CHASSIS AND VEHICLE DYNAMICS TECHNOLOGY
EDUCATION & TRAINING GUIDE

June – December 2014

FEATURED COURSES
• Fundamentals of Steering Systems Seminar - Page 10
• The Tire as a Vehicle Component Seminar - Page 13
• Tire Wheel and Safety Issues - Page 14
• Commercial Vehicle Braking Systems Seminar and e-Seminar - Page 20
• Hydraulic Brake Systems for Passenger Cars and Light Trucks Seminar - Page 22
Welcome to the Summer Issue of the Chassis and Vehicle Dynamics Technology Education and Training guide. We have again included ALL the training and education SAE offers related to chassis, and vehicle dynamics – Live classroom, live online, and online, on demand courses. Training when you want it.

THIS GUIDE INCLUDES COURSES THAT EXPLORE THE FOLLOWING TOPICS:

• Vehicle Dynamics and Handling
• Chassis
• Steering systems
• Tires and wheels
• Brakes and braking performance

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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
• That it is an ACTAR approved course

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

ACTAR LOGO
This icon indicates the course is an ACTAR approved course. For more information on ACTAR and ACTAR accredited courses, visit training.sae.org/seminarsinfo/actar

As an IACET Authorized Provider, SAE International offers CEUs for its programs that qualify under the ANSI/IACET Standard.
# TABLE OF CONTENTS

## 4 VEHICLE DYNAMICS AND HANDLING
4 Advanced Vehicle Dynamics for Passenger Cars and Light Trucks Seminar
6 Applied Vehicle Dynamics Seminar
8 Chassis & Suspension Component Design for Passenger Cars & Light Trucks Seminar
10 Fundamentals of Steering Systems Seminar
11 Fundamentals of Heavy Truck Dynamics Seminar
12 Introduction to Heavy Truck Tire, Steering, and Suspension Dynamics Seminar
13 The Tire as a Vehicle Component Seminar
14 Tire and Wheel Safety Issues Seminar
15 New! Vehicle Dynamic Basics for Off-highway Trucks Seminar
16 Vehicle Dynamics for Passenger Cars and Light Trucks Seminar and e-Seminar

## 18 BRAKES AND BRAKING SYSTEMS
18 Brake Friction Materials: Testing, Quality and Selection Seminar
19 Brake Noise Problem Resolution Seminar
20 Commercial Vehicle Braking Systems Seminar and e-Seminar
22 Hydraulic Brake Systems for Passenger Cars and Light Trucks Seminar
23 New! Introduction to Brake Noise, Vibration, and Harshness Seminar
24 Introduction to Brake Control Systems: ABS, TCS, and ESC Seminar and e-Seminar
26 Vehicle Braking Performance: Braking Confidence and Pedal Feel Fast Track
27 Vehicle Braking Performance: Stopping Distance Fast Track

## 28 LIVE LEARNING SCHEDULE

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.
VEHICLE DYNAMICS CERTIFICATE PROGRAM

Designed to equip engineers with key vehicle dynamics and handling theory and application from a systems perspective, the objective of this program is for engineers to understand the interaction and performance balance between the major vehicle subsystems. The program design requires completion of fundamental and advanced-level vehicle dynamics theory and application courses with three elective courses that best suit an individual’s interest areas or engineering emphasis.

The courses do not have to be taken in any specified order, although the Required Courses are good starting points if they can be scheduled and completed prior to the electives. The entire program must be completed within five years.

Successful completion of this multi-course certificate program equates to 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.

Required Courses
- Vehicle Dynamics for Passenger Cars and Light Trucks Seminar or e-Seminar - see course description on page 16; OR Fundamentals of Heavy Truck Dynamics Seminar - see course description on page 11
- Advanced Vehicle Dynamics for Passenger Cars and Light Trucks Seminar - see course description on page 4

Electives include:
- Applied Vehicle Dynamics Seminar - see course description on page 6
- Chassis & Suspension Component Design for Passenger Cars & Light Trucks Seminar - see course description on page 8
- Commercial Vehicle Braking Systems Seminar or e-Seminar - see course description on page 20
- Fundamentals of Steering Systems Seminar - see course description on page 10
- Hydraulic Brake Systems for Passenger Cars and Light Trucks Seminar - see course description on page 22
- High-Performance Brake Systems Seminar - see course description online at: training.sae.org/seminars/c0718
- Introduction to Brake Control Systems: ABS, TCS, and ESC Seminar or e-Seminar - see course description on page 24
- Fundamentals of Heavy Truck Dynamics Seminar - see course description on page 11
- Vehicle Dynamic Basics for Off-highway Trucks Seminar - see course description on page 15

View the complete list of courses available as part of the Vehicle Dynamics Certificate Program. Visit sae.org/certificate/vehicle_dynamics

To enroll in the Certificate Program
There is no formal application process; simply begin courses at your convenience. Self-monitor your transcript as you progress through the program, visit mylearn.sae.org and click My Transcript (requires log in).

To request certificate
When all courses are completed, please notify SAE Customer Service, 877-606-7323 or CustomerService@sae.org. Once your transcript is audited and completion of courses verified, your certificate will be issued.
ADVANCED VEHICLE DYNAMICS FOR PASSENGER CARS AND LIGHT TRUCKS

Governing state-space equations with transfer functions for primary ride and open loop handling will be developed & analyzed. Building on the analysis of the state space equations, common physical tests and their corresponding CAE solutions for steady state and transient vehicle events will be presented. The “state-of-the-art” of vehicle dynamics CAE will be discussed. Common lab and vehicle tests and corresponding metrics used to assess chassis system and vehicle performance will be discussed in great detail. Hands-on workshops using CARSIM™ vehicle dynamics simulation software will help reinforce the material. Significant time will also be dedicated to the use of design of experiments (DOE) as a tool to assist in the analysis and optimization of chassis systems for multiple vehicle responses.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:
• Apply vehicle dynamics theory to practical evaluation and measurement
• Use governing state space equations and transfer functions to determine the effect of key parameters on primary ride and open loop handling
• Describe the current “state-of-the-art” of vehicle dynamics CAE
• Articulate various types of vehicle dynamics models
• Recognize kinematics and compliance (K&C) lab tests commonly used to quantify chassis system performance
• Identify and evaluate important K&C metrics used in vehicle dynamics development
• Identify and utilize important vehicle tests commonly used in industry to evaluate ride, steering and handling performance
• Relate chassis system characteristics to vehicle dynamic performance
• Utilize vehicle dynamics CAE software for the simulation of common physical lab and vehicle tests
• Apply design-of-experiments (DOE) to vehicle dynamics development

WHO SHOULD ATTEND

This seminar is designed for automotive engineers in the vehicle dynamics, chassis, suspension, steering and braking fields who work in product design, development, testing, simulation or research.

Go beyond the basics of passenger car and light truck vehicle dynamics by applying advanced theory, physical tests and CAE to the assessment of ride, braking, steering and handling performance.
CONTENT HIGHLIGHTS

• Modeling Primary Ride Dynamics
• Modeling Vehicle Handling Dynamics
• Introduction to Vehicle Dynamics CAE
• Measurement and Simulation of Suspension Kinematics and Compliance (K&C)
• Measurement and Simulation of Primary Ride
• Measurement and Simulation of Acceleration and Braking
• Measurement and Simulation of Steering
• Measurement and Simulation of Open Loop Handling
• Measurement and Simulation of Closed Loop Handling
• Design of Experiments (DOE) Applied to Vehicle Dynamics Development
• CarSim™ Exercises--Primary Ride Simulation, Steering, Open Loop Handling, Closed Loop Handling, Primary Ride

INSTRUCTOR

Dr. Richard Lundstrom
Independent Research and Project Engineer

Timothy Drotar
Product Development Engineer
Ford Motor Company

L.D.# C0415

SCHEDULE

October 29-31, 2014
Troy, Michigan

FEES

List: $1,665
Members
Classic: $1,485
Premium: $1,405
Elite: $1,325

THREE-DAYS/2.0 CEUS

Get more information and register:
training.sae.org/seminars/C0415

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While a variety of new engineering tools are becoming available to assist in creating optimal vehicle designs, subjective evaluation of vehicle behavior is still a vital tool to ensure desired braking, handling, and other dynamic response characteristics. In order to better prepare you for this task, this course offers study devoted to the key fundamental principles associated with longitudinal and lateral vehicle dynamics. Each classroom session is paired with an on-track exercise to immediately reinforce concepts with a dedicated behind-the-wheel driving session, effectively illustrating these principles in the real world.

Exercises build the bridge between vehicle dynamics theory and practical application by providing a rich academic underpinning and then reinforcing it with highly focused and relevant driving experiences. Significant technical skill-building is provided, with increased instructor supervised track time to further absorb the principles learned on days one and two. If your job description does require performance driving skills, the dynamic exercises on day three will lay a solid foundation on which you can independently refine your own skills.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:
• Explain tire-road friction limits and compose the friction circle for a given vehicle system
• Compute fundamental braking response attributes
• Illustrate the physics of turning and calculate lateral weight transfer
• Estimate brake system balance and brake proportioning
• Measure and graph a vehicle’s understeer gradient
• Analyze basic anti-lock brake system (ABS) operation
• Discuss the effectiveness and limitations of electronic stability control (ESC) systems
• Demonstrate the interactions of brake, steering, suspension, and powertrain systems
• Calculate the most efficient path for a vehicle to negotiate a given test maneuver
• Comprehend the subtle effects that vehicle positioning has on vehicle speed
• Predict what response characteristics can be influenced by vehicle state
• Define those vehicle dynamic attributes which can be impacted through vehicle selection
WHO SHOULD ATTEND
This course has been developed for engineers and technical personnel involved in all fields related to the design or development of vehicle dynamics, vehicle braking systems, powertrain systems, chassis systems, or suspension systems. In addition, this course is valuable to those with component design responsibilities in brake, chassis, suspension, or tire disciplines who desire a fundamental background in vehicle dynamics with a practical driving linkage.

CONTENT HIGHLIGHTS
• Longitudinal Slip and Weight Transfer
• Fundamentals of Straight-Line Braking
• Slip Angle and Transient Response
• Braking Stability
• Steady-State Cornering
• Combining Lateral and Longitudinal Slip
• Anti-Lock Brake Systems
• Electronic Stability Control
• Test Procedure Selection
• Test Procedure Sensitivity
• Test Vehicle Sensitivity
• Comparison Vehicle Evaluation
• Driving Exercises—brake in a turn; skidpad; avoidance; wet skidpad; path selection; path variation; low pressure; lapping

INSTRUCTOR
James Walker, Jr.
Principal Engineer
Carr Engineering, Inc.

I.D.# CO414

SCHEDULE
November 17-19, 2014
Greer, South Carolina

FEES
List: $2,595
Members
Classic: $2,345
Premium: $2,205
Elite: $2,075

THREE-DAYS/2.4 CEUS

Get more information and register:
training.sae.org/seminars/c0414

Instructor
James Walker, Jr.
Principal Engineer
Carr Engineering, Inc.
CHASSIS & SUSPENSION COMPONENT DESIGN FOR PASSENGER CARS & LIGHT TRUCKS

Just as the chassis and suspension system provides an ideal framework for the automobile, this popular SAE seminar provides an informative framework for those involved in the design of these important systems. Emphasizing the fundamental principles that underlie rational development and design of suspension components and structures, this course covers the concepts, theories, designs and applications of automotive suspension systems.

LEARNING OBJECTIVES
By attending this seminar, you will be able to:
• Identify the types of suspensions and structures and their design differences from concept to prototype, theory to application; static and dynamic load conditions; and suspension modeling
• Describe the chassis design process and various suspension system interactions through demonstrations, video and audio devices and computer simulation
• Illustrate how an algorithm for a complete design cycle of the chassis works
• Explain the various chassis suspension analyses and designs that need to be performed and verified during development
• Recognize Magic Numbers in suspension design and the Suspension Design Factors (SDF)
• Analyze, predict, and evaluate the design parameters and performance characteristics for ride and handling quality control behavior of ground motor vehicles as a result of suspension design
• Reference a unique set of lecture notes related to suspension design

WHO SHOULD ATTEND
This seminar is designed primarily for engineers involved in vehicle ride, handling, chassis design, suspension, steering and brake design for passenger cars and light trucks.

“This was an excellent seminar that coupled mechanical engineering principles with real-life application in automotive suspensions.”

Rick A. Borns
Director of Technology & Program Management
Alcoa Automotive Castings
CONTENT HIGHLIGHTS

• Tires and Wheels
• Ride and Ride Design Criteria
• Handling and Handling Design Criteria
• Vehicle Dynamics Terminology
• Roll Rates, Roll Motion
• Dynamic Transfer During Cornering
• Understeer Coefficient
• The Design of Springs, Stabilizer Bars, Shock Absorbers, Bushings, Control Arms
• Links, Semi-Active Damper, and Control Links
• Static Analysis and Design of Suspensions
• Suspension Terminology
• Fore/Aft Dynamic Load Transfer Analysis
• Dive, Lift and Squat
• Steering Systems
• Active and Semi-Active Suspension
• CAD/Static, Dynamic and Proving Ground Testing
• Suspension Design Cycle
• Magic Number in Suspension Design

INSTRUCTOR

Pinhas Barak
Professor of Mechanical Engineering
Vehicular Dynamics Design Center at Kettering University

L.D.# 95025

SCHEDULE

November 12-14, 2014
Troy, Michigan

FEES

List: $1,645
Members
Classic: $1,475
Premium: $1,385
Elite: $1,305

THREE-DAYS/2.0 CEUS

Get more information and register: training.sae.org/seminars/95025

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FUNDAMENTALS OF STEERING SYSTEMS

You analyze the steering system from the steering wheel to the road wheel in this interactive seminar. The seminar covers the anatomy and architecture of the lower steering system, its effect on vehicle response, and how a force at the contact patch translates to torque in the steering wheel. The anatomy and architecture of the upper steering system, including the topic of non-uniformity and the role of the system in the occupant protection system, is also explored. The instructor devotes time to the generation of power assist, including system anatomy/architecture and the effect of the system on fuel economy; and finishes with discussion of common steering objective tests and how the kinematics, compliances, friction and power assist affect steering response and torque feedback. You also participate in exercises throughout the seminar.

LEARNING OBJECTIVES
By attending this seminar, you will be able to:
• Identify common steering and suspension system architectures
• Compare and contrast different types of steering gears
• Describe the function of the steering column and intermediate shaft subsystem
• Describe the influence of system tuning on steering response and torque feedback
• Compare and contrast different types of power assist systems
• Describe the effect of power steering on fuel economy
• Calculate important parameters that affect steering response and torque feedback

WHO SHOULD ATTEND
This seminar is designed for automotive engineers in the vehicle dynamics, chassis, suspension, steering and chassis controls fields who work in product design, development, testing, simulation or research.

CONTENT HIGHLIGHTS
• The Lower Steering System
• The Upper Steering System (steering column & intermediate shaft)
• Power Assist Systems
• Vehicle Level Considerations
• Class Exercises

INSTRUCTOR
Timothy Drotar
Product Development Engineer
Ford Motor Company

“I very informative class on everything that goes into designing a steering system from the ground up.”
Cory C. Cousineau
Development Engineer
EMP-Engineered Machined Products, Inc.

I.D.# C0716

SCHEDULE
July 31-August 1, 2014
Troy, Michigan

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

TWO-DAYS/1.3 CEUS

Get more information and register: training.sae.org/seminars/C0716
This seminar provides a comprehensive introduction to the fundamentals of heavy truck dynamics. It covers all of the critical subsystems that must be considered by designers and decision makers in determining the effect of various components on heavy truck dynamics. This seminar begins where the tires meet the ground, progressing up through the various components and bringing together the theory and practice of heavy truck dynamics. A series of case studies offer demonstration of knowledge gained and introduces some of the newer technologies related to evaluating and improving heavy truck ride dynamics.

LEARNING OBJECTIVES
By attending this seminar, you will be able to:
• Acquire an overall understanding of heavy truck dynamics, both its theory and practice
• Acquire and demonstrate knowledge of heavy truck ride engineering and the factors that affect it
• Define the dynamics of various truck sub-systems and components that include tires, steering system, and truck suspensions
• Identify how sub-systems or components interact with other sub-systems to effect truck dynamics
• Describe some of the contemporary issues in heavy truck dynamics
• Assess and evaluate selected research topics you may want to consider for the sub-systems and components that you work with

WHO SHOULD ATTEND
Engineers in the heavy truck industry, most notably the original equipment manufacturers and their suppliers. Professionals that have a need to understand heavy truck dynamics will also benefit from attending this seminar.

CONTENT HIGHLIGHTS
• Tire Dynamics
• Steering System
• Suspension Dynamics and Kinematics
• Vehicle Dynamics Elements; Heavy Truck Dynamics
• Vibration Sources; Human Body Response to Vehicle Vibrations
• Perception of Ride
• Case Studies: Contemporary Topics in Heavy Truck Dynamics

INSTRUCTOR
Mehdi Ahmadian, Ph.D.
Professor of Mechanical Engineering
Virginia Tech

“The Fundamentals of Heavy Truck Dynamics course offered by SAE is a great tool for engineers trying to get into the heavy truck world as well as a good refresher for those who have been in the industry for some time.”

Shawn Bozarth
Project Engineer
Hendrickson

I.D.# C0837
SCHEDULE
Upcoming open enrollment dates are always being scheduled. Please visit the course website for more information.

FEES
List: $1,665
Members
Classic: $1,505
Premium: $1,405
Elite: $1,325

THREE-DAYS/2.0 CEUS
Get more information and register: training.sae.org/seminars/C0837
INTRODUCTION TO HEAVY TRUCK TIRE, STEERING, AND SUSPENSION DYNAMICS

This seminar provides an introduction to several critical aspects of heavy truck dynamics. The comprehensive presentation and discussion will begin with the mechanics and dynamics of heavy truck tires, followed by steering dynamics, and finally moves participants into suspension kinematics and dynamics. Starting at the ground and moving up, this seminar explores the important dynamic aspects of each subsystem and how each is related to the overall truck dynamics. This one-day course is derived from the instructor’s three-day course titled Fundamentals of Heavy Truck Dynamics and serves to present important concepts and contemporary issues related to heavy truck dynamics in a convenient single-day format.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

• Acquire a fundamental understanding of heavy truck dynamics, both in its theory and practice
• Identify how subsystems and components interact with other subsystems to effect the truck dynamics
• Define the dynamics of various truck subsystems and components, including tires, steering system and truck suspensions

WHO SHOULD ATTEND

This course will benefit anyone in the heavy truck industry, most notably the original equipment manufacturers and their suppliers. It is also suitable for others that have a need for a broad understanding of truck dynamics such as section managers, decision makers, program managers, system engineers, and marketing staff.

CONTENT HIGHLIGHTS

• Introduction to Systems, Components, and Terminology
• Tire Structure
• Tread Patterns
• Tire Dynamics
• Steering System
• Truck Suspension
• Spring Elements
• Damping Elements

INSTRUCTOR

Mehdi Ahmadian, Ph.D.
Professor of Mechanical Engineering
Virginia Tech
THE TIRE AS A VEHICLE COMPONENT

The principal functions of the pneumatic tire are to generate driving, braking, and cornering forces while safely carrying the vehicle load and providing adequate levels of ride comfort. This seminar explains how tire forces and moments are generated under different operating and service conditions and, in turn, demonstrates how these forces and moments influence various vehicle responses such as braking, handling, ride, and high-speed performance. The content focuses on the fundamentals of tire behavior in automobiles, trucks, and farm tractors, but also includes experimental and empirical results, when necessary.

The Pneumatic Tire, a 700-page E-book on CD, edited by Joseph Walter and Alan Gent is included in the course material.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:
• Explain the force and moment generating behavior of tires as related to construction, materials, and operating conditions
• Predict vehicle response based on tire characteristics using basic laws of mechanics supplemented by experimental results as necessary

WHO SHOULD ATTEND

This course is designed principally for technical professionals in the automobile, tire, and wheel industries and their suppliers. In addition, some case studies and examples involve truck, agriculture, and aircraft tires.

CONTENT HIGHLIGHTS

• Longitudinal Tire Properties
• Lateral Tire Properties
• Combined Longitudinal and Lateral Forces
• The Tire as a Spring
• Tire and Wheel Non-Uniformities
• Influences of Tire Properties on Vehicle Response
• Future Technological Developments

INSTRUCTOR

Dr. Joseph D. Walter
Adjunct Professor, College of Engineering
The University of Akron

“Impressive! This instructor was as entertaining as he was knowledgeable and prepared. He covers a wide ranging spectrum succinctly and provided useful handouts.”

Tom Vadnais
Partner
Vadnais, Wood & Rivers

I.D.# C0101

SCHEDULE

July 21, 2014
Troy, Michigan

FEES

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

ONE-DAY/.7 CEUS

Get more information and register: training.sae.org/seminars/C0101
TIRE AND WHEEL SAFETY ISSUES

One of the most important safety critical components on cars, trucks, and aircraft is the pneumatic tire. Vehicle tires primarily control stopping distances on wet and dry roads or runways and strongly influence over-steer/under-steer behavior in handling maneuvers of cars and trucks. The inflated tire-wheel assembly also acts as a pressure vessel that releases a large amount of energy when catastrophically deflated. The tire can also serve as a fulcrum, both directly and indirectly, in contributing to vehicle rollover. This seminar covers these facets of tire safety phenomena. Engineering fundamentals are discussed and illustrated with numerous practical examples and case studies of current public interest.

The Pneumatic Tire, a 700-page E-book on CD, edited by Joseph Walter and Alan Gent is included in the course material.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

• Describe the most important performance parameters and operating conditions of pneumatic tires related to safety
• Use fundamental equations of engineering science to predict and/or explain tire-vehicle interactions related to safety

WHO SHOULD ATTEND

This course is designed principally for technical professionals in the automobile, tire, and wheel industries and their suppliers. In addition, some case studies and examples involve truck, agriculture, and aircraft tires.

CONTENT HIGHLIGHTS

• Vehicle accident statistics
• Role of the tire in accident prevention/causation
• Construction features
• Failure Modes
• Tire Grip and Related Phenomena
• Brake Performance
• The Tire as a Pressure Vessel
• Over-steering Vehicles
• Vehicle Rollover Analysis

INSTRUCTOR

Dr. Joseph D. Walter
Adjunct Professor, College of Engineering
The University of Akron
NEW! VEHICLE DYNAMIC BASICS FOR OFF-HIGHWAY TRUCKS

This seminar concentrates on the basics of off-highway trucks and the differences with their on-highway counterparts. Emphasized in the course are the practical and theoretical aspects of off-highway trucks as they relate to various components and subsystems, including tires, steering system, and suspensions. The course also highlights how various components and subsystems dynamically interact with each other, and how their collective interaction is manifested in the overall vehicle dynamics.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:
• Describe the theory and practice of off-road truck dynamics
• Define the dynamics of various off-road truck sub-systems and components including tires, steering system, and suspension
• Identify how sub-systems and components interact with other sub-systems and components to effect the dynamics of off-road trucks
• Describe the effects of loading, weight transfer, and grade on off-road truck dynamics

WHO SHOULD ATTEND

This seminar will benefit design, manufacturing, and customer support engineers in the heavy off-road truck industry, most notably OEMs and their suppliers. Professionals with a need to understand heavy off-road vehicle dynamics will also benefit from attending this seminar.

CONTENT HIGHLIGHTS

• Tire Dynamics
  • Effect of operation on tire temperature
  • Effect of overloading the tire
• Steering System
  • Ackermann steering for off-road vehicles
  • All-wheel steering dynamics
• Suspensions
  • Dynamic and kinematics attributes of off-highway suspensions
  • Effect of suspension on vehicle: Ride; Handling; Stability
• Off-highway Truck Dynamics
  • Effect of off-centered loads
  • Vehicle rollover dynamics

INSTRUCTOR

Mehdi Ahmadian, Ph.D
Professor of Mechanical Engineering
Virginia Tech
This seminar will present an introduction to Vehicle Dynamics from a vehicle system perspective. The theory and applications are associated with the interaction and performance balance between the powertrain, brakes, steering, suspensions, and wheel and tire vehicle subsystems. The role that vehicle dynamics can and should play in effective automotive chassis development and the information and technology flow from vehicle system to subsystem to piece-part is integrated into the presentation. Governing equations of motion are developed and solved for both steady and transient conditions. Manual and computer techniques for analysis and evaluation are presented. Vehicle system dynamic performance in the areas of drive-off, braking, directional control and rollover is emphasized. The dynamics of the powertrain, brakes, steering, suspension, and wheel and tire subsystems and their interactions are examined along with the important role of structure and structural parameters related to vehicle dynamics. Physical experiments, applicable to vehicle dynamics are also introduced. Attendees will receive the Bosch Automotive Handbook and The Automotive Chassis: Engineering Principles by Reimpell, Stoll and Betzler.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

• Summarize how vehicle dynamics is related to the voice of the customer

• Identify important vehicle system parameters useful for effective application of vehicle dynamics to chassis development

• List and explain parameters that effect vehicle performance relative to drive-off, braking, directional control and rollover

• Identify physical measurements needed to effectively apply vehicle dynamics to passenger cars and light trucks

• Define the value of vehicle dynamics simulation in the development and evaluation of vehicles

• Explain the balance required between ride, directional control and rollover and the essential process for this balance to be obtained for marketplace vehicles

WHO SHOULD ATTEND

Automotive engineers and quality professionals who work in product design, testing, quality, process or development will benefit from attending.
CONTENT HIGHLIGHTS

• The Role of Vehicle Dynamics in Passenger Car and Light Truck Product Development
• Vehicle Dynamics and the Voice of the Customer
• Effective Metrics for Vehicle Dynamics
• Tire Fundamentals: Tire Wheel System Anatomy and Architecture, Tire Axis System, Parameters and Characteristics
• Elementary Tire Patch Forces and Moments: Forces and Moments at the Tire Contact Patch During Steady Braking, Steady Cornering and Steady Drive-Off Maneuvers
• Acceleration (Drive-Off) Performance
• Braking Performance
• Ride Fundamentals
• Cornering Fundamentals
• Suspension Systems
• Steering Systems
• Roll-Over Fundamentals
• Introduction to CAE Applications for Vehicle Dynamics

INSTRUCTOR

Dr. Richard Lundstrom
Independent Research and Project Engineer

I.D.# 99020

SCHEDULE

October 20-22, 2014
Troy, Michigan

FEES

List: $1,785
Members
Classic: $1,615
Premium: $1,525
Elite: $1,425

THREE-DAYS/2.0 CEUS

Get more information and register: training.sae.org/seminars/99020

ALSO AVAILABLE AS AN ONLINE, ON-DEMAND COURSE.

Convenient, portable, and with core content from the instructor-led seminar, this fifteen 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 course offers instruction and simulations divided into nineteen video modules and includes the same resources and handouts as the classroom option.

I.D. # PD1307020N

FEES

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

15-HOURS/ 1.5 CEU

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

WHAT IS “ONLINE, ON DEMAND”

SAE International online, on demand offerings are a variety of full-length recorded seminars and webinars, and short-course options that offer quick bits of learning – learning options that you can access anytime and anywhere you have a laptop and internet access. We are also proud to offer on demand courses from partner organizations like Ford, CALISO, and Industrial Metallurgists, LLC.
This seminar will provide an introduction to brake lining raw materials and formulation, manufacturing, quality control and testing. The course covers the critical elements that must be reviewed before arriving at a lining selection decision. Different classes of friction material and their use are defined.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

• Describe the principles of friction
• Define the basic elements of friction material formulations
• Identify the difference between OE and after-market friction materials
• Identify appropriate tests to distinguish the differences between friction materials
• Interpret friction material test results

WHO SHOULD ATTEND

Engineers and technicians working for friction material manufacturers and suppliers to friction material industries will find this course valuable. Brake system designers, quality control auditors, product development engineers, application engineers, lab/bench/vehicle test technicians, managers/friction material sales and marketing will all gain valuable insight into this highly guarded industry.

CONTENT HIGHLIGHTS

• Principles of Friction Materials
• Lining Coefficient of Friction
• Formulation/Compounding Friction Material
• Manufacturing Friction Material
• General Asbestos/Non-asbestos Friction Material Characteristics
• Friction Material Testing
• Edge Code
• Bench & Vehicle Tests
• Wheel Dust Test
• Government Regulations
• OE and After-market Friction Material Lining Selection
• Issues Facing Friction Material Industries
  • Copper in brake pads
  • CA intended regulations
• Workshop

INSTRUCTOR

Mohammad Vakili
Independent Consultant

The choice of brake friction materials varies per application, but each must have the appropriate coefficient of friction and be able to disperse large amounts of heat without adversely affecting braking performance.

I.D.# C1020

SCHEDULE

October 9, 2014
Burlingame, California

Held in conjunction with the SAE 2014 Brake Colloquium and Exhibition

FEES

List: $765
Members
Classic: $695
Premium: $655
Elite: $605

ONE-DAY/.65 CEUS

Get more information and register: training.sae.org/seminars/c1020
BRAKE NOISE PROBLEM RESOLUTION

Brake noise is one of the highest ranked complaints of car owners. Grunts, groans, squeaks, and squeals are common descriptions of the annoying problem which brake engineers spend many hours trying to resolve. This course will provide you with an overview of the various damping mechanisms and tools for analyzing and reducing brake noise. A significant component of this course is the inclusion of case studies which will demonstrate how brake noise squeal issues have been successfully resolved.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:
• Describe the various brake shim damping mechanisms
• Compare the various brake shims available in the market place
• Describe the various tools available to reduce brake noise
• Utilize lessons learned in various brake noise problem case studies

WHO SHOULD ATTEND

Anyone involved in the resolution of brake noise problems will find this course helpful.

CONTENT HIGHLIGHTS

• Brief Review of Brake Noise
  • Types of brake noises
  • Frequency range
  • Source/path/receiver
• Principles and Applications of Brake Shims
  • Damping
  • Role and purpose of brake shims
  • Different types of brake shims
  • Brake shims damping mechanisms
• Tools for Brake Noise Analysis/Reduction
  • Brake noise categorization
  • Solution strategy
  • Investigative tools -- Testing; Simulation
• Squeal
  • Brake pad design optimization
  • Pressure distribution optimization
  • Low frequency squeal
• Moan/Groan
  • After-stop noise program -- Problem identification; Transmission of the road to the lab; Measurement systems; Root cause analysis; Solution
• Question and Answer Session

INSTRUCTOR

Eric Denys
Vice President of Sales, Marketing & Technology
Material Sciences Corporation

Consumer expectations and the high cost of warranty repairs are pushing the optimization of brake NVH performance.

I.D.# C0831

SCHEDULE
October 10, 2014
Burlingame, California
Held in conjunction with the SAE 2014 Brake Colloquium and Exhibition

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

ONE-DAY/.7 CEUS

Get more information and register:
training.sae.org/seminars/C0831
Increased public pressure to improve commercial truck safety and new stopping distance regulations have intensified the need to better understand the factors influencing heavy vehicle braking performance. To assist you and your organization in preparing for these new truck braking standards, this seminar focuses you on understanding medium-duty hydraulic brake systems and heavy-duty air brake systems and how both systems’ performance can be predicted, maintained and optimized. The function and application of the major brake system components will be explained and you will discover how brakes, tires and roadways interact as a system. Federal braking regulations for both hydraulic and air brake vehicles will also be covered. You will receive the text, Commercial Vehicle Braking Systems: Air Brakes, ABS and Beyond, written by Leonard C. Buckman.

LEARNING OBJECTIVES
By attending this seminar, you will be able to:
• Design safe and efficient braking systems
• Test and measure braking performance
• Maintain and troubleshoot braking systems
• Comply with state and federal regulations on brakes
• Describe the brake implications of accident investigation

WHO SHOULD ATTEND
This seminar is designed for engineers and technicians who are involved in the design, development and testing of heavy vehicle brakes. Fleet personnel involved with safety and brake system specification and maintenance, driver-trainers, and truck accident investigators will also find this course of value.

“This was an excellent seminar, by far the most useful seminar I have taken. Practical statistical analysis.”

Michael Klatt
Engineer
Wabco Compressor Mfg. Co.

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CONTENT HIGHLIGHTS

- Medium Truck Hydraulic Brake Actuation Systems
- Heavy Truck, Bus & Trailer Air Actuation Systems
- Brake Actuation Components - Function, Advantages/disadvantages, Applications
- Foundation Brakes - Cam, Wedge, Air Disc, Hydraulic Disc
- Braking Performance Fundamentals
- Maintenance and its Impact on Performance
- Brake Force Distribution
- Heavy Vehicle Dynamics and Tire Characteristics
- Thermal Considerations
- Tractor - Trailer Brake Compatibility
- Truck & Tractor Air Antilock Braking Systems
- Trailer Air Antilock Braking Systems
- Hydraulic Antilock Braking Systems
- Electronic Data Communication
- Automatic Traction Control Systems (ATC)
- Electronically Controlled Braking Systems (ECBS or “Brake-by-Wire”)  
- Electronic Stability Control and Roll Stability Control - Extended Applications of Electronics in Braking
- Brake Testing Procedures
- NHTSA and FMCSA Commercial Vehicle Brake Regulations

INSTRUCTOR

Paul Johnston
Senior Director of Compression and Braking
Meritor WABCO

I.D. # CO233

SCHEDULE

June 23-25, 2014
Troy, Michigan

December 10-12, 2014
Troy, Michigan

FEES

List: $1,665
Members
Classic: $1,485
Premium: $1,405
Elite: $1,325

THREE-DAYS/2.0 CEUS

Get more information and register at:
training.sae.org/seminars/CO233

ALSO AVAILABLE AS AN ONLINE, ON-DEMAND COURSE.

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. The course offers an overview and 17 modules on video, course exercises, and a coordinated handbook.

I.D. # PD130611ON

FEES

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

18-HOURS/1.8 CEU

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

i.d. # C0233

Schedule
June 23-25, 2014
Troy, Michigan

December 10-12, 2014
Troy, Michigan

Fees

List: $1,665
Members
Classic: $1,485
Premium: $1,405
Elite: $1,325

Three-Days/2.0 Ceus

Get more information and register at:
training.sae.org/seminars/CO233

Also Available As an Online, On-Demand Course.

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. The course offers an overview and 17 modules on video, course exercises, and a coordinated handbook.

I.D. # PD130611ON

Fees

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

18-Hours/1.8 Ceu

View the complete course description and a video demo: training.sae.org/eseminars/cvbs
This course analyzes automotive braking from a system's perspective, emphasizing legal requirements as well as performance expectations. Calculations necessary to predict brake balance and key system sizing variables that contribute to performance will be discussed. Major components of a brake system, including calipers, boosters, master cylinders, drum brakes, and park brakes are presented in detail highlighting the many design variations. An overview of the chassis control components and operating principles will be presented with an emphasis on ABS, traction control and stability control.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

• Design a brake system in compliance with Federal Motor Vehicle Safety Standards
• Calculate the ideal brake balance for a vehicle under any loading condition
• Calculate the actual brake balance and brake output for a selected set of brake components and evaluate the effects of changing component parameters
• Determine the effects of variation in component parameters on the system performance
• Describe the basic function of major brake components
• Describe various chassis control systems and their role in vehicle safety
• Determine the appropriate design variation for a particular application

WHO SHOULD ATTEND

Engineers interested or responsible for the specification, prediction and validation of braking system performance. It will also benefit engineers responsible for brake component design.

CONTENT HIGHLIGHTS

• System Level Requirements
• Brake Balance and System Output Calculations
• Workshop - design a brake system and predict the performance to key system level targets
• Component Functional Review
• Workshop - determine the effects of component variation on design
• Anti-lock Braking Systems
• Advanced Concepts and Technology

INSTRUCTOR

Thomas J. Hall
Owner/Manager
MaxG Technology LLC

“This was an excellent overview of the topic, but it dealt with enough specifics to give me a good knowledge base to help me do my job better.”

Alan S. Halvorson
Project Engineer
Harley-Davidson Motor Company
NEW! INTRODUCTION TO BRAKE NOISE, VIBRATION, AND HARSHNESS

Brake Noise, Vibration, and Harshness (NVH) is recognized as one of the major problems currently faced by the automotive manufacturers and their suppliers, with customers warranty claims of more than $100 million per year for each manufacturer. This seminar provides an introduction to brake NVH, including a concise summary of the various brake NVH problems, current lab and vehicle measurement techniques and SAE global standards which are utilized to characterize the noise correctly in order to get the best option/solutions quickly.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:
• Describe NVH and brake NVH
• Identify the various brake NVH problems
• Describe the components of a brake NVH dynamometer
• Configure and perform dyno and vehicle brake NVH tests measurements
• Utilize SAE J2521, the only international standard for brake NVH dynamometer evaluation
• Interpret basic noise and vibration data in the time and frequency domain
• Explain the premise behind various SAE Standards related to brake NVH

WHO SHOULD ATTEND

The information in this course is relevant to a wide audience, from the brake test technician who seeks to understand more about NVH and brake NVH, to the experienced brake NVH engineer who wishes to know more about the details of the tests performed and the meaning of the results. Brake development and brake component engineers who are not familiar with brake NVH will also find the course beneficial.

CONTENT HIGHLIGHTS

• Basics of Noise and Vibration
• Basics of Brake NVH
• Basic Dynamometer Testing
• Vehicle Brake Testing
• Brake SAE NVH Standards Currently Released and Under Development
• Introduction to Brake NVH Problem Resolution

INSTRUCTOR

Eric Denys
Vice President of Sales, Marketing & Technology
Material Sciences Corporation
INTRODUCTION TO BRAKE CONTROL SYSTEMS: ABS, TCS, AND ESC

This comprehensive seminar introduces participants to the system-level design considerations, vehicle interface requirements, and inevitable performance compromises that must be addressed when implementing electronic brake control systems.

The seminar begins by defining the tire-road interface and analyzing fundamental vehicle dynamics. Following an in-depth study of system electronics, hydraulic hardware, and sensor requirements, you learn about the control strategies employed by anti-lock brakes (ABS), dynamic rear proportioning (DRP), traction control (TCS), and electronic stability control (ESC) with strong emphasis placed on vehicle dynamic response. The seminar concludes with a study of unique applications, a look forward to advanced brake control system integration, and an overview of Federal Motor Vehicle Safety Standard 126. Over 500-pages of detailed course notes and illustrations are provided for on-the-job reference.

LEARNING OBJECTIVES

By attending this seminar, you will be able to:

• Analyze brake system design parameters and their vehicle performance effects
• Evaluate the compromises between stability, steerability, and stopping distance
• Discern the discrete mechanical components required for ABS
• Specify fundamental ABS performance attributes
• Estimate dynamic brake balance and explain the benefits of DRP
• Reconcile TCS performance expectations vs. method of implementation
• Interpret ESC metrics and ultimate dynamic limitations
• Discuss opportunities for advanced brake control system integration
• Comprehend federal requirements for the performance of ESC

WHO SHOULD ATTEND

This course has been developed for engineers involved in all fields related to the design or development of vehicle dynamics, vehicle braking systems, powertrain systems, chassis systems, or suspension systems. In addition, this course can be valuable to those with component design responsibilities in brake, chassis, suspension, or tire disciplines.
CONTENT HIGHLIGHTS
• Tire-Road Interface Characteristics
• Hydraulic Brake System Overview
• Stability, Steerability, Stopping Distance
• Mechanization of ABS
• ABS Sensor Overview
• ABS Performance
• DRP Performance
• Mechanization of TCS and ESC
• TCS and ESC Sensor Requirements
• TCS Performance
• ESC Performance
• Special Conditions and Considerations
• Advanced Integration (handout only - no presentation)
• Federal Motor Vehicle Safety Standard 126

INSTRUCTOR
James Walker, Jr.
Principal Engineer
Carr Engineering, Inc.

I.D.# C0315

SCHEDULE
November 3-4, 2014
Troy, Michigan

FEES
List: $1,295
Members
Classic: $1,165
Premium: $1,105
Elite: $1,035

TWO-DAYS/1.3 CEUS
Get more information and register:
training.sae.org/seminars/C0315

ALSO AVAILABLE AS AN ONLINE,
ON-DEMAND COURSE.
Convenient, portable, and with core content from the instructor-led seminar, this 9.5-hour e-Seminar option offers an alternative way to receive the same instruction without the expense of travel and time away from the workplace. The course is divided into 13 video modules, accompanied by a handbook.

I.D. # PD130501ON

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

9.5-HOURS/ 1.0 CEU
View the complete course description and a video demo: training.sae.org/eseminars/brakecontrolsystems

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Braking confidence and pedal feel are important braking performance attributes that should be optimized to achieve customer satisfaction with a vehicle’s braking system. The relationship between the input force and travel provided by the driver to achieve the desired vehicle deceleration is as core to the vehicle personality or DNA as ride, handling, or driveability. This Fast Track will cover the main concepts and methods needed for tuning brake systems to desired pedal force and travel characteristics.

**LEARNING OBJECTIVES**

By participating in this Fast Track short course, you will be able to:

- Explain the general mechanism by which pedal force is converted to stopping force and vehicle deceleration by the brake system
- Determine the amount of stopping force and deceleration that will occur for a given pedal force and pedal travel
- Explain the general parametric relationships between pedal force, travel and vehicle deceleration, and how to adjust key parameters to achieve pedal force, pedal travel and vehicle deceleration targets
- Explain how external factors such as elevation and temperature affect braking performance
- Identify the challenges related to braking design and braking confidence optimization for emerging technologies such as regenerative braking capabilities of hybrid and electric vehicles

**IS THIS FAST TRACK FOR YOU?**

This course is valuable to anyone involved in the validation of a braking system, either in the development of the validation plan or the execution of the validation plan.

**CONTENT HIGHLIGHTS**

- Introduction to Braking Confidence
- Input Force to Vehicle Deceleration Relationship
- Input Travel to Vehicle Deceleration Relationship
- Parametric Analysis
- Environmental Effects
- Emerging Trends Affecting Braking Confidence

**INSTRUCTOR**

Thomas J. Hall  
Chief Engineer, Braking Systems  
Robert Bosch Corporation
VEHICLE BRAKING PERFORMANCE: STOPPING DISTANCE FAST TRACK

The measurements associated with Stopping Distance are used within the development of the vehicle and are a critical aspect of accident prevention and reconstruction, and overall occupant and pedestrian safety management. This course reviews the methods used to measure and report stopping distance and analyzes the associated formulations to determine the braking forces created by a wheel brake and necessary to achieve a desired distance.

LEARNING OBJECTIVES
By participating in this Fast Track short course, you will be able to:
- Calculate the stopping distance of a vehicle based on known vehicle parameters
- Determine the stopping distance of a vehicle under different road surface conditions
- Compare the performance of tires on various road surfaces and slip conditions
- Relate the published stopping distance to the ability to avoid (stop short) of a road obstacle
- Formulate the brake force required to achieve a desired stopping distance
- Calculate the brake force created by a wheel brake
- Normalize actual test data to commonly reported standard values
- Determine the contribution of ABS to stopping performance
- Compute ABS efficiency by common methods

IS THIS FAST TRACK FOR YOU?
Anyone involved in the validation of a braking system, either in the development of the validation plan or the execution of the validation plan. Those involved in accident reconstruction and accident prevention would benefit from an understanding of the techniques and principles.

CONTENT HIGHLIGHTS
- Common Procedures Used to Assess Stopping Distance
- Performance Metrics Compared to Target Avoidance
- Determination and Generation of Forces Necessary to Stop a Vehicle
- Contributions and Limitations

INSTRUCTOR
Thomas J. Hall
Chief Engineer, Braking Systems
Robert Bosch Corporation

I.D.# PD230826ON

SCHEDULE
Online, on demand/3-month access

FEES
List: $110
Members
Classic: $99
Premium: $94
Elite: $88

60-MINUTES
Get more information and register: training.sae.org/fasttracks/stoppingdistance

27
SELECTED LIVE LEARNING SCHEDULE
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McLean, Virginia – 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.# C0525
Jun 5-6  Vehicle Frontal Crash Occupant Safety and CAE -- I.D.# C0621
Jun 9-10  Program and Risk Management -- I.D.# C0409
Jun 23-25  Commercial Vehicle Braking Systems -- I.D.# C0235
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 Hybrid and 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
Aug 11-12  Modern Fluids for Crankcase Engines: An Overview -- I.D.# C070
Aug 13  Effective Decision Making: A Methodology Approach -- I.D. C1354
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 20-22  Turbocharging Internal Combustion Engines -- I.D.# C0314
Aug 21-22  Leading High Performance Teams -- I.D.# C0410
Aug 25-27  Gasoline Direct Injection (GDI) Engines -- I.D.# C1009
Webinar – Live Online
Aug 4-15 Design of Experiments (DOE) for Engineers Webinar -- I.D.# WB0932
Aug 5-7 Diesel Engine Noise Control Webinar -- I.D.# WB1041
Aug 19- Sep11 Fundamentals of Geometric Dimensioning & Tolerancing (GD&T) Webinar -- I.D.# WB0933

Troy, Michigan – SAE International Office
Sep 8-9 The Basics of Internal Combustion Engines -- I.D.# C0103
Sep 11-12 Creating and Managing a Product Compliance Program -- I.D.# C1213
Sep 15-16 Exhaust Gas Recirculation (EGR) for Diesel Engines -- I.D.# C1214
Sep 18-19 Evaporative and Refueling Emission Control -- I.D.# C0928
Sep 25-26 Compact Heat Exchangers for Automotive Applications -- I.D.# 97002
Sep 29-30 Engine Failure Investigation and Analysis -- I.D.# C1344

Webinar – Live Online
Sep 8-17 Implementing SAE AS6081 – Counterfeit Electronic Parts Avoidance for Distributors Webinar – I. -- I.D. #WB1355
Sep 10-19 Vehicle Sound Package Materials Webinar -- I.D.# WB1204
Sep 16 Introduction to Hybrid Powertrains Webinar -- I.D.# C0903
Sep 18 Basic Hybrid and Electric Vehicle Safety Webinar -- I.D.# C0904
Sep 23-25 Introduction to Powertrain Calibration Engineering Webinar -- I.D.# WB1346
Sep 30- Oct 2 Driver Distraction from Electronic Devices: Insights and Implications Webinar -- I.D.# WB1140

Anaheim, California – held in conjunction with the SAE 2014 On Board Diagnostics Symposium
Sep 8 Emissions-Related OBD Systems: A Design Overview -- I.D. #C0708

Norwalk, California – Cerritos, College (SCCT)
Oct 27-28 Damage Tolerance for Gas Turbine Engines -- I.D.# C1323
Oct 27-29 Applying Automotive EDR Data to Traffic Crash Reconstruction -- I.D.# C1210
Oct 29-30 Understanding the FAA Parts Manufacturer Approval Process -- I.D.# C1324

Troy, Michigan – SAE International Office
Oct 1-2 Advanced Diesel Particulate Filtration Systems -- I.D.# C0502
Oct 2-3 Design of Experiments for Engineers -- I.D.# C0406
Oct 2-3 Piston Ring Design/Materials -- I.D.# 86009
Oct 3 Exhaust Flow Performance and Pressure Drop of Exhaust Components and Systems -- I.D.# C0235
Oct 7 Introduction to Gears -- I.D.# C0822
Oct 8 Patent Law for Engineers -- I.D.# 88007

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