Standards and Regulatory Requirements:
  - General Conductive Charging System Descriptions
  - Charge Couple Requirements
  - Performance
  - General EV/PHEV Requirements
  - General EVSE Requirements
  - Control and Data

INSTRUCTOR

Gery J. Kissel
Engineering Specialist, Global Battery Systems Engineering, General Motors

I.D.# WB1046

SCHEDULE
May 6-8, 2014
Live Online
November 5-7, 2014
Live Online

FEES
List: $415
Members
Classic: $374
Premium: $353
Elite: $332

TWO, 2-HOUR SESSIONS/.4 CEUS

Get the complete course description and register:
training.sae.org/webinars/wb1046

ACCESS THIS COURSE ONLINE AND ON DEMAND AS A WEBINAR RECORDING.

SAE Webinar Recordings are audio/visual captures of live webinars and offer access to the unedited sessions, including instructor/participant interaction and Q&A. A learning assessment is available at the end of the course to reinforce learning and retention and gauge your understanding of the topic.

I.D.# PD331046ON

FEES
List: $385
Members
Classic: $347
Premium: $327
Elite: $308

30-DAY ACCESS/3.5-HOURS/.3 CEUS

Get more information about the webinar recording:
training.sae.org/webrecordings/pd331046ON
PRINCIPLES OF ELECTRIC DRIVES WEBINAR

More than two million hybrid vehicles worldwide utilize electric drive components, and battery technology has matured enough to enable major manufacturers to develop light-duty and commercial electric vehicles for mass production and sale. It is also likely that many conventional vehicles aspects of the technology as an integral part of efforts to meet U.S. CAFE standards and EU CO2 emission requirements. Industry professionals who are looking for a general understanding of the structure and components of vehicular electric drives will benefit from this course, which will cover theory, design, operation, and diagnostics of all major components used in electric drives as applied to all forms of vehicles, including charge-sustaining hybrids, plug-in hybrids, fuel cell hybrids, and battery electric vehicles. Battery chemistry, charging systems, power conversion, switching techniques, and traction motor construction will be discussed in detail.

LEARNING OBJECTIVES

By connecting with this webinar, you will be able to:

• Explain the design, function, and interactions of all major components of a typical electric vehicle powertrain
• Describe the operation, attributes, and behavior of battery packs, inverters, motor-generators, on-board and off-board charging systems, and DC-DC converters across all ranges of performance
• Identify the different design configurations and requirements of electric drives in hybrids, plug-in hybrids, fuel cell hybrids, and battery electric vehicles
• Classify different types of battery packs, inverters, motors, and DC-DC converters
• Analyze the design and construction of a given electric powertrain, and evaluate its particular attributes and drawbacks
• Assess fault detection and protection strategies and circuits as well as on-board diagnostic requirements
• Appraise technical limitations of electric drive components, as well as design and technological trends that may address such limitations

WHO SHOULD ATTEND

Powertrain engineers, electrical engineers, project planners, project managers, technical writers, safety officers, component specialists, component suppliers, and anyone else who is professionally impacted by the development of electric vehicle technology will be able to use this information to help them transition to working with electric drives.

“Well done. I very much like the capability to download workbooks and recording for use offline (e.g. at the airport). Jack Rosebro has excellent background and insight into electric drive technology and takes great care to answer questions thoroughly.”

Kevin Walsh
Staff Engineer
Fisker Automotive Inc
CONTENT HIGHLIGHTS

• Calculating Onboard Energy Storage Needs
• Battery Chemistries and Lithium-Ion Sub-Chemistries
• Battery Pack Performance
• Integrating an Energy Storage System into the Chassis
• Thermal Management Systems and Considerations; System Degradation
• Onboard Charging Strategies
• Recycling and Recovery of Battery Cell Material
• Charging Systems for Electric Vehicles
• Inductive and Conductive Charging
• Power Supply Considerations
• Vehicle-to-Grid Systems
• Power Transistors And Switching Operation
• Basic Motor Control
• Pulse-Width Modulation; PWM Inefficiencies
• Boost Converters
• Thermal Management of Inverters
• Upcoming Power Electronics Developments and Enhancements
• Rotor and Stator Construction
• Torque Production, Motor-Generator Types
• Operation in Motor, Generator, and High-Speed Modes
• Field-Weakening
• Choosing a Motor-Generator, Thermal Management of Motor-Generators
• EMF Considerations

INSTRUCTOR

Jack Rosebro
Independent Consultant

I.D.# WB0941

SCHEDULE
July 8-17, 2014
Live Online
December 9-18, 2014
Live Online

FEES
List: $620
Members
Classic: $558
Premium: $527
Elite: $496

FOUR, 2-HOUR SESSIONS/.8 CEUS

Get the complete course description and register:
training.sae.org/webinars/wb0941
SAFE HANDLING OF HIGH VOLTAGE BATTERY SYSTEMS

Electric and hybrid vehicles are becoming more visible on today’s roadways and the automotive companies are working hard to make these vehicles as transparent as possible to enhance consumer acceptance. This seminar will introduce participants to the risks encountered in handling high voltage battery systems and their component parts. With the understanding of these risks, the seminar will then address how to raise risk awareness and then methods of dealing with those risks. The outcome of this seminar should be improved avoidance of personal injury, reduced risk of reputation loss and product liability actions and reduced risk of loss of property and time.

Students will have an opportunity to participate in a real world battery handling case study scenario in which they will identify solutions for potential risk situations.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

• Identify the handling risks of the battery system
• Respect the risks and work with them
• Develop a safety program to manage the risks

WHO SHOULD ATTEND

This seminar is primarily intended for vehicle systems, battery and battery systems integration, testing, electrical engineers, and thermal management engineers recently assigned to their roles or returning to hybrid or electric vehicle programs. It will also be beneficial to those involved in the specification, design, development, testing and planning of hybrid vehicle programs. Prototype shop staff will find the safety protocol aspects helpful.

The instructor recommends the SAE International course, Introduction to Hybrid and Electric Vehicle Battery Systems (I.D.# CO626), as a prerequisite to this course. See the description on page 67.
CONTENT HIGHLIGHTS

• High Voltage Batteries
  • Electrochemical energy
  • Construction aspects and controls
  • DC vs AC
  • Lithium Ion aspects
• Risks of HV Batteries
  • Team exercise: identifying the risks
  • Risk drivers
  • Hazards classifications
  • Cell vs pack level
• Risk Management
  • Abuse prevention
  • Best practices, design measures, error proofing
  • Prevention & warnings
  • Claims vs. test data
  • Housekeeping
  • Containment
• High Voltage Issues in Engineering and Manufacturing Environments
  • Avoidance of internal dangers from handling
  • What can go wrong in different environments
  • MSDS
  • Special tools
  • Handling of ‘failed’ batteries or cells
  • Dealing with an incident - team exercise

INSTRUCTOR

Erik Spek
Chief Engineer, TÜV SÜD Canada
This seminar provides an introduction to the fundamental concepts and evolution of passenger car and light truck 4x4/all-wheel drive (AWD) systems including the nomenclature utilized to describe these systems. Basic power transfer unit and transfer case design parameters, component application to system function, the future of AWD systems, and emerging technologies that may enable future systems are covered. This course is an excellent follow-up to the SAE course, A Familiarization of Drivetrain Components (I.D.# 98024). See the description for this course on page 4.

LEARNING OBJECTIVES
By attending this seminar, you will be able to:

• Identify front wheel drive and rear wheel drive vehicle architectures
• Identify part time, full time, and on demand all-wheel drive systems
• Explain the benefits of all-wheel drive over two-wheel drive
• Quantify all-wheel drive traction and mobility benefits
• Describe auxiliary axle disconnect systems
• Explain basic vehicle dynamics performance and the effect of AWD on performance
• Identify couplers vs. biasing devices and their basic function
• Describe the differences between mechanical and electrical implementation in AWD systems
• Describe basic control strategies and logic
• Discuss advanced propulsion concepts and systems

WHO SHOULD ATTEND
This seminar is designed for engineers (working with ground vehicles) who need to master AWD componentry, and the function and effect of those components. Engineers new to the 4WD/AWD field, as well as managers, marketing personnel, purchasing professionals and others interested in all-wheel drive fundamentals will benefit from this seminar.

“Although a complex topic, this seminar provided a one day overview of many of the latest devices in the automotive drivetrain arena that are currently in the market.”

Steven J. Wesolowski
Director of Global Strategies
Dana Corporation
CONTENT HIGHLIGHTS

• Front wheel drive and rear wheel drive vehicle architectures
• Part time, full time, and on demand all-wheel drive systems
• Benefits of all-wheel drive as compared to two-wheel drive
• Quantifying all-wheel drive traction and mobility benefits
• Auxiliary axle disconnect systems
• Basic vehicle dynamics performance and the effect of AWD on performance
• Couplers vs. biasing devices
• Mechanical vs. electrical implementation in AWD systems
• Effects of AWD driveline configuration on NVH and weight
• Basic control strategies and logic
• Advanced propulsion concepts and systems

INSTRUCTOR

Joseph Palazzolo
Chief Engineer – Geared Products, GKN Driveline Torque Technology Group

I.D.# C0305

SCHEDULE
December 4, 2014
Troy, Michigan

FEES
List: $775
Members
Classic: $695
Premium: $655
Elite: $615

ONE-DAY/0.7 CEUS

Get the complete course description and register:
training.sae.org/seminars/c0305

ALSO AVAILABLE AS ONLINE, ON-DEMAND COURSE.

Fundamentals of Automotive All-Wheel Drive Systems e-Seminar

Convenient, portable, and with core content from the instructor-led seminar, this 4.5-hour e-seminar option offers an alternative way to receive the same instruction as the live classroom learning without the expense of travel and time away from the workplace. The course offers ten video modules accompanied by a handbook.

I.D.# PD13556ON

FEES
List: $265
Members
Classic: $239
Premium: $225
Elite: $212

4.5-HOURS/.5 CEUS

View the complete course description and a video demo:
training.sae.org/eseminars/awdsystems
Show the industry the depth of your organization’s expertise and complete a series of courses designed to deepen your knowledge in a specific technical area. To learn more about these certificate programs related to Power and Propulsion, and other certificate programs you can pursue visit training.sae.org/credentialing.

**TRANSMISSION/DRIVETRAIN CERTIFICATE PROGRAM**

This program familiarizes engineers with key drivetrain components and how those components function as a system. By completing the certificate, engineers can increase their expertise within the drivetrain body of knowledge and, at the same time, earn the SAE Certificate of Achievement.

The following courses are required:

- A Familiarization of Drivetrain Components - page 4
- Fundamentals of Automotive All-Wheel Drive Systems - page 80
- Fundamentals of Modern Vehicle Transmissions - page 6
- Introduction to Gears - page 08
- High-Performance Differentials, Axles, & Drivelines (I.D.# C1113 - visit training.sae.org/seminars/c1113 for more information)
- Powertrain Selection for Fuel Economy & Acceleration Performance - page 30

**DIESEL TECHNOLOGY CERTIFICATE PROGRAM**

This certificate equips engineers with a solid understanding of diesel engines, emissions and aftertreatment strategies, and related components including fuel injection and air management. The program requires completion of courses that address these areas and offers further depth through a menu of electives.

The following courses are required:

- Diesel Engine Technology - page 19
- Common Rail Diesel Fuel Injection - page 15
- Turbocharging Internal Combustion Engines - page 38
- Advanced Diesel Particulate Filtration Systems - page 44

Completion of the Diesel Engine Technology Engineering Academy can be used as a substitute for Diesel Engine Technology and one elective.

There are a wide variety of elective options for this certificate. Visit training.sae.org/certificate/dieselttech to see the complete list of electives.

**SI ENGINE CERTIFICATE PROGRAM**

This certificate is designed to familiarize engineers with key spark ignition engine components and technologies and how they function as a system. By completing the certificate, engineers can acquire fairly deep engine expertise and, at the same time, earn an SAE credential.

The following courses are required:

- Basics of Internal Combustion Engines - page 34
- Internal Combustion Systems: HCCI, DoD, VCT/VVT, DI and VCR - page 26
- Turbocharging Internal Combustion Engines - page 38
- Powertrain Selection for Fuel Economy and Acceleration Performance - page 30

There are a wide variety of elective options for this certificate. Visit training.sae.org/certificate/siengine to see the complete list of electives.
UPON COMPLETION OF THIS ENGINEERING ACADEMY, YOU WILL BE ABLE TO:

• Assess your own management style and develop an action plan for continued growth
• Select communication behaviors which enhance performance and team interactions
• Identify traits that are important for managers to be effective coaches
• Identify keys to successful decisions
• Assess your individual behavioral style in conflict situations and identify best practices for dealing with conflict
• Select positive strategies for dealing with employee performance issues
• Identify specific types of interview questions which provide you with the most valuable information for the selection process
• Identify important attributes, as well as impediments, of high performing teams

training.sae.org/academies/acad09
SELECTED LIVE LEARNING SCHEDULE

For the most up-to-date schedule visit: training.sae.org/all/bydate

Greer, South Carolina - BMW Performance Center
May 19-21  Applied Vehicle Dynamics -- I.D.# C0414

Charlotte, North Carolina - Charlotte/Mecklenburg Police Training Academy
May 13-16  Accessing and Interpreting Heavy Vehicle Event Data Recorders -- I.D.# C1022

Troy, Michigan - SAE International Office
May 13-14  Introduction to Failure Mode and Effects Analysis for Product and Process -- I.D.# C1201
May 15-16  Sound Package Materials for Vehicle Noise Control -- I.D.# 92032
May 19-20  In-Vehicle Networking with LIN and FlexRay Applications -- I.D.# C0136
May 19-21  Gasoline Direct Injection (GDI) Engines -- I.D.# C0109
May 19-21  Fundamentals of Heavy Truck Dynamics -- I.D.# C0837
May 21-22  Introduction to Welded Joints -- I.D.# C1343
May 28-30  Applying Automotive EDR Data to Traffic Crash Reconstruction -- I.D.# C1210
May 28-30  Advanced Vehicle Dynamics for Passenger Cars and Light Trucks -- I.D.# C0415

Troy, Michigan – SAE International Office
May 12-16  Engineering Management Academy

Warrendale, PA – SAE International Office
May 20-21  Understanding the FAA Aircraft Certification Process -- I.D.# C0821
May 22-23  Aircraft Cabin Safety and Interior Crashworthiness -- I.D.# C0926

Webinar - Live Online
May 13  Introduction to Hybrid Powertrains Webinar -- I.D.# C0903
May 15  Basic Hybrid and Electric Vehicle Safety Webinar -- I.D.# C0904
May 20  Plug-in Hybrids: Opportunities and Challenges Webinar -- I.D.# C0905
May 19-30  Root Cause Problem Solving: Methods and Tools Webinar -- I.D.# WB0931
May 22  Hybrid and Electric Vehicles: Current Production, Future Strategies Webinar -- I.D.# C0906

McLean, VA – LMI
Jun 3-4  Damage Tolerance for Gas Turbine Engines – I.D.# C1323
Jun 5-6  Understanding the FAA Parts Manufacturer Approval Process – I.D.# C1324

Norwalk, California - Cerritos, College (SCCT)
Jun 9  AS5553 and Counterfeit Electronic Parts Avoidance -- I.D.# C1302
Jun 9-10  Design for Manufacturing & Assembly (DFM/DFA) -- I.D.# 92047
Jun 10-11  Implementation of SAE AS6081- Counterfeit Electronic Parts Avoidance for Distributors -- I.D.# C1135
Jun 11-12  Understanding and Supporting Aircraft Accident Investigation and Reconstruction – I.D.# C1143
Troy, Michigan - SAE International Office
Jun 2-6  Diesel Engine Technology Engineering Academy -- I.D.# ACAD03
Jun 2  Introduction to NVH Aspects of Hybrid and Electric Vehicles -- I.D.# C1128
Jun 2-3  Control Systems Simplified -- I.D.# CO525
Jun 5-6  Vehicle Frontal Crash Occupant Safety and CAE -- I.D.# C0621
Jun 09-10  Program and Risk Management -- I.D.# C0409
-- I.D.# 98003
Jun 23-25  Commercial Vehicle Braking Systems -- I.D.# C0233
Jun 24  Surface Texture: Specification and Control -- I.D.# C1110
Jun 30-Jul 2  Strategic Leadership -- I.D.# C0620

Webinar - Live Online
Jun 2-13  Finite Element Analysis (FEA) for Design Engineers Webinar
-- I.D.# WB1241
Jun 6  Introduction to AS9100: Requirements and Value-Added Implementation
Webinar -- I.D.# WB1244
Jun 9-12  Design FMEA Update: What's New in J1739 Webinar -- I.D.# WB0955

Norwalk, California - Cerritos, College (SCCT)
Jul 21-22  Diesel Engine Technology -- I.D.# 93014
Jul 21-22  Engineering Project Management -- I.D.# 99003
Jul 22-24  Weibull-Log Normal Analysis Workshop -- I.D.# 86034

Troy, Michigan - SAE International Office
Jul 21  The Tire as a Vehicle Component -- I.D.# C0101
Jul 21-23  Fundamentals of Electric and Hybrid Electric Vehicles -- I.D.# C1232
Jul 22  Tire & Wheel Safety Issues -- I.D.# C0102
Jul 24-25  Product Liability & The Engineer -- I.D.# 82001
Jul 28-30  Fundamentals of Modern Vehicle Transmissions -- I.D.# 99018
Jul 28-30  Principles of Cost and Finance for Engineers -- I.D.# C0828
Jul 31-Aug 1  Fundamentals of Steering Systems -- I.D.# C0716

Webinar - Live Online
Jul 8-17  Principles of Electric Drives Webinar -- I.D.# WB0941

Troy, Michigan - SAE International Office
Aug 4-5  Threaded Fasteners and the Bolted Joint -- I.D.# 95030
Aug 6-8  Managing Engineering and Technical Professionals -- I.D.# C0608
Aug 6-8  Fundamentals of Metal Fatigue Analysis -- I.D.# 94024
-- I.D.# C0135
Aug 11-12  Modern Fluids for Crankcase Engines: An Overview -- I.D.# C0704
Aug 11-13  Turbocharging Internal Combustion Engines -- I.D.# C0314
Aug 18-20  Combustion & Emissions for Engineers -- I.D.# 97011
Aug 18-20  Hydraulic Brake Systems for Passenger Cars & Light Trucks -- I.D.# C0509
Aug 21-22  Leading High Performance Teams -- I.D.# C0410
Aug 25-27  Gasoline Direct Injection (GDI) Engines -- I.D.# C1009

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