Tire Modeling and its Application in Tire and Vehicle Development

Tire Technology Expo 2026 – Hannover, Germany

Presenters include:

Mohammad Behroozi, Amazon/Zoox
Flavio Farroni, Andrea Sammartino, University of Naples, MegaRide
Axel Gallrein, Fraunhofer ITWM
Mathieu Grob, Julien Levray, JEDAi
Joachim Stallmann, Christian Ludwig, Cosin Scientific Software
Carlo Lugaro, Willem Versteden, Siemens
George Mavros, Loughborough University
Henning Olsson, Calspan Corporation
Martin Shaw, Jaguar Land Rover

Abstract:

The course covers the computer modeling of tires within a full vehicle system and is aimed at engineers and researchers working in both industry and academia. The subject matter will be of primary interest to vehicle dynamics engineers, for whom the tire is the primary force and moment generation element on the vehicle. The course is also useful to engineering managers who wish to understand existing tire modeling activity and its challenges, or to successfully implement new tire simulation processes in the workplace.

The course starts with an overview of tire force and moment characteristics and relates these to the physics of the tire-road interaction. Fundamental modeling approaches are discussed in such a way that participants can understand the concepts behind commercially available tyre simulation packages or even attempt their own custom solution. Empirical, data-based tire models and the associated laboratory and field testing of tires for model fitting have a special place in tire force simulation and are also addressed in detail. Finally, several state-of-the-art commercially available tire simulation models are presented, covering both families of empirical and physical models.

Course Summary

Agenda DAY 1 (2 March 2026 9AM-5PM)	
MODERATOR: **Mohammad Behroozi**	
Course 1.1 – Overview and Introduction	Mohammad Behroozi
Course 1.2 – Tyre Testing	Henning Olsson
Course 1.3 – Physical Tyre Modeling – The Building Blocks	George Mavros
Course 1.4 – Tyre modeling methodology based on the Magic Formula	Carlo Lugaro Willem Versteden
Agenda DAY 2 (3 March 2026 8:30AM-5PM)	
MODERATOR: **George Mavros**	
Course 2.1 – Finite Element Modeling of Tyres | part 1	Mohammad Behroozi
Course 2.2 – Finite Element Modeling of Tyres | part 2	Mohammad Behroozi
Course 2.3 – CD-Tire fundamentals	Axel Gallrein
Course 2.4 – FTire Introduction	Joachim Stallmann
Agenda DAY 3 (4 March 2026 8:30AM-5PM)	
MODERATOR: **Mohammad Behroozi**	
Course 3.1 – The Role of Driving Simulators in Tire Design	Mathieu Grob Julien Levray
Course 3.2 – Physical Tyre Modeling for Real Time Simulation	Flavio Farroni Andrea Sammartino
Course 3.3 – Terramechanics Tyre Modeling	George Mavros
Course 3.4 – Tire Modeling in Jaguar Land Rover	Martin Shaw

Agenda DAY 1 (March 2nd, 2026)

MODERATOR: **Mohammad Behroozi**

09:00 – Overview and Introduction

- Course introduction
- Introduction to Tyre Modeling
- Simulation Tools
- Tyre Forces and Moments

Mohammad Behroozi

10:45 – Break

11:00 – Tyre Testing

- How to measure tire performance?
- Overview of tire test equipment and test methods
- Strengths and weaknesses of common measurement approaches
- Automotive vs Motorsports tire testing
- From in-door lab testing to the real road

Henning Olsson

12:30 – Lunch

13:30 – Physical Tyre Modeling – The Building Blocks

- The Bush tyre model
- A simple model for transient tyre behaviour
- Friction Thermal tyre modeling

George Mavros

15:00 – Break

15:20 – Tyre modeling methodology based on the Magic Formula

- History of the Magic Formula: 35 years of evolution
- MF-Tyre/MF-Swift: MF-based modular tyre model
- MF-Tool: Tyre model parameterisation
- Tyre data acquisition methodologies

Carlo Lugaro
Willem Versteden

17:00 – Finish

Agenda DAY 2 (March 3rd, 2026)

MODERATOR: **George Mavros**

08:30 – Finite Element Modeling of Tyres

- FE modeling philosophy
- Fundamental understanding of tire mechanical structure
- Material testing and modeling

Mohammad Behroozi

10:00 – Break

10:20 – Finite Element Modeling of Tyres

- Practical development of tyre FE model
- Simulation of static and dynamic tyre performance characteristics
- Virtual Tire Development Process using FE modeling techniques

Mohammad Behroozi

12:00 – Lunch

13:30 – CD-Tire Introduction

- Closing the gap to structural analysis
- Multi-physical aspects of tire modeling

Axel Gallrein

15:00 – Break

15:20 – FTire Introduction

- FTire – The physical 3D nonlinear tire simulation model
- Outline of model formulation
- Interfaces, tools, and results
- Extended handling
- Thermal and wear model
- Flex-rim model
- Hard real-time applications

Joachim Stallmann

17:00 – Finish

Agenda DAY 3 (March 4th, 2026)

MODERATOR: **Mohammad Behroozi**

08:30 – The Virtuous Circle of tire measurement, modeling and correlation

- One tire, but not alone: the tire as part of the ground/vehicle/driver system.
- The Virtuality: how to combine Virtual and Reality methods.
- Digital Twins methodology.
- Tire Modeling philosophy: the right model for the right applications.
- The driving simulator as the virtual development hub for tire design.
- Examples and illustrations of the industry.

Mathieu Grob
Julien Levray

10:00 – Break

10:20 – Physical Tyre Modeling for Real Time Simulation

- T.R.I.C.K.: getting experimental tyre interaction curves from vehicle data
- RIDElab: managing multiphysics in tyre analysis and modeling
- thermoRIDE: a real time physical tyre thermal model
- weaRIDE: from road and rubber knowledge to wear and degradation
- adheRIDE: an MF-evo formulation accounting for temperature, roughness, viscoelasticity, and wear
- VESevo: a device for non-destructive tread viscoelastic characterization

Flavio Farroni

Andrea Sammartino

12:00 – Lunch

13:30 – Terramechanics Tyre Modeling

- The physics of tyre-soil interaction
- FE and analytical modeling
- Testing
- Full vehicle implementation

George Mavros

15:00 – Break

15:20 – Tire Modeling in Jaguar Land Rover

- Vehicle Development and CAE
- Testing of Tyres for Purpose of Modeling
- Challenges and Vision

Martin Shaw

17:00 – Finish