tire technology EXPO 2018

20, 21, 22 FEBRUARY 2018

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NVH by virtual simulation and validation at vehicle level. It also covers source level noise measurement and unique analysis techniques to quantify tire NVH performance at vehicle level.

12:15 Modelling and replicating real-world surfaces for indoor laboratory testing

Matthew Della Pia, simulation engineer, Global Center for Automotive Performance Simulation, USA

Historically, the precisely controlled environments at indoor tire testing facilities has produced repeatable tire force and moment data with the understanding that the testing surface was not asphalt. Indoor surfaces that are more characteristic of asphalt allow for repeatable test data that is more representative of outdoor testing results. This presentation will demonstrate an analytical approach for transforming outdoor surface roughness scan data into viable surfaces for indoor high-speed flat-belt testing.

12:40 - 14:00 Lunch

14:00 Simulation of rolling disc with lateral tread pattern

Thirumal Alagu Palanichamy, doctoral student, Leibniz University, GERMANY

The present methods for the simulation of rolling tires with lateral tread pattern take a lot of computational effort . Arbitrary Lagrangian Eulerian (ALE) relative kinematic framework is widely used for rolling tires due to less computational effort. But the disadvantage is that it can only be applied to axi-symmetric tire models. In this work, a coupled ALE - Lagrangian framework is proposed for the simulation of tire model with lateral tread pattern. The tread cap is defined in the Lagrangian manner and the tread base is defined in an ALE relative kinematic framework.

14:25 Finite element modelling of tires for dynamic test

Abubaker Al-Tayawe, PhD researcher, Cranfield University, UK

The presentation discusses the procedures to implement a proper dynamic rubber material card on a finite element model of a tire. Current state-of-the-art models implement an improper representation of rubber behaviour in dynamic scenarios. This presentation looks at the implementation of an equation-based material card, which best defines the viscoelastic dynamic behaviour of rubber at varying strain rates. The material model is supported by material test data, where validations were carried out on the material card. Several static and dynamic scenarios of a tire are modelled using LS-DYNA software: quasi-static compression, dynamic rolling tire, rolling tire over a wedge.

14:50 Three-dimensional characterisation of dynamic tire deflections

Henning Olsson, director, research and development, Calspan, USA

The external shape of a tire changes significantly with operating conditions such as speed, load and inflation pressure. Using dynamic measurements of tire surfaces, a method has been developed to correlate operating conditions with external tire surface deflection. The deflection correlation is used to generate a tire surface model. Analysis of how operating conditions influence the overall tire geometry is presented. Finally, the use of this in full vehicle aerodynamics simulation and its impact on vehicle energy efficiency is discussed.

15:15 Temperature, roughness and wear in real-time advanced MF modelling

Dr Flavio Farroni, research fellow - CEO and co-founder, University of Naples - MegaRide, ITALY

The physical modelling of tire-road interaction phenomena and the employment of advanced simulation tools developed by UniNa Vehicle Dynamics research group and engineered by its spin-off, MegaRide, allow the prediction and simulation of tire temperature local distribution, tread wear and the adhesive and hysteretic components of friction arising at the road interface. The cooperation among such physical models allows the level of realism and reliability provided by a simulation system to be increased, predicting, in the proposed case study, the modifications that the effects of the cited phenomena will cause to the parameters of an innovative methodology to implement Pacejka's MF formulation.

09:00 - 12:15 Stream 11 - Tire Material Research - University of Twente *Casablanca 1 & 2*

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09:00 Influence of resins on in-rubber properties of an elastomeric compound

Neven Markovic, PDEng, University of Twente, The Netherlands, NETHERLANDS

Resins are widely used in adhesives due to their ability to improve tack. For the same reason they are applied in rubber compounds. These resins are low-molecular-weight oligomers produced from a natural or synthetic source of monomers. When applied in a rubber formulation they can replace the oil and act as a processing aid. The solubility of both a rubber and a resin are major factors that determine the behaviour of a rubber-resin blend. Besides solubility, the structure molecular-weight and concentration of the resin have the highest influence on a rubber. These influences will be covered during the presentation.

09:25 Dispersion control during mixing of silica-filled tread compounds

Ayush Kharel, PDEng, University of Twente, NETHERLANDS

Rheology of silica-reinforced compounds is affected by the filler interaction with the elastomer. The process of mixing silica into the elastomer determines the interaction between them and influences their extrudability and rheological properties. A mechanical breakdown of silica agglomerates as well as a chemical reaction between silica and silane have to occur during mixing. Therefore, it is a challenge to maintain a consistent level of interaction in every batch. The Payne effect is an indicator of inter-particle interaction. This project aims to design a predictive mixing control method by mapping the evolution of Payne effect with mixing parameters.

09:50 Prediction of in-rubber dispersibility of silica by analytical methods

Fabian Grunert, PhD student, University of Twente, NETHERLANDS

Precipitated silica in combination with bi-functional organosilanes are among the most important fillers for passenger car tire tread compounds. Still, the challenge is to reach a good dispersion and distribution of the silica inside the rubber matrix. It is known that the compound formulation and mixing process influence the processing and dispersion behaviour. Moreover, silica itself has a great impact on the in-rubber dispersion quality and it is crucial to be aware of the typical analytical parameters and their impact on the dispersibility. Therefore, different approaches were investigated to predict the in-rubber dispersibility of silica by new analytical methods.