FALL ISSUE; VOL. 2

ELECTRICAL & ELECTRONICS TECHNOLOGY

EDUCATION & TRAINING GUIDE

December 2017 – December 2018

PLAN YOUR TRAINING FOR 2018! NEXT YEAR'S OFFERINGS INCLUDED.

PLUS—Explore Related Electrical & Electronics Technology Resources on pages 40–41!

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In this issue of the ***Electrical and Electronics Technology Education & Training Guide***, you'll find an extensive selection of courses designed to keep you ahead of the industry.

PLUS - don't miss the suggested Related Electrical and Electronics Technology Resources on page 42. We've selected key SAE books, standards, journals, and technical events to further your professional development and deepen your technical knowledge.

THIS GUIDE INCLUDES COURSES THAT EXPLORE THE FOLLOWING TOPICS

- The connected vehicle & autonomous vehicles
- Cybersecurity
- Hybrid and electric vehicle safety, battery systems, and powertrains
- Automotive functional safety standard ISO 26262
- In-vehicle user interfaces

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WHY SAE? WHAT OUR CUSTOMERS ARE SAYING

"Pierces the cloud of confusion regarding competing automotive networking standards."
(In reference to Acquiring and Analyzing Data from Sensors and In-Vehicle Networks - page 16)
Sherman Couch
Director of Engineering
Constellation Data Systems, Inc.

"Very informative. Great instructor. Highly recommend this course to anyone who deals with OBD."
(In reference to Emissions-Related OBD Systems: A Design Overview - page 18)
Vinay Premnath
Research Engineer
Southwest Research Institute

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

CATALOG KEY

Look for the icons below included with the course descriptions. The icons indicate delivery formats for the course and whether the course is part of an SAE Certificate program.

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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 Web Seminar offered live and online via telephone and internet connection

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These offerings are available online anytime the participant would like to access the course through the internet

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This icon indicates that this course is part of an SAE International curriculum-based, multi-course certificate.

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As an IACET Accredited Provider, SAE International offers CEUs for its programs that qualify under the ANSI/IACET Standard.

TABLE OF CONTENTS

NEW! PERFORMING A CYBERSECURITY THREAT ANALYSIS AND RISK ASSESSMENT

SAE J3061 sets out a recommended cybersecurity engineering process framework for organizations developing cyber physical systems. One of the recommendations of this framework is to carry out a threat analysis and risk assessment early in the product development. A threat analysis identifies and models the relevant threats against assets, and a risk assessment classifies the impact and likelihood associated with each threat. The approach enables the prioritization of risks and appropriate risk treatment measures to be determined in subsequent development phases.

This live, online course, provides you with the knowledge of appropriate methods to carry out threat analysis and risk assessment for the development of a typical vehicle feature.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

- Identify relevant threats
- Carry out threat modelling
- Create attack tree analyses
- Develop risk assessment
- Determine Cybersecurity Assurance Levels and Security Goals

WHO SHOULD ATTEND

To get full benefit from the course, you should have prior knowledge and experience of J3061; participation in Keys to *Creating a Cybersecurity Process from the J3061 Framework* (I.D. WB1604, page 5), or equivalent training / experience is strongly recommended within their organizations.

CONTENT HIGHLIGHTS

- Threat Analysis
  - Threat identification
  - Threat modeling
  - Attack trees
  - Exercise 1: Threat Analysis
- Risk Assessment
  - Severity classification
  - Likelihood classification
  - Exercise 2: Risk Assessment
- Assurance Levels and Cybersecurity Goals
  - Determining the assurance level
  - Developing cybersecurity goals
- Worked example: Cybersecurity Goals

INSTRUCTORS

David Ward
Senior Technical Manager, Functional Safety, HORIBA MIRA

Paul Wooderson
Senior Functional Safety/Cyber Security Engineer, HORIBA MIRA

I.D.# WB1742

SCHEDULE
2018 offerings are being scheduled for this course. Check the course web page for the most up-to-date information and schedule.

FEES

List:	$550
Members	
Classic:	$495
Premium:	$468
Elite:	$440

THREE, 2-HOUR SESSIONS/.6 CEUS

Get the complete course description and register: training.sae.org/webseminars/wb1742/

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CYBERSECURITY: INTRODUCTION TO EMBEDDED SYSTEM EXPLOITATION

Embedded hardware is everywhere from your vehicle's infotainment system to medical devices and everything else in-between. One would think that such devices would be secure against attack; however, for a large number of devices this is not the case. So, how do we go about identifying and mitigating (or capitalizing) the potential security vulnerabilities of embedded hardware? The answer to this question, and the subject of this seminar, is through the reverse engineering of the hardware itself.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

- Identify key hardware components of embedded systems
- Research and use datasheets
- Interpret basic schematics
- Locate and utilize hidden communication paths (i.e. debug ports)
- Interface target hardware with a PC
- Use a logic analyzer to capture communications between an Micro Controller Unit (MCU) and external memory
- Extract firmware from an embedded system

WHO SHOULD ATTEND

Those wanting a basic understanding and the corresponding skill set needed for the hardware reverse engineering of embedded systems.

CONTENT HIGHLIGHTS

- Overview of Hardware Reverse Engineering
- Engineer Bling – Gather Your Tools
- Basic Electronic Concepts for the Budding Hardware Engineer
- Key Components in Embedded Systems
- Embedded Systems Communication Protocols
- Perimeter Reconnaissance
- Cracking Open the Box
- Identification of Pins and Components
- Datasheet Reconnoitering
- Building a Pre-Attack Plan
- Covert Operations

INSTRUCTOR

Michael Messuri
Senior Systems Analyst and Exploitation Engineer, Assured Informations Security, Inc.

This seminar includes lecture and hands-on exercises. Students get the opportunity to attack and defeat a custom embedded device.

I.D.# C1524

SCHEDULE
2018 dates are being scheduled. Please check the course web page for the most up-to-date schedule and information.

FEES

List	$1,530
Members	
Classic	$1,377
Premium	$1,301
Elite	$1,224

TWO-DAYS/1.3 CEUS

Get the complete course description and register: training.sae.org/seminars/c1524/

KEYS TO CREATING A CYBERSECURITY PROCESS FROM THE J3061 PROCESS FRAMEWORK

This course defines key concepts in cybersecurity and discusses what a cybersecurity process consists of and why one is needed for the development of cyber-physical vehicle systems. The course discusses process framework as described in J3061 enabling you to relate it to your own organization's processes, including cybersecurity and safety activities. The instructors, key authors of the standard, provide guidance on tailoring the standard's process framework into an internal process to build cybersecurity robustness into cyber-physical systems.

LEARNING OBJECTIVES

By participating in this web seminar, you will be able to:

- Define key cybersecurity concepts
- Describe what a process consists of and why a cybersecurity process is needed
- Relate the process framework described in J3061 to your own development processes
- Recognize ways to integrate cybersecurity and safety within your organization
- Describe analysis activities to be performed with respect to an effective cybersecurity process
- Recognize potential pitfalls and key issues with respect to implementation

WHO SHOULD ATTEND

Anyone involved in cybersecurity including those wishing to lead their organization in implementing and applying a cybersecurity process.

CONTENT HIGHLIGHTS

- Brief History of Automotive Security and Cybersecurity
- Cyber-Physical Systems
- Five Levels of Vehicle Attack
- Reactive vs. Proactive Approach to Cybersecurity
- Key Concepts in Cybersecurity Defined
- Introduction to J3061—scope, rational, and intent
- When to Apply a Cybersecurity Process
- Overall management of cybersecurity
- Product development at the system, hardware and software levels
- Relationship between Cybersecurity Process and Safety Process
- Tailoring the J3061 Process Framework into an Internal Process

INSTRUCTORS

Barbara Czerny
Sr. Technical Specialist Safety and Cybersecurity, ZF TRW

David Ward
Senior Technical Manager, Functional Safety, HORIBA MIRA

The information provided equips you with the necessary foundation to begin tailoring the J3061 process framework for application within your organization.

I.D.# WB1604

SCHEDULE
November 27-December 1, 2017
Live Online

February 12-16, 2018
Live Online

June 18-22, 2018
Live Online

December 12-19, 2018
Live Online

FEES

List:	$610
Members	
Classic:	$549
Premium:	$519
Elite:	$488

ONE, 2-HOUR SESSION; TWO, 2.5-HOUR SESSIONS/ 0.7 CEUS

Get more information and register: training.sae.org/webseminars/wb1604/

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CYBERSECURITY: AN INTRODUCTION FOR THE AUTOMOTIVE SECTOR

What does cybersecurity mean? Who is attacking and why? What must we change? What is the larger organization's role? What will the government likely do and how will it affect us? What does "secure" look like?

We live in an age when cyber-related recalls will happen, when remote, over-the-air updates will become routine, and in which our cars have more lines of code than a small office. This seminar introduces critical cybersecurity concepts and puts them in an automotive context. Interaction and discussion is important, so after each lecture block there is a discussion period and a written work product.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

- Describe key concepts in automotive cybersecurity such as the InfoSec Triad; Threat, Vulnerability, and Risk; Defense in Depth, etc.
- Understand the importance of organizational roles and support, and how doing this can make cybersecurity an operational value proposition and not just a costly after-thought
- Understand and recognize good software and embedded security practices
- Understand why "hackers" are focusing on the automotive industry, and how they tend to think and operate

WHO SHOULD ATTEND

Anyone not familiar with automotive cybersecurity. Engineering staff and management looking to learn about the cybersecurity issues that affect all aspects of the automotive industry

CONTENT HIGHLIGHTS

- InfoSec Triad – "Plus": Confidentiality; Integrity; Critical Design Features
- InfoSec Governance: Standards; Ongoing monitoring; Oversight
- Secure Software Development
- Hackers
- Embedded Security
- Hardware and Software Cybersecurity Techniques
- Supply Chain Cybersecurity
- Built-in vs. Bolt-on Argument
- Defense In-Depth

INSTRUCTOR

Karl Heimer or **Robert Dekelbaum**
Founding Partner, AutoImmune, Inc.

This course cuts through to the "so what" basics that enable understanding and provides ideas to implement in your company.

I.D.# C1619

SCHEDULE
2018 offerings are being scheduled for this course. Check the course web page for the most up-to-date schedule and information.

FEES

List:	$810
Members	
Classic:	$729
Premium:	$689
Elite:	$648

ONE-DAY/.7 CEUS

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P151640

INTRODUCTION TO HIGHLY AUTOMATED VEHICLES

This course familiarizes you with the technologies enabling advanced driver assistance systems and how they integrate with existing passive occupant crash protection systems. Learn how ADAS functions perceive the world, make decisions, and either warn drivers or actively intervene in controlling the vehicle to avoid or mitigate crashes.

Every year, the U.S. experiences more than 32,000 traffic deaths and over 3.8 million crash injuries. While the trend in traffic deaths has been downward for the past decade, most of this reduction has been the result of optimizing passive occupant crash protection systems such as seatbelts and airbags.

LEARNING OBJECTIVES

By attending this seminar you will be able to:

- Explain the SAE Levels of Automation and where different ADAS functions fit in the hierarchy
- Explain the ADAS functions and articulate their limitations
- Identify different sensors used in advanced driver assistance systems, how they operate, and their limitations
- Analyze how different sensors can be combined to improve overall system performance
- Describe the current and future methodologies used in developing ADAS algorithms
- Articulate how ROC curves, DOE and Monte Carlo techniques can be used to measure and improve algorithm performance
- Critically examine the proposed federal rules and validation methods for advanced driver assistance systems
- Analyze how active safety systems may affect the performance of existing passive occupant safety systems and how integration of the systems might be accomplished
- Describe liability and policy considerations for OEM's and Tier suppliers

WHO SHOULD ATTEND

Anyone involved with vehicle safety performance or concerned with proposed NHTSA rulemaking; insurance industry analysts developing coverage standards for vehicles with active safety technologies.

CONTENT HIGHLIGHTS

- Role of Vehicle Automation in Reducing Traffic Fatalities
- Three Main Functions Provided by Highly Automated Vehicles (HAVs)
- Sensors Used in Highly Automated Vehicles
- Levels of Automation
  - BASt; NHTSA
  - SAE - Prior to September 2016 & September

2016 Operational Driving Domain revision
  - Comparison of the Three Versions
  - Level 3 Handoff Problem
- Operation / Functionality of Various HAV Capabilities, including:
  - Blind spot warning / Do not pass warning / Left turn assist
  - Backup assist / cross traffic warning
  - Lane departure warning; Lane keep assist
  - Cruise control/Adaptive cruise control
  - Forward collision warning; Collision imminent steering
  - Automatic emergency braking
  - Pedestrian detection
  - Auto park / park assist
  - Platooning
- SAE Level of Automation in Each Application
- Advantages and Limitations of Each Capability
- Sensor(s) used in Each Capability
- Technology Spread, Effects on Insurance Claims
- Sensors – Passive and Active
  - GPS; GLONASS; IMU; Gyros; Cameras; Ultrasonic; Radar; Lidar; Leddar; Matrix TOF camera; DSRC
  - Limitations of Sensors Used in HAV Capabilities
  - Sensor Performance; Sensor Recalls
- Algorithms: types; examples; Using ROC Analysis to Measure Algorithm Performance
- Testing Used in Development of Systems; Strengths & Weaknesses
- Basic Network Architecture of a Modern Vehicle
- Probable Attack Surfaces & Their Vulnerabilities
- OBD II Vulnerabilities
- Possible Defenses Against Attacks
- NHTSA October 2016 Best Practices Guidance
- Ethical Challenges
  - Differences Between Human and Autonomous Crash Decision Making
  - Rational Decision-making Approaches; Deontology and Consequentialism
  - Artificial Intelligence Approach - Strengths and Weaknesses
- Liability
- Regulations
- HAV Implications for Passive Safety
- HAV Public / Industry Misconceptions

INSTRUCTOR

Jeffery Blackburn
North American Sales Manager, Tass International

I.D.# C1603

SCHEDULE

December 7-8, 2017
Shanghai, China

February 26-27, 2018
Herndon, Virginia

April 9-10, 2018
Detroit, Michigan

July 23-24, 2018
El Segundo, California

November 6-7, 2018
Troy, Michigan

FEES

List	$1,370
Members	
Classic	$1,233
Premium	$1,165
Elite	$1,096

TWO-DAYS/1.3 CEUS

Get the complete course description and register: training.sae.org/seminars/c1603/

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NEW! INTRODUCTION TO RADAR FOR AUTOMOTIVE APPLICATIONS

This course covers radar fundamentals, emphasizing the understanding of physical principles and limitations of radar systems from the perspective of radar returns from objects of interest to automotive radar including vehicles, pedestrians and transportation infrastructure. You are exposed to all aspects of radar design at a level detailed enough to understand system engineering estimates for the major functions by examining the basic functions of radars, from the waveform generation in the transmitter, all the way to matched filter detection in the receiver. Gain an understanding of how to characterize the impact on these basic functions due to radar design parameters. Trends in hardware and the associated benefits and trade-offs of new technologies is discussed.

The course is taught from the perspective of a system level that can be used to evaluate design choices and understand their impact on the radar system as a whole.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

- Define basic radar operation from the perspective of waveform generation, RF carrier insertions, transmitter, channel effects, receiver mixing, and matched filtering
- Define basic radar design parameters including wavelength, bandwidth, antenna size, beam-schedule, and transmitter power
- Compute basic radar design parameters using signal to noise ratio, range resolution, unambiguous range, Doppler resolution, and unambiguous Doppler
- Discuss the concept of a radar cross section and use statistical models for realistic performance estimates for radar cross-section, scattering from canonical objects, scattering from extended targets, and statistical models
- Characterize system performance using design parameters and quantities for Receiver Operating Characteristic (ROC) curves, and Detector Error Trade (DET) curves

WHO SHOULD ATTEND

This course will be particularly valuable for assisted driving advanced system engineers, active safety technology engineers, radar engineers, and safety test engineers.

CONTENT HIGHLIGHTS

- Basic Radar Architecture
- Radar Range Equation
  - Equivalent isotropically radiated power
  - Computing signal to noise ratio
- Antenna Basics
  - Aperture & radiation pattern
  - Mono-static vs. bistatic
  - Electronically steered antenna
- Radio Frequency Mixing
  - Carrier frequency mixing
  - Homodyne & heterodyne receiver
- Waveform Design
  - Bandwidth
  - Frequency & Pseudo-noise modulated continuous wave radar
  - Pulse repetition interval
- Matched Filter
  - Envelope detector output
  - Range & Doppler resolution
- Radar Range
- Automotive Radar Types
  - Overview of Applications
  - Automotive Radar Parameters
- Radio Propagation Channel
  - Signal to Clutter Ratio
  - Channel Fading
  - Radio Frequency Interference
- Character of Radar Targets
  - Radar Cross Section Definition
  - Canonical Shapes
  - Wavelength Effects
  - Polarization Effects
  - Statistical Character of Extended Targets
- Estimating Peformance
  - Hypothesis Testing for Detection
  - Statistics of Detector Output
  - Receiver Operating Characteristic and Detector Error Trade Curves

INSTRUCTOR

William Buller
Principal Investigator, Michigan Tech Research Institute

I.D.# C1627

SCHEDULE
April 12-13, 2018
Detroit, Michigan - *held in conjunction with the WCX: SAE World Congress Experience*

July 23-24, 2018
Troy, Michigan

November 5-6, 2018
Troy, Michigan

FEES

List:	$1,370
Members	
Classic:	$1,233
Premium:	$1,165
Elite:	$1,096

TWO-DAYS/1.3 CEUS

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NEW! ADAS APPLICATION: AUTOMATED EMERGENCY BRAKING

This one-day course is designed to provide an overview of the typical ADAS AEB system from multiple perspectives. A technical overview of the development cycle processes specific to AEB, including system level requirements and design architecture will be presented as well as design considerations for AEB from a functional safety (ISO 26262) perspective. A general overview of algorithm concepts for the various AEB subsystems will be demonstrated followed by a review of AEB system test and validation methods. Finally, discussion is facilitated toward understanding customer perception and acceptance of AEB at present. The participant should obtain a fundamental understanding of design principles and functional composition for a typical AEB system.

Active Safety, Advanced Driver Assistance Systems (ADAS) are now being introduced to the marketplace as they serve as key enablers for anticipated autonomous driving systems. Automated Emergency Braking (AEB) is one ADAS application which is either in the marketplace presently or under development as nearly all automakers have pledged to offer this technology by the year 2022.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

- Describe AEB features / functionality as provided by most OEMs, including the capabilities and limitations of typical AEB systems
- Identify key principles of vehicle dynamics and system engineering disciplines which are integral to AEB system development
- Describe the general activities required for driving and braking tasks and comment on how these form the bases for AEB system requirements
- Identify AEB system architectures and subsystem composition and describe the function and purpose of each subcomponent
- Identify functional safety (ISO 26262) implications specific to AEB including review of basic hazard and risk analysis examples
- Explain algorithm concepts and functions for each of the AEB subsystems
- Critically examine various methods and levels of testing specific to AEB
- Describe the current state of AEB development from a consumer perspective

WHO SHOULD ATTEND

This course is designed for engineers and managers within related professions who are looking for an in-depth technical overview of Automated Emergency Braking systems.

CONTENT HIGHLIGHTS

- Automatic Emergency Braking Overview
  - History: active safety origins
  - Key enablers for Automatic Emergency Braking (AEB)
  - AEB level of automation
  - AEB features and marketed benefits
- Primer: Basic Engineering Fundamentals
  - Vehicle dynamics; Wheel dynamics
  - System engineering requirements flow down
- AEB System Requirements
  - Basic driving tasks; Basic braking tasks
  - General & refined system requirements
- AEB System Architecture and Decomposition
  - Functional Architecture – sensing systems, warning systems, actuation systems
  - AEB operation modes
  - Physical Architecture – sensors, adaptive cruise control (ACC) ECU, body control module (BCM) ECU, electronic stability control (ESC) ECU
- AEB System Design: Safety
  - ISO-26262 framework
  - Hazard analysis and risk assessment exercise
  - AEB safety goals and requirements
  - Safety of the intended function (SOTIF) considerations
- AEB System Design: Performance Objectives
  - Sensing technology and implementation
  - Computational objectives: AEB ECU computing platforms
  - Human Machine Interface (HMI) warnings and considerations
  - Actuator objectives: braking actuator control design
- AEB System Test and Validation
  - AEB validation objectives
  - Subsystem testing
  - Vehicle level testing
- Conclusions and Future Direction
- Market penetration
- Customer acceptance
- Incremental steps towards full autonomy

INSTRUCTOR

Eldon Leaphart
Principal Engineer, Carr Engineering, Inc.

I.D.# C1704

SCHEDULE
April 11, 2018
Detroit, Michigan - *held in conjunction with the WCX: SAE World Congress Experience*

June 26, 2018
Troy, Michigan

October 17, 2018
Palm Desert, California

FEES

List:	$810
Members	
Classic:	$729
Premium:	$689
Elite:	$648

ONE-DAY/.7 CEUS

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CONTROL SYSTEMS SIMPLIFIED

The advent of digital computers and the availability of ever cheaper and faster microprocessors has brought a tremendous amount of control system applications to the automotive industry in the last two decades. From engine and transmission systems, to virtually all chassis subsystems (brakes, suspensions, and steering), some level of computer control is present. Control systems theory is also being applied to comfort systems such as climate control and safety systems such as cruise control or collision mitigation systems.

This seminar begins by introducing the highly mathematical field of control systems focusing on what the classical control system tools do and how they can be applied to automotive systems. Dynamic systems, time/frequency responses, and stability margins are presented in an easy to understand format. Utilizing Matlab and Simulink, you will learn how simple computer models are generated. Other fundamental techniques in control design such as PID and lead-lag compensators will be presented as well as the basics of embedded control systems. During this interactive seminar, you will utilize case studies to develop a simple control design for a closed loop system. And, with the aid of a simple positioning control experiment, you will learn the major components and issues found in many automotive control applications today.

"Great seminar to acquire practical understanding of control systems. The material was delivered in such a way that even an engineer out of school for 20 years could understand!"

Tim Drotar
Senior Engineer
Ford Motor Company

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

- Determine performance characteristics of open and closed loop systems such as time and frequency responses and stability margins
- Analyze compromises and select the best compromised solution between stability and closed loop performance metrics
- Model simple physical systems in MatLab/Simulink environment
- Analyze and design simple compensators in MatLab/Simulink environment
- Evaluate issues associated with digital control systems including effects of sampling time, word length, and throughput
- Explain the functions of various components found in today's automotive embedded control systems including ECU I/O section, software/algorithm, power electronics, and sensors and actuators
- Communicate with control systems designers more effectively in terms of technical issues as well as toolsets, and functional needs

WHO SHOULD ATTEND

This introductory course is designed for individuals with little or no background in control systems. Engineers, managers, and technical managers with backgrounds in systems, mechanical, electrical, or industrial engineering who work with vehicle chassis (suspension/brakes/steering), powertrains, comfort systems, vehicle dynamics, sensors/actuators, and diagnostics will find the seminar beneficial. Test engineers and technicians, patent attorneys, and business executives may also find this course valuable.

CONTENT HIGHLIGHTS

- Background Information
  - Examples and block diagrams—open and closed loop systems
  - Dynamic systems
  - Stability
  - Compromises of a closed loop system
- Model Development
  - Modeling philosophes
- Model Analysis
- Compensation (Controller Design) Methods
  - On-Off
  - Gain
  - PID
  - Lead-Lag
- Control System Design
- Embedded Systems
- Design Implementation
- Nonlinear/adaptive control
- Robust control
- Trends and tools
- Case Studies

INSTRUCTOR

Dr. Farhad Bolourchi
Staff Research Engineer II, Nexteer Automotive Innovation Center

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I.D.# C0525

SCHEDULE
February 12-13, 2018
Detroit, Michigan

September 12-13, 2018
Troy, Michigan

FEES

List:	$1,370
Members	
Classic:	$1,233
Premium:	$1,165
Elite:	$1,096

TWO-DAYS/1.3 CEUS

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EMISSIONS-RELATED OBD SYSTEMS: A DESIGN OVERVIEW

On-board diagnostics (OBD), 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 seminar provides 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

or

Igor Anilovich
Diesel OBD II and AECD Leader, General Motors Powertrain Group

“Very informative. Great instructor. Highly recommend this course to anyone who deals with OBD.”

Vinay Premnath
Research Engineer
Southwest Research Institute

I.D.# C0708

SCHEDULE
April 13, 2018
Detroit, Michigan - *held in conjunction with the WCX: SAE World Congress Experience*

September 14, 2018
Detroit, Michigan - *held in conjunction with the SAE 2018 On-Board Diagnostics Symposium - North America*

FEES

List:	$885
Members	
Classic:	$797
Premium:	$752
Elite:	$708

ONE-DAY/.7 CEUS

Get the complete course description and register: training.sae.org/seminars/c0708/

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P151640

DESIGNING ON-BOARD DIAGNOSTICS FOR LIGHT AND MEDIUM DUTY EMISSIONS CONTROL SYSTEMS

On-board diagnosis of engine and transmission systems has been mandated by government regulation for light and medium vehicles since the 1996 model year. The regulations specify many of the detailed features that on-board diagnostics must exhibit. In addition, the penalties for not meeting the requirements or providing in-field remedies can be very expensive. This course is designed to provide a fundamental understanding of how and why OBD systems function and the technical features that a diagnostic should have in order to ensure compliant and successful implementation.

Fundamental design objectives and features needed to achieve those objectives for generic on-board diagnostics will be covered. The course will also include a review of the California Air Resources OBD II regulation, providing students with a firm foundation for reading and understanding the requirements, including the in-use rate portion of the regulations and how to properly calculate and output the required rate information. Relationships between the regulation and various SAE and ISO recommended practices will be reviewed. The course will also explore the relationship of the OBD system with the underlying control system.

"Outstanding course. Recommended to anyone involved with emissions."

Homayoun Ahari
Diesel AT Tech Expert
Chrysler

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

- Articulate the underlying design objectives of on-board diagnostic systems
- Use the latest California Air Resources Board On-Board Diagnostic Regulation for Light and Medium Vehicles to find and apply OBD requirements
- Apply the design features that all diagnostics need for successful implementation
- Design diagnostics to comprehend variation
- Successfully implement algorithms to track in-use rates in accordance with the CARB OBD II Regulation
- Use SAE J1979 to implement generic scan tool support in diagnostic design
- Implement OBD design requirements in control system design

WHO SHOULD ATTEND

This course is designed for engineers involved in either the design or control of on-board diagnostic systems for engines or transmissions for light and medium duty on-road vehicles. In addition, engineers involved in engine and transmission hardware will benefit by obtaining a better understanding of the design of OBD systems. Engineers new to the area of OBD system design and engineers involved in the design of control systems wishing to obtain a better understanding of OBD requirements will also find the course valuable.

CONTENT HIGHLIGHTS

- Fundamental Design Objectives for OBD Systems
- Basic Design Features for OBD Systems
- Overview of the World Wide OBD Regulatory Structure
- California Air Resources Board (CARB) Regulatory Process
- How to use the CARB Light/Medium Regulation
- CARB Regulation - an in-depth look
- Introduction to a Diagnostic Design Process
- Defining “Good” vs. “Bad” Systems
- Anatomy of an On-Board Diagnostic
- Diagnostic Modeling
- Understanding and Dealing with Variation
- SAE J1979 - An Overview
- System Design for Diagnosibility
- Overview of Regulatory Requirements Related to OBD
- OBD Certification Process
- The Relationship between the Control and OBD System Design
- Classroom Exercises

INSTRUCTOR

John Van Gilder
Technical Fellow, OBD II Development,
GM Powertrain Group

or

Igor Anilovich
Diesel OBD II and AECD Leader,
GM Powertrain Group

I.D.# C0707

SCHEDULE
June 25-27, 2018
Troy, Michigan

November 12-14, 2018
Troy, Michigan

FEES

List:	$1,865
Members	
Classic:	$1,679
Premium:	$1,585
Elite:	$1,492

THREE-DAYS/2.0 CEUS

Get the complete course description and register:
training.sae.org/seminars/c0707/

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P1776191

DRIVER DISTRACTION FROM ELECTRONIC DEVICES: INSIGHTS AND IMPLICATIONS

Although many have an idea of what the term "driver distraction" means, there is no common definition within the research community. This course provides an overview of driver distraction: the problem; how to define it; the current state of research; how to critically evaluate research to make informed decisions; and the effectiveness of state laws and fleet policies to reduce it. The course summarizes strategies, techniques, and technologies shown to be effective in reducing distracted driving from electronic devices.

LEARNING OBJECTIVES

By connecting with this web seminar, you will be able to:

- Weigh the extent of the driver distraction problem
- Define driver distraction
- Critically examine the current state of driver distraction research
- Identify the strengths and limitations of various research approaches that assess driver distraction from electronic devices
- Recognize the difference between various forms of distraction (cognitive, auditory, visual, manual)
- Assess the effectiveness of policy efforts to reduce driver distraction from electronic devices
- Explain that all cell phone "tasks" do not have equal risk
- Determine effective strategies, techniques, and technologies for minimizing distracted driving

WHO SHOULD ATTEND

Those interested in being equipped to critically examine the current state of research in driver distraction. Vehicle manufacturers, OEMs, and cell phone providers and manufacturers can use the information presented to develop engineering solutions in this area.

CONTENT HIGHLIGHTS

- Definition of Driver Distraction & Overview of the Problem
- Forms of Distraction
- Overview of Methods to Assess Driver Distraction
- Possible Reasons for Discrepancies
- Effectiveness of Policy Efforts to Reduce Driver Distraction from Electronic Devices
- Research Needs/Next Steps
- Minimizing Distracted Driving from Electronic Devices

INSTRUCTOR

Jeffrey Hickman
Group Leader, Virginia Tech Transportation Institute

"Very interesting topic and good insight on past studies."

Susan Drescher
Product Management
Continental Automotive

I.D.# WB1140

SCHEDULE
April 3-5, 2018
Live Online

October 2-4, 2018
Live Online

FEES

List:	$425
Members	
Classic:	$383
Premium:	$361
Elite:	$340

TWO, 2-HOUR SESSIONS/.4 CEUS

Get the complete course description and register: training.sae.org/webseminars/wb1140/

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FUNDAMENTALS OF SHIELDING DESIGN FOR EMC COMPLIANCE

It is important for electronic and hardware engineers to not only be knowledgeable of a product's intended function and performance, but also its ability to perform within electromagnetic compatibility (EMC) limits. This seminar introduces practical shielding theory, design fundamentals, and configurations, including shielding products, common and differential modes, electromagnetic fields, and enclosure shielding. A segment on enclosure testing is presented in conjunction with an aperture attenuation modeling program (which is used to model attenuation characteristics at various frequencies and aperture size prior to expensive FCC/CE compliance or MIL-STD 461 testing). Honeycomb vent panels, plating attenuation comparisons, and galvanic compatibility per MIL-STD 1250 will also be discussed. Although the concepts presented in this seminar may be applicable to the automotive industry, the examples and standards presented are primarily focused on military and commercial vehicle applications.

It is important for electronic and hardware engineers to not only be knowledgeable of a product's intended function and performance, but also its ability to perform within electromagnetic compatibility (EMC) limits.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

- Identify the basic characteristics of Common and Differential Mode
- Recognize E,H, and Plane wave fields, Surface current and "Skin effect" based on increased frequency
- Specify Galvanic compatibility of various metal plating
- Specify industry standard shielding products for EMC compliance
- Evaluate waveguide effect of EMI/RFI shielded honeycomb ventilation panels
- Analyze aperture attenuation modeling for EMC design

WHO SHOULD ATTEND

This seminar will benefit engineers requiring an understanding of their electronic product or system's electromagnetic impact on meeting commercial EMC and MIL-STD 461 requirements, as well as those engineers needing to incorporate shielding products into new or current product improvement designs.

CONTENT HIGHLIGHTS

- EMC Fundamentals
  - Definitions
  - Maxwell equations
  - EMI and apertures; environment and characteristics
- Practical Shielding Theory
  - Common / Differential modes
  - BLS Crosstalk / Radiated fields
  - Reciprocity
  - Emitter location effects
  - Partial shields
  - H, E, and PW fields
  - Shielding material testing
  - Absorption and reflection
- Shield Apertures
  - Skin depth
  - EM Leakage
  - Aperture calculation
  - Multiple apertures
  - RF current flow
- Aperture Attenuation Modeling Program
  - Aperture Calculations
  - PCB test data comparisons
  - Attenuation Modeling and Test Factor
- Honeycomb Vent Panels
  - Design - waveguide effect
  - Attenuation of various panels
  - Galvanic compatibility
  - EMC Shielding Products and Materials
  - Board Level Shields (BLS)
  - Gaskets (BeCu fingerstock, conductive fabric, conductive elastomer, wire mesh)
  - Ferrites Materials
  - RF Absorber
  - Shielding principles
- EMC Shielding Specifications and Applications
  - MIL-STD 461 / 464 test specifications
  - Shielding applications
- Group discussion on specific EMC design concerns and applications

INSTRUCTOR

Michael J. Oliver
Vice President, Electrical / EMC Engineering
MAJR Productions Corporation

I.D.# C0835

SCHEDULE
March 26, 2018
Troy, Michigan

September 12, 2018
Troy, Michigan

FEES

List:	$810
Members	
Classic:	$729
Premium:	$689
Elite:	$648

ONE-DAY/.7 CEUS

Get the complete course description and register: training.sae.org/seminars/c0835/

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AUTOMOTIVE LIGHTING: DESIGN AND TECHNOLOGY

This seminar provides broad information about automotive lighting systems with emphasis on lighting functions, effectiveness, and technologies. Since only the exterior lighting devices on the ground vehicles are regulated by the federal and local governments, and standardized by the SAE Lighting Committee and the international communities, this course will only address automotive exterior lighting.

"This is a valuable program for any one who is interested in the automotive lighting industry be it OEM, Tier 1 Supplier or Equipment Supplier."

Jeff Mateer
Sales Engineer
Leybold Optics

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

- Describe various automotive lighting technologies
- Articulate the legal aspects and implications related to automotive lighting
- Examine safety measurements used with lighting functions and human factors costs
- Discuss the latest advancements in lighting technologies and trends in lighting styling

WHO SHOULD ATTEND

This seminar benefits automotive body engineers responsible for lighting and vehicle interface and integration; vehicle stylists interested in lighting effects on vehicle cosmetics; regulatory personnel involved with the legal specifications of automotive lighting; marketing specialists who are interested in customers' preferences based on relationships of human vision and lighting.

CONTENT HIGHLIGHTS

- Fundamentals of Automotive Lighting
- Light Sources Used in Automotive Lighting
- Automotive Lamp Photometry Design
- Optical Design for Automotive Lamps
- New Automotive Lighting Technologies
- Improved projector modules

INSTRUCTOR

Jianzhong Jiao
Independent Consultant — LED's and lighting technology development, products, design, testing, standards, and regulations

I.D.# C0202

SCHEDULE
April 9-10, 2018
Detroit, Michigan - *held in conjunction with the WCX: SAE World Congress Experience*

FEES

List:	$1,370
Members	
Classic:	$1,233
Premium:	$1,165
Elite:	$1,096

TWO-DAYS/1.3 CEUS

Get the complete course description and register: training.sae.org/seminars/c0202/

AUTOMOTIVE LIGHTING: LED APPLICATIONS

Lighting Emitting Diode (LED), a new generation semiconductor light source often referred to as Solid-State Lighting (SSL), has been broadly adopted in illumination, display, visualization, and other areas due to its higher efficacy and longer life. LEDs, first introduced for automotive interior applications such as indicators, expanded to exterior applications including center high mounted stop lamps and other automotive signal lighting devices. Today, LED technologies are being used for night vision, occupancy detection, and many other automotive application areas. This seminar is designed to provide the attendee with an overview of LEDs and their applications in automotive lighting and illumination.

Today, LED technologies are being used for night vision, occupancy detection, and many other automotive application areas.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

- Describe the basic LED configurations, characteristics, and classifications
- Assess LED and SSL technologies used in automotive applications
- Identify technical challenges and limitations of LEDs
- Select appropriate equipment for measurement of various conditions
- Evaluate LEDs for conformance to SAE standards
- Establish a basic design strategy for specific applications including forward lighting devices
- Manage a design activity to deal with thermal management

WHO SHOULD ATTEND

This seminar can be of benefit to LED automotive body and system engineers responsible for lighting and vehicle interface and integration; vehicle stylists who are interested in lighting effects on vehicle cosmetics and lighting developers and manufacturers; marketing specialists who are interested in customers' preferences based on the relationship of human vision and lighting; and newcomers in the automotive industry who need to obtain a general overview of lighting.

CONTENT HIGHLIGHTS

- LED Definitions and Classifications
- LED Measurements and Standardization
- LED Automotive Exterior Lighting Applications

INSTRUCTOR

Jianzhong Jiao
Independent Consultant — LED's and lighting technology development, products, design, testing, standards, and regulations

I.D.# C0727

SCHEDULE
April 13, 2018
Detroit, Michigan - *held in conjunction with the WCX: SAE World Congress Experience*

FEES

List:	$810
Members	
Classic:	$729
Premium:	$689
Elite:	$648

ONE-DAY/.7 CEUS

Get the complete course description and register: training.sae.org/seminars/c0727/

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AUTOMOTIVE LIGHTING: TESTING AND REQUIREMENTS

It has not been commonly known that automotive exterior lights are safety devices and must comply with governmental regulations. Since the 1930s, the SAE Lighting Standards Committee has been actively working with the automotive industry OEMs, lamp makers, tier-two suppliers, and human factor experts to develop automotive lighting standards. These standards have been widely used or referenced by the U.S. federal or state governments in establishing and enforcing the lighting regulations. This seminar emphasizes the safety importance of automotive lighting devices and provides important information on lighting functions, standards or regulations, testing and evaluations.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

- Describe the legal aspects and implications related to automotive lighting
- Search for and use the lighting related standards for all exterior lighting devices
- Establish or assist with lighting tests and evaluations

WHO SHOULD ATTEND

Automotive engineers and product development personnel who are responsible for lighting design, manufacturing, quality assurance, installation, vehicle interface and integration. Regulatory personnel who are involved with the legal specifications of automotive lighting, law enforcement agencies or individuals responsible for lighting regulations, and testing engineers or technicians responsible for evaluating and verifying the compliance of lighting standards and regulations will find the information valuable and relevant.

CONTENT HIGHLIGHTS

- Introduction - SAE Lighting Standards Committee
- Definitions and Terminologies Used in Automotive Lighting
- Testing and Evaluations
- Automotive Lighting Requirements

INSTRUCTOR

Jianzhong Jiao
Independent Consultant — LED's and lighting technology development, products, design, testing, standards, and regulations

This seminar emphasizes the safety importance of automotive lighting devices and provides important information on lighting functions, standards or regulations, testing and evaluations.

I.D.# C0618

SCHEDULE
April 13, 2018
Detroit, Michigan - *held in conjunction with the WCX: SAE World Congress Experience*

FEES

List:	$810
Members	
Classic:	$729
Premium:	$689
Elite:	$648

ONE-DAY/.7 CEUS

Get the complete course description and register: training.sae.org/seminars/c0618/

CONTROLLER AREA NETWORK (CAN) FOR VEHICLE APPLICATIONS

The Controller Area Network has become the standard of choice for most automotive manufacturers. This seminar covers the theory and use of the CAN protocol, and its applications in the automotive industry.

Details on how the CAN protocol and other standards (J2411, J2284, J1939, ISO 11898, etc.) complement each other are presented. You will learn about CAN application layers; the latest J1939, J2284, J2411, and IDB standards, regulations, and implementation requirements; and details of device hardware and software interfaces. Demonstrations using system development tools are presented. The SAE standard, *J1939 Recommended Practice for a Serial Control and Communications Vehicle Network*, is included in the course materials.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

- Explain CAN protocol
- Demonstrate how CAN is used in various automotive applications
- Employ CAN-related standards and specifications

WHO SHOULD ATTEND

This seminar is geared toward validation engineers, test engineers, embedded programmers, and those who are or will be working with applications using CAN.

CONTENT HIGHLIGHTS

- In-vehicle market overview
- General network topology overview
- CAN protocol
- CAN controller programming
- CAN physical layers
- Overview of J2411, J2284, IDB, J1939, Diagnostics on CAN, etc.
- J1939 & IDB in-depth review
- Demonstrations

INSTRUCTOR

Mark Zachos
President, Dearborn Group, Inc.

"This seminar helped me understand very clearly the soft and hardware requirements of CAN."

John H. Boone
Specialist
Toyota Motor Manufacturing North America, Inc.

I.D.# C0120

SCHEDULE
May 24-25, 2018
Troy, Michigan

November 12-13, 2018
Troy, Michigan

FEES

List:	$1,445
Members	
Classic:	$1,301
Premium:	$1,228
Elite:	$1,156

TWO-DAYS/1.3 CEUS

Get the complete course description and register: training.sae.org/seminars/c0120/

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UNDERSTANDING AND USING THE SAE J2534-1 API TO ACCESS VEHICLE NETWORKS

The SAE J2534-1 API (Recommended Practice for Pass-Thru Vehicle Programming) gives engineers the tool to collect vehicle data from multiple network types including CAN, ISO15765, J1850, ISO9141 and Chrysler SCI, using standard J2534 interface devices. In addition, the aftermarket can access the vehicle's OBDII information from the diagnostic connector. Using the SAE J2534-1 API, an engineer can write a single program that communicates on multiple protocols, uses an off-the-shelf interface device and is scaleable. This course is designed to give you an understanding of the J2534-1 API, enabling you to create your own programs that accomplish your vehicle communication needs. In addition to learning how to use each of the J2534-1 functions, you will have the opportunity to write a program that collects messages off of the CAN vehicle bus and another program that reads trouble codes off of a J1850 vehicle. Note that because of the proprietary nature of the information, this class does not provide details on reprogramming algorithms or proprietary data collection. You will receive a copy of the SAE J2534-1 Recommended Practice for Pass-Thru Vehicle Programming.

In addition to learning how to use each of the J2534-1 functions, you will have the opportunity to write a program that collects messages off of the CAN vehicle bus and another program that reads trouble codes off of a J1850 vehicle.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

- Write programs that use the SAE J2534-1 compliant hardware to communicate with vehicles
- Reduce your dependency on proprietary vehicle communication hardware
- Increase your productivity by collecting the specific vehicle information you need when you need it
- Solve vehicle integration problems by capturing events from the vehicle network
- Protect your software investments by writing your application using a standard API

WHO SHOULD ATTEND

This seminar is designed for engineers involved with automotive design and development who need to write programs that interact with vehicles through the in-vehicle network. This includes engineers who validate OBDII, engineers developing and validating new electronic control modules, engineers writing reprogramming application, test engineers who log vehicle data, system integrators who need to validate system operation, and after-market engineers who add new functionality to vehicles. The seminar would also be helpful for people who develop end-of-line tests, service diagnostics or inspection and maintenance cells for vehicles.

CONTENT HIGHLIGHTS

- What is the SAE J2534-1 PassThru API
  - Why use the SAE J2534-1 PassThru API
  - Overview of the SAE J2534-1 PassThru API
  - Overview of vehicle communication
  - History of the SAE J2534-1 PassThru API
  - Future of SAE J2534-1, J2534-2, J2534-3
- PassThru PC Setup
  - Using the registry to find devices
  - Loading the SAE J2534-1 DLL
- PassThru Open and Close
- PassThru Connect and Disconnect
  - PassThruConnect: protocols, connect flags, baudrates
  - PassThruDisconnect
- Lab 1: PassThru on the PC: Simple SAE J2534-1 Program
- PassThru Read Messages and Write Messages
  - The PassThru message structure
  - PassThruReadMsgs: read, loopback and indication messages
  - PassThruWriteMsgs
- PassThru Start Message Filter and Stop Message Filter
  - PassThruStartMsgFilter: pass, block and flow control filters
  - PassThruStopMsgFilter
- PassThru Other Functions
  - PassThruSetProgrammingVoltage
  - PassThruReadVersion
  - PassThruGetLastError
- Lab 2: A Complete SAE J2534-1 Program
- PassThru Start Periodic Message and Stop Periodic Message
- PassThru I/O Control
  - GET_CONFIG and SET_CONFIG
  - Other parameters
- ISO15765 in J2534-1
  - Flow control filters
  - Indication messages
- Lab 3: Enhancing your PassThru Program
  - Changing device configuration
  - ISO15765 message reader

INSTRUCTOR

Mark Vine
Senior Development Engineer, Drew Technologies, Inc.

I.D.# C0733

SCHEDULE
2018 offerings are being scheduled for this course. Check the course web page for the most up-to-date schedule and information.

FEES

List:	$865
Members	
Classic:	$775
Premium:	$735
Elite:	$695

ONE-DAY/.7 CEUS

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NEW! HIGH VOLTAGE VEHICLE SAFETY SYSTEMS AND PPE

High voltage vehicle safety is a primary concern for every technician or engineer involved in developing, diagnosing or repairing hybrid or electric vehicles. Engineers/technicians working in this field should complete safety training before they interface with hybrid, plug-in or electric vehicles. This course provides you with fundamental technical and safety information on high voltage personal protective equipment (PPE) such as how to test high voltage gloves, when and where to send high voltage gloves for periodic testing, and how to safely use test equipment for measuring high voltage components in live and disabled high voltage systems.

The vehicle safety systems contain interlock circuits, passive and active bus (capacitor) discharge circuits, and DC and AC isolation detection systems that are monitored by high voltage controllers to maintain the required resistance barrier between the vehicle technician/engineer and the vehicle body/chassis to mitigate the possibility of an electrical shock event.

Much of the high voltage vehicle safety systems information covered in this course is based on the FMVSS requirements and SAE Recommended Practices.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

- Properly care for high voltage electrical gloves
- Field test high voltage electrical gloves
- Identify providers that test high voltage gloves required by ASTM requirements
- Disable a vehicle high voltage system
- Safely acquire measurements on a high voltage system
- Describe the operation of automotive AC and DC isolation fault detection systems
- Apply FMVSS 305 requirements and SAE J1766 Recommended Practice to testing high voltage vehicle safety systems
- Describe the operation of high voltage interlock circuits and passive and active bus discharge circuits
- Test the high voltage system for isolation faults, interlock circuit failures and passive and/or active discharge circuits
- Describe how and when to use high voltage gloves, serial data (Scan Tool), insulation meter, and DVOM to test the high voltage system and components

WHO SHOULD ATTEND

This course will benefit vehicle electrification engineers involved in the design or development of high voltage systems as well as lab and vehicle technicians (beginner to intermediate level) who perform systems diagnostics as well as vehicle proto builds. This course will also benefit automotive technicians with an automotive certificate, A.A.S. or B.S. (experienced auto techs but are beginners in vehicle electrification) who service automotive systems. This course would assist all disciplines and personnel working with automotive high voltage systems found in vehicle electrification in understanding how high voltage vehicle safety systems operate, and how to use safe practices and the necessary equipment to analyze, test, and repair them.

CONTENT HIGHLIGHTS

- High Voltage Safety & PPE
  - Characteristics of AC and DC Electrical Power
  - Ground Circuit Paths
  - Tools & Equipment CAT Ratings
  - Tool & Equipment Usage
  - High Voltage Glove Selection, Field Testing, Testing Requirements, and Storage
  - Insulation Meters and Usage on High Voltage Components
- High Voltage Vehicle Safety Systems
  - High Voltage Cabling
  - High Voltage Cable and Electrical Symbol Identification
  - Service Disconnect Types, Locations, and Removal/Install
  - High Voltage Fuse
  - Interlock Systems and System Types, Location, Circuits, Operation, Failure Modes and Diagnostics
  - Active and Passive Bus Discharge Systems, Location, Circuits, Operation, Failure Modes and Diagnostics
  - Isolation Fault Detection Systems, Circuits, Operation, and Diagnostics

INSTRUCTOR

Mark Quarto
Chief Technology Officer, Quarto Technical Services

I.D.# C1732

SCHEDULE
March 26, 2018
Troy, Michigan

September 27, 2018
Troy, Michigan

FEES

List:	$810
Members	
Classic:	$729
Premium:	$689
Elite:	$648

ONE-DAY/.7 CEUS

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training.sae.org/seminars/c1732/

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HYBRID AND ELECTRIC VEHICLE SYSTEMS

Hybrid Electric Vehicle (HEV), Plug-In Hybrid Electric Vehicle (PHEV), and Battery Electric Vehicle (BEV) technology model offerings and production volumes continue to accelerate with each model year. This three-day practical and applications-based course will concentrate on architectures, operation, functions, and design considerations of the safety, power electronics, energy systems, and failure modes associated with HEV and BEV vehicles, providing an environment in which participants can acquire a solid systems and integration foundation for applying this content to vehicle/systems design. Practical systems and circuit analyses with calculations will be used throughout the course.

Advanced technology vehicle populations are significantly increasing throughout the world, making it vital for engineers, technicians, and educators to have a thorough understanding of these technologies and systems.

LEARNING OBJECTIVES

By attending seminar, you will be able to:

- Identify the different hybrid and electric vehicle (HEV) architectures
- Follow a procedure for safe interaction with high voltage
- Identify the components of HEV safety systems, controls, and diagnostics
- Consider the architectural options for controls and diagnostics
- Identify energy management components and functions
- Identify electric motor components and functions

WHO SHOULD ATTEND

This course is designed for engineers, scientists, and technicians who are involved with the design, development, manufacturing, or service of electrified vehicles or subsystems.

CONTENT HIGHLIGHTS

HEV/BEV Systems Operation Modes, Torque Production and Component Contributions

- HEV
- PHEV
- BEV

High Voltage Safety - Personal Protection Equipment

- High Voltage Systems
- Using Meters, Oscilloscopes, Insulation Meters, and HiPot Equipment to Test High Voltage System Components

HEV/PHEV/BEV – Vehicle Safety Systems, Controls and Diagnostics

- Battery Pack Manual Disconnect Systems
- High Voltage Interlock Circuits, Bus Active & Passive Discharge Circuits
- Isolation Fault Detection Circuits
- CAN Parameter ID Structure for Safety Systems and Diagnostics

Rechargeable Energy Management (Battery Pack) Systems, Controls and Diagnostics

- Hardware components
- NiMH, Lithium Battery Families
- Module/cell sensing systems
- Thermal Management Systems
- Battery Pack/Module Testing
  - HEV/PHEV/BEV Power & Energy Testing
  - Automotive Field Experiences with Battery Systems

HEV/BEV – Permanent Magnet (PM) and Induction Machine (IM) Electric Machine and Power Inverter Technologies

- PM and IM Technologies
  - Permanent Magnet Electric Machine Construction/Operation
  - PM/IM Failure Modes
- Power Inverter Technology and Electric Machine Control
  - Power electronics devices: IGBTs and Gate Drives
  - Electric machine controls
  - Power Inverter Testing: Analyzing Waveforms using Oscilloscopes, Current Probes
- dc-dc Converter Systems
  - Buck Converter; Buck/Boost Converter
  - Testing

INSTRUCTOR

Mark Quarto
Chief Technology Officer, Automotive Research and Design, LLC

I.D.# C1504

SCHEDULE
May 27-29, 2018
Troy, Michigan

September 24-26, 2018
Troy, Michigan

FEES

List:	$1,745
Members	
Classic:	$1,571
Premium:	$1,483
Elite:	$1,396

THREE-DAYS/2.0 CEUS

Get the complete course description and register: training.sae.org/seminars/c1504/

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training.sae.org/corplearning

INTRODUCTION TO HYBRID AND ELECTRIC VEHICLE BATTERY SYSTEMS

Driven by the need for lower emissions, better fuel economy and higher efficiency, hybrid vehicles are appearing in many different configurations on today's roadways.

While the powertrain components 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. This seminar introduces you to the concepts of hybrid vehicles, their missions and the role of batteries in fulfilling those requirements. Battery topics including limitations, trends in hybrid development, customer wants and needs, battery system development timelines, comparison of electrochemistries and safety will be examined. Current offerings, cost factors, pack design considerations and testing are also reviewed.

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

This seminar is primarily intended for vehicle systems engineers, battery system integration engineers, testing engineers, 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. Product planners and program managers will find the overview aspects helpful.

CONTENT HIGHLIGHTS

- Terminology, Definitions and Conventions
- Brief Review of the Hybrid Market
  - Market drivers and expectations
  - Market influences
  - Competing technologies
  - Customer expectations
- Review of Common Vehicle Product Offerings (battery descriptions, power, technology, size, architecture)
- Fundamentals
  - Fossil fuel vs. hybrid vs. electric
  - Source ragone plot
  - Efficiencies, weights
  - Cost of fuel (fossil vs. electrons)
- Role of Battery
  - ICE vs. electric systems
  - Energy vs. power
  - Expectations over vehicle lifetime
- Product Liability / FMEA
- Battery Development Cycle
  - You don't know what you don't know!
  - Why does it take so long and cost so much?
- Cost Factors
  - Scope of product: system vs. cells vs. sticks
- System Considerations
- Electrochemistry Selection
- Safety
  - Advance planning for safety tests
  - Thermal runaway
  - String configuration (series, parallel)
- Range Estimation: Hybrid vs. Electric Vehicle
- Real-life Battery Analysis Exercise (using a contemporary vehicle as an example)
- Battery Pack Design Considerations
- Failure Modes
  - Wear-out
  - Power and energy degradation
  - High resistance / open circuit
  - Controller / signal malfunction
- Vehicle Trends
- Battery Trends, Warranty and Recycling

INSTRUCTOR

Erik Spek
Chief Engineer, TÜV SÜD Canada

I.D.# C0626

SCHEDULE
May 2-3, 2018
Troy, Michigan
November 6-7, 2018
Troy, Michigan

FEES

List:	$1,370
Members	
Classic:	$1,233
Premium:	$1,165
Elite:	$1,096

TWO-DAYS/1.3 CEUS

Get the complete course description and register: training.sae.org/seminars/c0626/

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SAFE HANDLING OF HIGH VOLTAGE BATTERY SYSTEMS

The battery system forms a key part of any electric or hybrid vehicle and is probably the least understood.

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. With practically no moving parts the battery systems show no visible or audible warning of any latent dangers. This seminar introduces you to the risks encountered in handling high voltage battery systems and their component parts. With the understanding of these risks, the seminar addresses how to raise risk awareness and methods of dealing with those risks. The outcome of this seminar is improved avoidance of personal injury, reduced risk of reputation loss and product liability actions, and reduced risk of loss of property and time.

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

The SAE seminar, *Introduction to Hybrid and Electric Vehicle Battery Systems* (I.D.# C0626) is recommended as a prerequisite for this course. See course description on page 32.

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 and battery, battery system integration, battery testing, safety systems, electrical, 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.

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

INSTRUCTOR

Erik Spek
Chief Engineer, TÜV SÜD Canada

VOLUNTEER TODAY

SAE offers a host of rewarding volunteer opportunities for individuals who want to get involved. Whether you have a little or a lot of time to give, there are a wide variety of projects from which to choose:

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• Go to the Member Connection at connection.sae.org

• Select "Volunteer Opportunities" from the Volunteer drop down at the top of the page and sign-up for the opportunities that work for you

• Or, opt into the volunteer pool to be matched with options based on criteria you provide; you'll also receive alerts on future openings

I.D.# C1019

SCHEDULE
May 4, 2018
Troy, Michigan

November 8, 2018
Troy, Michigan

FEES

List:	$810
Members	
Classic:	$729
Premium:	$689
Elite:	$648

ONE-DAY/.7 CEUS

Get the complete course description and register: training.sae.org/seminars/c1019/

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CONNECTED VEHICLE PROFESSIONAL™ CREDENTIALING PROGRAM

Designed to build a valuable skill set and increase professional credibility in the Intelligent Transportation Systems (ITS) Community, the *Connected Vehicle Professional (CVP)™ Credentialing Program* is a comprehensive curriculum launched by SAE International, the Connected Vehicle Trade Association (CVTA), and Mobile Comply.

A vendor-neutral certification, the CVP signifies an individual possesses the complete knowledge and comprehension needed to perform tasks involving connected vehicle and intelligent transportation best practices, in-vehicle safety, infrastructure, communication protocols, security and more.

Designed for all engineering, technical, and industry professionals who touch the "connected vehicle", the multi-course program provides the understanding of vehicle and infrastructure connectivity necessary to operate within the rapidly advancing field of Intelligent Transportation Systems (ITS) and Connected Vehicles.

A blended-learning approach combines extensive online learning and resource activities with classroom sessions that emphasize problem solving, Q&A, and real-world case studies.

PROFESSIONALS WHO ARE AWARDED THE SAE INTERNATIONAL/CONNECTED VEHICLE TRADE ASSOCIATION CERTIFICATE OF COMPETENCY ARE ABLE TO:

- Identify and differentiate the elements of the various technological functions that pertain to connected vehicle technologies.
- Discuss deployment, integration, and support of many forms of communication protocols.
- Discuss management of a safe and efficient mobile environment within the domain of transportation.
- Identify how information and entertainment can be used in vehicle communication.
- Discuss emerging technologies relative to connected vehicle technologies.
- Identify software development languages and become familiar with software tools.

COURSE ONE: CONNECTED VEHICLE PROFESSIONAL I – FUNCTION, PROTOCOLS, AND ARCHITECTURE

2018 offerings are being planned. Check the course web page for the most up-to-date schedule and information.

All offerings are at the Mobile Comply office in Sterling Heights, Michigan

The first course discusses topics within the connected vehicle ecosystem including: vehicle application concepts and vision, performance functions, communication protocols, hardware architecture components, and software architecture methodologies. To ensure awareness of global technology impacts, the course includes in-depth wide ranging course materials, suggested domestic and internationally sourced reading resources, and testing on various key areas of instruction.

To review the complete course description: training.sae.org/seminars/cmc1501/

COURSE TWO: CONNECTED VEHICLE PROFESSIONAL II – STANDARDS, ORGANIZATIONS, PROGRAMS, V2X

2018 offerings are being planned. Check the course web page for the most up-to-date schedule and information.

All offerings are at the Mobile Comply office in Sterling Heights, Michigan

This course emphasizes connected vehicle standards from various organizations such as SAE, IEEE and other standardization groups. This also exposes learners to multiple organizations and programs recognized throughout the industry. Emphasis for this class is on Vehicle-to-Vehicle (V2V), Vehicle-to-Infrastructure (V2I), Vehicle-to-Data (V2D) technologies. To ensure a globally informed awareness, learners will be presented with in-depth wide-ranging course materials, suggested domestic and internationally source reading resources, and tested on various key areas of instruction.

To review the complete course description: training.sae.org/seminars/cmc1502/

COURSE THREE: CONNECTED VEHICLE PROFESSIONAL III – DATA, MARKETS, POLICY AND REGULATIONS

2018 offerings are being planned. Check the course web page for the most up-to-date schedule and information.

All offerings are at the Mobile Comply office in Sterling Heights, Michigan

Course III focuses on data generated by connected vehicle. Further, learners are introduced to major consortia and agencies supporting the development, implementation and regulation of connected cars and other connected vehicle ecosystems. Additionally, learners are provided overviews on policies and regulations-being introduced into this space. To ensure a globally informed awareness, learners will be presented with in-depth wide-ranging course materials, suggested domestic and internationally source reading resources, and tested on various key areas of instruction.

To review the complete course description: training.sae.org/seminars/cmc1503/

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Enrich your professional development with these related electrical and electronics technology resources from SAE.

BOOKS

INTEGRATED VEHICLE HEALTH MANAGEMENT - SYSTEM OF SYSTEMS INTEGRATION

This book brings together ten seminal SAE technical papers addressing the challenges and solutions to maintaining highly complex vehicles.

AUTOMOTIVE 48-VOLT TECHNOLOGY

The introduction of 48-volt technology enables traditionally parasitic applications that run off the engine to be replaced with electrically driven systems, resulting in improvements in performance and efficiency. In the first of a series of reports produced jointly by ABOUT Automotive and SAE International, this comprehensive Executive Report analyses major engineering challenges facing the industry, and the solution strategies key players are beginning to adopt.

ADVANCES IN ELECTRIC PROPULSION

This book will take the reader through various technologies that will enable a more-electric aircraft future, as well as design methods and certification requirements of more-electric engines.

AUTOMOTIVE CYBERSECURITY: FROM PERCEIVED THREAT TO STARK REALITY

This review analyzes automotive cybersecurity threats that are gaining attention worldwide and the apparent ways industries are responding to them. It also addresses the need to continue investment in cyber research and security, as well as the 'security by design' approach that automakers are likely to adopt as a long-term strategy to fend off cyber-attacks.

PROCEEDINGS FROM THE 9TH AVL INTERNATIONAL COMMERCIAL POWERTRAIN CONFERENCE

Organized in cooperation with SAE International, the 2017, 9th ICPC focused on alternative powertrain technologies and innovations to improve operating efficiency. The focus of the proceedings includes: Future challenges for engines and emissions; Smart Technologies Changing Farming; Cyber Physical Systems in Agriculture Business; and Autonomous and Connected Trucks.

JOURNALS

TRANSPORTATION CYBERSECURITY AND PRIVACY: AN SAE INTERNATIONAL JOURNAL

a scholarly publication of original high-quality scientific articles focusing on the Cyber Physical System (CPS) related areas of transportation cybersecurity and privacy.

NEW! TRANSPORTATION CYBERSECURITY AND PRIVACY, SCHOLARLY JOURNAL FROM SAE

A scholarly publication of original high-quality scientific articles focusing on the Cyber Physical System (CPS) related areas of transportation cybersecurity and privacy..

SAE INTERNATIONAL JOURNAL OF PASSENGER CARS - ELECTRONIC AND ELECTRICAL SYSTEMS

The primary source of comprehensive and innovative research in the areas of electrical and electronic systems and components such as those related to connectivity and communications, controls, active safety, infotainment, intelligent vehicle systems, electromagnetic compatibility, actuators, diagnosis, and related subjects.

EVENTS

SAE 2018 GOVERNMENT/INDUSTRY MEETING

January 24-26, 2018
Washington, District of Columbia, USA

Engage, network, and connect with technical authorities who are leading regulations, pending legislation, and the advanced technology to address critical compliance issues as we move forward toward zero emissions and zero fatalities. Build or grow relationships with other industry professionals to compare strategies and successes for dealing with legislation and regulations.

SAE INTERNATIONAL CONNECT2CAR: CONNECTING WITH CONFIDENCE

January 9, 2018
Las Vegas, Nevada, USA

Join us for the SAE International conference track at the CES® 2018. The 2018 program is bigger and better than anything we have done at CES®! We have partnered with the GENIVI Alliance to create a full-day program that brings the best of current automotive technology discussions to CES!

WCX™: SAE WORLD CONGRESS EXPERIENCE

April 10-12, 2018
Detroit, Michigan, USA

At *WCX™: SAE World Congress Experience* practical meets potential. The premier talent in the automotive and mobility industry converge to address current challenges, discover new avenues of exploration, and explore the promise of the future of transportation engineering in an interactive experience.

CONNECT2CAR AT WCX

April 10-12, 2018
Detroit, Michigan, USA

This event brings the new world of technology together with the automotive industry to create the future of transportation. The three-day event will run alongside WCX 18, but will be focused solely on the connected car and all its components.

STANDARDS

JPAKS

JPaks are online annual subscriptions that provide a cost-effective and convenient way to access the 2,000+ individual standards in SAE MOBILUS pertaining to ground vehicles. In addition, JPaks customers can now search and download any of the more than 2,600 historical versions of SAE Ground Vehicle Standards.

INDIVIDUAL STANDARDS

Individual SAE standards are always available for purchase.

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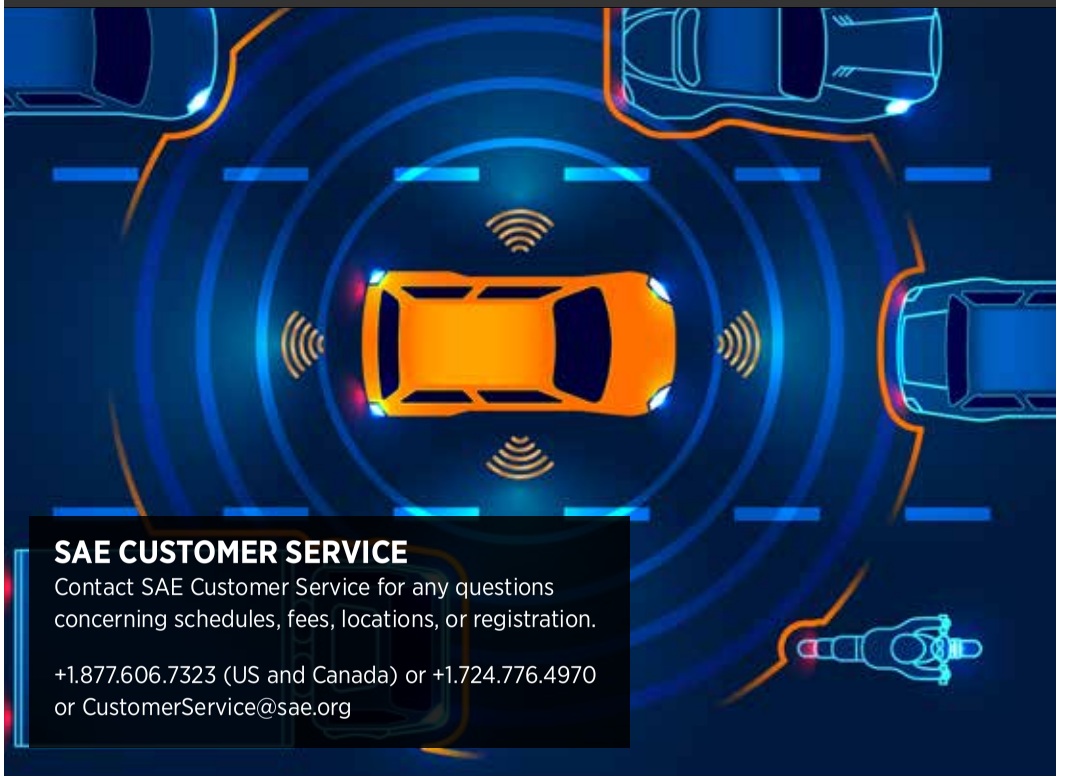

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