University of Akron 56th Tire Mechanics Short Course

Deutsche Messe, Hannover, Germany, March 2-5, 2026

The 56th Tire Mechanics Short Course will be held concurrently with Tire Technology Expo 2026 in Hannover, Germany, on March 2-5, 2026.

Contact Information

Course Information

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Program Schedule

Monday, March 2, 2026

09:00 – 09:30

Welcome and Introduction

Dr. Xiaosheng Gao
Department of Mechanical Engineering, College of Engineering and polymer science
The University of Akron, Akron, OH. USA

09:30 – 16:30 (Complimentary Lunch 12:00-13:00)

TIRE COMPONENTS, TIRE COMPOUNDS AND TIRE MATERIALS

Dr. Annette Lechtenböhmer
Goodyear Innovation Center, Luxembourg (Retired); Associate Editor of Tire Science and Technology

This lecture gives an overview of the tire components, the demands on their compounds and the use of materials in these compounds. It attempts to make the connection between the role of components in a tire, the compound requirements of these components and the raw materials and cure which results in the desired compound properties. The lecture wants to close the loop between the raw materials and reinforcements used, the compound properties, tire preparation and cure, and final tire properties. The lecture will cover:

1. A Short Introduction
2. Components of a tire and demands
3. Tire compounds and their materials, including polymers, fillers, additives, sulfur, and curatives
4. Tire structures and composites, textile cords, wire, carcasses, beads, and belts
5. Processing, including mixing, calendaring, and extrusion
6. Tire building

Tuesday, March 3, 2026

09:00-16:30 (Complimentary Lunch 12:00-13:30)

THE TIRE AS A VEHICLE COMPONENT

Dr. Gerald Potts
GRP Consulting, Akron, OH, USA

Dr. James Cuttino, Presenter
Yokohama Corporation of North America, Cornelius, NC, USA

Today's pneumatic tire must serve four functions: (1) support a moving load; (2) generate steering forces; (3) generate driving and braking forces; and (4) provide isolation from road irregularities. In examining the complex mechanisms involved in satisfying the four requirements, participants will study the tire's importance in determining overall vehicle performance; for no matter what level of complexity is designed into a vehicle, its only communication with the road is through its tires, which must be tough and strong, yet flexible. The following topics will be covered:

1. Mechanics of Force Generation in the Contact Patch
2. Tire Performance (Cornering and Traction)
3. The Tire and Vehicle Dynamics
4. Tire Testing
5. Brief Overview of Tire Modeling

16:30 – 18:00

Visit to the Exhibition

Wednesday, March 4, 2026

09:00 – 16:30 (12:00 – 13:30 Complimentary Lunch)

Impact of Rubber and Reinforcement Properties on Tire Footprint Mechanics

Dr. Mahmoud Assaad
Senior Technical Advisor, Endurica, Findlay, OH, USA

Global Tire Performance Prediction, Computational Mechanics
The Goodyear Tire & Rubber Co, Akron, OH. USA (Retired)

The viscoelastic behavior of the rubber compounds and the reinforcing cords influences the stability of the tire footprint shape. Additional physical properties such as the strain dependency of both constituents and their thermal stability contribute to the contact pressure distribution. The resultant tire forces and moments transmitted to the vehicle are measured using tri-axial force pin transducers or pressure-sensitive mats. The interaction between the materials' behavior and the tire global response controls the mechanics of tire readability and wear characteristics. The following topics will be discussed:

1. Mechanical properties of Rubber
   Elasticity and Viscoelasticity
   Strength of rubber compound
   Payne, Mullins Effects
   Energy Dissipation
   Strain Energy Release rate

Neural Network (Feed Forward-Back Propagation) based constitutive model for rubber material

2. Fibers and cords: load-displacement, creep, stress relaxation, and shrinkage; Impact of steel wires & polymeric cords on tire performance; Reinforcement adhesive coatings and processing
3. Tire transient force & moment response to slip angle sweep
   Footprint characteristics
   F&M measurement
   Cornering stiffness
   Small-medium-large slip angle regimes
4. Tire applications
   How tires age and how to measure aging in tires
   Tire electric resistance
   Tire pressure loss over time-impact of liner material and thickness
   Tire post cure inflation
   Tire digital twin technology
   Monitor health of tire using Continuum Damage Mechanics (CDM)

16:30 – 18:00

Visit to the Exhibition

Thursday, March 5, 2026

08:15 – 15:15 (12:00 – 13:00 Complimentary Lunch)

VIRTUAL TIRE MODELING for IMPROVED PERFORMANCE

Dr. Ronald Kennedy

Center for Tire Research, The University of Akron and Virginia Tech. Blacksburg, Va. U.S.A (Retired); Associate Editor of Tire Science and Technology Journal

Simulations are increasingly being used in companies' virtual design processes to develop a tire more effectively and efficiently with desired performance attributes. These simulation methods run the gamut from simple empirical or analytical models to highly detailed finite element models. These increasing levels of modeling will be described along with examples, with extended focus on the finite element modeling method. Various finite element modeling techniques will be shown as part of the tire performance simulation examples. The lecture will cover:

1. Tire load transfer, cord force, and tire shape mechanics and model representations
2. Review of tire performance modeling methods of increasing complexity, with examples
   - Empirical
   - Analytical

    - Physically based Numerical.
3. Brief introduction to tire finite element analysis (FEA)
4. Application of FEA to tire performance prediction
    - Tire/road contact and forces (static, rolling, cornering)
    - Rolling resistance
    - Tread wear
    - Durability
    - Hydroplaning

15:15 – 15:45

Course Evaluations and Distribution of Certificates

Dr. Xiaosheng Gao
Department of Mechanical Engineering
The University of Akron, Akron, OH, USA

Biographical Notes

Dr. Mahmoud C. Assaad

In 1983, Dr. Assaad earned his Ph.D. degree in Engineering Science and Mechanics as major and Applied Mathematics as minor from Iowa State University, Ames, Iowa. In 1979, he received a M.S. degree in Structural Engineering from the same university. In 1990, he received a M.S. degree in Polymer Science from The University of Akron (Akron, Ohio). In 1983, he joined The Goodyear Tire & Rubber Company. His current research interests include development of multi-physics simulation of tire performance including structural, thermal, and oxidative response. He is a lecturer at the Goodyear Institute of Technology. He was an Adjunct Assistant Professor in the Civil Engineering Department at The University of Akron and was also a lecturer at The University of Toledo. He Coauthored the composite segment of The Pneumatic Tire e-book, taught short courses on Plastics and Elastomers in Engineering Design in Italy, Luxembourg, and Germany. He was an invited speaker to the Gordon Conference on Fibers Science and to the 2009 “The Annual Workshops Materials’ Days at the University of Rostock”, Germany. He is currently working with ENDURICA as a Senior Technical Advisor.

Dr. Assaad was a recipient of the special Achievement Award from NASA for his meritorious accomplishments, dedicated work, and special efforts. He was the Winner of the “2008 Create the Future Design Contest” in the machinery/equipment category and served as a technical chairman for the 26th Anniversary of The Tire Society Conference. Dr. Assaad holds over 60 U.S., patents and trade secrets in U.S., and Europe.

Dr. James F. Cuttino

Dr. Cuttino is the Director of Tire Development and Testing at Yokohama Corporation of North America. In that role, Jim supervises the development of tires for both the Original Equipment and Replacement markets as well as the related testing activities. Prior to joining Yokohama, Jim was the Director of Tire Technologies and Product Line at LINK Engineering, where he oversaw the conceptualization and development of new tire testing equipment, business development related to tires, and tire testing services. He received his BS and MS degrees from Clemson University in 1985 and 1987, and began his career at Michelin Americas R&D Center before returning to school to earn his Ph.D. in Precision Engineering at NC State University. Over the next 14 years he taught Mechanical Engineering at The University of Alabama and UNC Charlotte, where he started the Motorsports and Automotive Research Center. Jim left teaching in 2009 to start Camber Ridge, a first of its kind tire testing facility designed to improve accuracy and fidelity in tire testing. He subsequently sold the technology to LINK Engineering in 2017.

Dr. Cuttino is the Chair of the SAE Truck and Bus Tire Committee along with having served on numerous organizing committees for the SAE, the Clemson Tire Conference, and others. Dr. Cuttino was the Keynote Speaker at the 2017 American Society for Precision Engineering Annual Meeting and received an SAE Best Paper Award at the 2013 SAE Commercial Vehicle Conference. He is the author of nine patents.

Dr. Ronald Kennedy

Dr. Ron Kennedy served as the Managing Director of the Center for Tire Research (CenTiRe), an industry/university consortium involving Virginia Tech, The University of Akron, and tire and tire-related companies. Before joining CenTiRe, he worked for 37 years in the tire industry at Firestone, Bridgestone/Firestone, and Hankook Tire performing tire finite element methods development and software programming, simulation systems development, advanced tire design, and tire factory uniformity studies. His work has covered the range of tire performance areas, manufacturing, and design. Dr. Kennedy is currently an Associate Editor of the Journal of Tire Science and Technology. He has numerous technical publications and presentations and has been awarded the Arch T. Colwell Merit Award from SAE, the Tire Society Superior Paper Award and an Honorable Mention Award, the CEO Award and President's Award from Bridgestone/Firestone. Dr. Kennedy was the Plenary Speaker at the 2017 Tire Society Conference and gave the Keynote Address at the 2018 ACS Rubber Division Meeting. Ronald Kennedy received his BS and MS degrees in Engineering Mechanics from the University of Wisconsin, and his Ph.D. in Mechanical Engineering from The University of Akron.

Dr. Annette Lechtenböhmer

Annette Lechtenböhmer, a citizen of Germany, finished her studies of chemistry at Westfälische Wilhelms-Universität Münster, Germany, with a Ph.D. in Physical Chemistry in 1981. After two post doctorates, she was employed at the Goodyear Innovation Center in Luxemburg, she filled

positions within compounding and compound testing. She achieved the title of Senior Research Associate of Material Science. During her 35 years of experience in the rubber industry, she has accumulated profound knowledge of compound development, compound testing and test principles, viscoelasticity, compound processing, testing for material modelling and structure of tires, quality control and production. Her positions required close cooperation with other steps of tire development, production, tire design, construction, raw material suppliers, and scientific institutes and universities.

In addition to her industry experience, she taught at Universität Hannover on “Tire Technology” for many years and lectured on “Elastomer Technology” at Luxemburg University. She holds several Patents and Trade Secrets. She is a member of Tire Society, German Chemical Society and German Rubber Society. She retired from Goodyear in 2020 but maintains her dedication to promote rubber and tire science. She continues teaching and serving as an Associate-editor of the Tire Science and Technology Journal. In June 2022, she was presented an award from the German Rubber Society at the International Rubber Conference for her special performances in research, technology, and economy.

Dr. Gerald Potts

Dr. Gerald Potts obtained his Ph.D. degree in Mechanical Engineering from Kansas State University. Upon graduation in 1970, he joined the Firestone Tire and Rubber Co. as a Research Scientist and Group Leader of the Dynamics Research Laboratory. In 1978, he became the Manager of Tire/Wheel Testing Systems at MTS Systems Corporation where he led the initial development of the Flat-Trace â tire test machine. Two years later, he was employed by the General Motors Institute as an Associate Professor of Mechanical Engineering teaching Vehicle Dynamics and Mechanical Vibrations. In the meantime, he established his own company, G.R. Potts Associates, Inc. From 1984 to 1991, then becoming President of TMSI specializing in tire high speed uniformity test systems, tire rolling resistance testers, On LEVEL tire test systems and vehicle crash testing. In 2013, he sold TMSI to MESNAC Americas, LLC, and remains as President of TMSI LLC. Dr. Potts has traveled and lectured to engineering groups, world-wide, having delivered a Plenary Lecture at the 2006 Indian Rubber Institute Conference in Cochin, India. He holds ten patents, has been an Adjunct Professor of Mechanical Engineering at The University of Akron since 1974, and was awarded a Lifetime Achievement Award by Tire Technology International at the 2014 conference and Exhibition in Cologne, Germany.