12 STREAMS
INCLUDING SCIENTIFIC, TECHNICAL
AND BUSINESS STRATEGY SESSIONS
PLUS 5 SPECIALIST COURSES

PRELIMINARY PROGRAM

FEBRUARY 25, 26, 27, 2020
DEUTSCHE MESSE, HANNOVER, GERMANY

160+ PRESENTATIONS

SPONSORS
Welcome to the Tire Technology Expo Conference

The **Tire Technology Expo Conference 2020** is our biggest and most all-embracing ever, with 160+ speakers already announced in this preliminary program. Each day, the streams and sessions announced here will remain as detailed; some additions may be incorporated as there are a few speakers with whom final arrangements are being made as this program goes to press. As always, one-, two- and three-day conference passes are available and there are options to combine these with five specialist courses as well. Note that the courses all commence on the Monday and the Akron Short Course spans four full days – see page 22 for details. Speaker additions will be announced on our website as they occur – www.tiretechnology-expo.com.

**Tony Robinson**, founder & CEO, UKi Media & Events

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### CONFERECE STREAMS AT A GLANCE

1. **Tire Technology for the Vehicle Revolution** – Days 1 & 2
2. **The Changing Science of Rubber Compounding** – Day 1
3. **Understanding the Role of Polymer, Filler and Compound Additives** – Days 1 & 2
4. **New Developments in Steel and Non-Steel Cord Reinforcement** – Day 1
5. **Developments in the Design of Tires** – Day 1
6. **Business Strategy** – Day 1, 2 & 3
7. **Tire Manufacturing – Making the Most of New Technologies** – Day 2
8. **Modeling the Tire, Vehicle and Road** – Days 2 & 3
9. **New Materials for Tire Performance Improvement** – Days 2 & 3
10. **Tire Testing for the Next Generation of Vehicles** – Days 2 & 3
11. **Enhancing Tire Value for Vehicles with RFID, Intelligence and Tire Regulation** – Day 3
12. **Solving the Problem of Waste Tires** – Day 3

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### Tire Technology Expo Conference rates

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<tr>
<th>Conference Pass</th>
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<td>Tire Technology Expo Conference 1-day pass</td>
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The main conference is February 25, 26, 27. You can book one- or two-day short courses PLUS two days of main conference as a package for €1,695; or three days of main conference PLUS an optional one-day course at €1,695. For other options please email mark.fenner@ukimediaevents.com.

**PLEASE NOTE:** Conference and Short Course passes are valid for FREE ENTRY into the exhibition on ALL DAYS

### SPECIALIST SHORT COURSES

<table>
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<td>Computer Modeling of Tires Within a Full Vehicle System and Models in a Simulation Environment Course - 3 days</td>
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<td>Basic Rubber Compounding Course - 2 days</td>
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<td>Future Tire Regulations Review Course - 1 day</td>
<td>€695</td>
<td>February 24</td>
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<tr>
<td>Tire Reinforcing Materials Applications and Fatigue Testing Course - 1 day</td>
<td>€695</td>
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www.tiretechnology-expo.com
Starting on Tuesday, February 25, the conference features three days packed with the latest developments in tire design, materials and manufacturing. Extra presentations to be added!

DAY 1 TUESDAY, FEBRUARY 25

Welcome

Tony Robinson, chairman and CEO, UKi Media & Events, founder of Tire Technology Expo, UK

The Robert William Thomson Lecture

Dr Gerald Potts, principal, GRP Dynamics LLC, USA

Stream 1 Tire Technology for the Vehicle Revolution

The role of intelligent tires in future mobility and transportation
Dr Hans Dorfi, director of digital engineering, Bridgestone Americas, USA
Bridgestone is committed to easier, safer, smoother and seamless mobility for our society and customers. Innovative technology is a key enabler to deliver on this commitment, and Bridgestone is at the forefront of the mobility transformation driven by multiple converging megatrends. The role of tires in this future mobility ecosystem will become increasingly important to deliver a safer, smarter and more efficient transportation experience that also improves social and environmental outcomes. The presentation will discuss the innovative digital technologies Bridgestone is developing to enable this future mobility experience.

Michelin UPTIS prototype takes the air out of the tire
Cyrille Jean-Paul Roget, scientific and innovation communication director, Michelin, France
In the world of new motilities and growing environmental challenges, the automotive industry is facing an unprecedented transformation, giving rise to new fields of innovation in sustainable mobility. In this context, the tire industry is facing paradigm shifts and needs to adapt its product offer, innovating in the area of energy efficiency, reduced maintenance cost and material consumption. Michelin UPTIS, a puncture-proof airless prototype for passenger cars, paves the road to this future. As a demonstration of Michelin’s proficiency in the high-tech materials domain, UPTIS revolutionizes the airless world, which was previously unachievable in passenger cars.

Material innovation on controlling aging reaction technology
Dr Bernd Löwenhaupt, managing director, Sumitomo Rubber Europe GmbH, Germany
Sumitomo Rubber Industries Ltd has developed an innovative rubber compound that emerged from Controlling Aging Reaction Technology based on our Smart Tyre concept. Along with the technology, we have successfully made it possible to keep the initial tire performances, contributing to the high robustness of tires coupled with the sensing core, long-term maintenance-free in Society 5.0 and long-term safety in the MaaS society.

A novel subjective-objective approach for assessment of tire performance
Dr Giovanni Caputi-Gennaro, vehicle dynamics - tire development engineer, Automobili Lamborghini SpA, Italy
A novel methodology is proposed for evaluation of tire performance by vehicle testing. The core of the methodology is a combined subjective-objective test approach. Unconstrained maneuvers performed by factory drivers are processed to isolate bits of significant statistics about tire behavior. A distinguishing feature of such a perspective is that no attempt is made to correlate subjective ratings with the usual vehicle dynamics KPI. Indeed, tailored metrics are defined in order to address vehicle handling issues, claimed to be the most significant by Lamborghini factory drivers. The reliability and physical consistency of the outcomes are promising. The presentation will discuss potential implications for tire development and tire virtual models optimization.

Leading change to cope with the future mobility challenges
Eduardo Minardi, founder, Minardi Global, UK
After summarizing the impact that mobility megatrends will have on the tire industry, the presenter will share his framework for how to manage change to successfully transform our businesses. He will share how leadership, vision and culture are linked in support of new strategic roadmaps. He will also cover the responsibilities of the senior leadership teams and how systematic corporate governance principles can support successful transformations. The speaker has global executive and CEO-level experience on different continents, having contributed to transforming large premium-brand tire businesses.

The rise of the emerging markets: tire market outlook
Robert Simmons, managing director, LMC Tyre & Rubber, UK
The axis of growth for the tire market is changing from the developed markets to the emerging markets. Vehicle sales and parc (vehicles in use) are increasing tire sales in the emerging markets. In addition, exports from low-cost to high-cost markets are further supporting tire production growth in these markets. The paper will examine these trends and how slowing economic growth and the use of anti-dumping duties is altering these trends.
Tires and road surfaces in the age of electric vehicles
Prof Ulf Sandberg, senior research leader, VTI, Sweden
With the shift from fossil-fuel vehicles to electric vehicles, which is expected in the next few decades, tires will have to be optimized somewhat differently than today. The most important change in optimization may be the increased focus on low rolling resistance, as this allows a greater operating range until recharging. It will be more important to keep inflation optimal for lowering rolling resistance, while not sacrificing other performances, which calls for more precise inflation pressure sensors and monitoring in the vehicle. Tire treads are likely to be thinner and have lower hysteresis losses. Airless tires may provide some solutions.

Stream 2 The Changing Science of Rubber Compounding

Physical and chemical analysis for Controlling Aging Reaction Technology
Dr Shinya Nakano, assistant manager, Sumitomo Rubber Industries Ltd, Japan
Sumitomo Rubber Industries Ltd has developed Controlling Aging Reaction Technology (CART), contributing to the high robustness of tires coupled with the Sensing Core, long-term maintenance-free in Society 5.0 and long-term safety in the MaaS society. Using original wear tester and synchrotron x-ray radiation, we have elucidated the physical and chemical degradation called mechano-chemical reaction which occurs on the rubber surfaces during friction and wear. We have developed a completely new compound that has controlled the mechano-chemical reaction.

Influence of morphology and fillers on the aging of rubber blends
Ulrich Giese, managing director, Deutsches Institut für Kautschuktechnologie eV, Germany
The aging stability of the properties of modern tire compounds is particularly important for the actual situation of p-phenylenediamines as environmentally critical substances. For improvement of the elastomer properties, different rubbers are usually combined in a blend system. The effect on the aging behavior is investigated in dependency on the type of rubbers, the blend morphology and blend ratio using different chemical analytical methods and micro indentation for high spatial resolution. Furthermore, the effect of fillers is investigated. Fillers have a limiting effect on the DLO effect or they play a role as oxygen carrier or catalyst.

Mechanical properties of reinforced rubber by conventional filler and cellulose-nanofiber
Tomoyuki Sakai, manager, The Yokohama Rubber Co Ltd, Japan
Yokohama Rubber Co Ltd has been researching sustainable materials for rubber as one of the eco-friendly companies. We prepared reinforced SBR by conventional fillers with a little addition of TEMPO oxidized cellulose nanofibers (TOCN), which were modified from paper pulp. The tensile stress of the reinforced rubbers markedly increased without a decrease in fracture characteristics. We will discuss how to improve their mechanical properties by microscopic observation and by examining the bond rubber of the interface between SBR matrix rubber and TOCN.

Non-destructive innovative methodologies for tire characterization at UniNa Tyre Lab
Dr Antonio Maiorano, PhD student, University of Naples Federico II, Italy
Knowledge of tires tread viscoelastic behavior is fundamental for the optimization of vehicle performance and safety. These properties are usually characterized by means of DMA applied to a tire tread sample. Therefore, the possibility to perform non-destructive analyses is an attractive solution in automotive for cost, time and integrity reasons. In recent years new methodologies, illustrated in the presentation, have been deeply investigated at UniNa Tyre Lab to characterize a tire within the temperature and frequency ranges of interest and extrapolate the final master curves for tire block – road modeling.

Resin-polymer compatibility and partitioning as a tool for optimizing tread
Gennaro Della Vecchia, group leader application development and technical service for tire additives in Europe and the Americas, Eastman Chemical Company, Belgium
Compatibility between a hydrocarbon resin and a given polymer strongly depends on the chemical structure of both the resin and the polymer. The impact of polymer-resin compatibility on tire compound performance is examined for both miscible and immiscible polymer blends. Optimized resins can boost dynamic performance, including wet grip, rolling resistance, wear and processing. For immiscible polymer systems, resins can partition between the polymer phases, influencing compound performance and reducing performance trade-offs. Understanding resin-polymer compatibility and resin partitioning can provide insights into potential tread performance and is a powerful tool to help compounders optimize tire formulations.

Functionalized liquid rubber for tire formulations
Daisuke Koda, polymer development team leader, Kuraray Co Ltd, Japan
Kuraray has developed a series of liquid rubber products with molecular weights ranging from a few thousand to a hundred thousand. These polymers, which consist of isoprene, butadiene and styrene and a new, bio-based farnesene, can be used by tire manufacturers to achieve improvements in processing and tire performance. This presentation includes newly developed liquid rubbers with a reactive silane group in the polymer chain that can interact with silica in tire formulations. These liquid rubbers offer, for example, advantageous vehicle fuel economy through reduction in tire rolling resistance.

Process control for the in-situ silanization of silica in tread compounds
Andreas Schröder, head of AT new technologies, Lanxess Deutschland GmbH, Germany
The in-situ silanization of silica in an internal mixer is a temperature-sensitive process. The mixing temperature of the rubber compounds needs to be above 140°C for effective coupling of the silane to the silica surface. On the other hand, sulfur-containing silanes tend to react with the polymer chains above 160°C. The Rheonowave inline process control based on the ultrasound technique is sensitive to both reactions of the silane. The quality control can be done immediately after batch-off by extrusion, preventing scrap.
In-situ experiments to study cavitation in tire rubber vulcanizates
Eric Euchler, PhD student, Leibniz Institute of Polymer Research, Germany

Different experimental techniques were applied to study the mechanical response and failure behavior of styrene-butadiene-rubber (SBR) vulcanizates. Using in-situ dilatometry and x-ray microtomography as well as small-angle x-ray-scattering experiments, the internal damaging process was characterized in disk-shaped pancake and pre-cracked notched planar specimens, respectively. The number and size of single defects, as well as their integral volume contribution, were studied for unfilled and carbon black reinforced SBR vulcanizates. As a result, microstructural network constraints have an effect on damaging comparable to that induced by geometrical constraints.

Silica-filled wet masterbatch-NR compounds with very low rolling resistance
Dr. Gong Seo, consultant, MiraeSi Company, Korea

Silica-filled NR compounds with exceptionally low rolling resistance have been successfully prepared by wet masterbatch (WMB) method using surface-treated hydrophobated silicas. The reaction between amine and glycidyl groups forms organic networks on silica that can be entangled with rubber chains. The addition of the silicas to NR latex followed by mixing and coagulation with acetic acid produces WMB with high silica yields. NR compounds with silica content of 50 phr prepared using WMB showed small tan δ value of ~0.4 at 70°C without sacrificing mechanical properties due to physical entanglement of rubber with the networks by suppressing irreversible deformation.

Surface-modified carbon black for new opportunities in tread compound design
Dr. Hauke Westenberg, manager compounding rubber, Orion Engineered Carbons GmbH, Germany

Novel filler systems developed by Orion Engineered Carbons enable improved rolling resistance indicators like heat build-up, tan δ and rebound at 60°C. Up to 50% in reduction of tan δ was observed while excellent rubber reinforcement required for abrasion resistance was maintained. This is enabled mainly by smart surface modification of the filler, which translates into higher bound rubber at the filler surface. New surface-modified CB grades and compounds containing these grades will be presented. The compounds offer interesting benefits over conventional unmodified carbon black or silica/silane-based rubber.

Tire polymer simulation for thermo and mechanical property prediction
Dr. Caroline Krauter, senior applications scientist, Schrödinger GmbH, Germany

Polymers such as styrene-butadiene copolymers and vulcanized elastomers provide the core properties for tires. The connection between monomer chemistry, polymer microstructure and the network with the properties of the macroscopic materials is critical for the design of better polymeric products. Chemically informed simulation methods provide key tools for building these connections and have been enabled by advances in computing technology. This presentation will review atomistic simulations and coarse-grained modeling used to predict the mechanical and thermodynamic properties of linear and network polymers as well as polymer interfaces.

Functional Low Tg SSBR for winter tire application
Dr. Hanjoung Cho, chief researcher, Korea Kumho Petrochemical (KKPC), Korea

The functional Low Tg SSBR will be introduced. The functionality given by two different methods and their compounding properties will be discussed. It will be a great advance in the functional SSBR market for winter tires and all-season tires with better abrasion properties.

Stream 3 Understanding the Role of Polymer, Filler and Compound Additives

Processing promoters based on renewable resources
Dr. Torsten Ziser, senior specialist, application technology – rubber and functional additives, Lanxess AG, Germany

One of Lanxess Rhein Chemie’s additives business unit’s core skills is to supply processing promoters for tire applications under the brand names Aflux, Aktiplast and Rhenofit. Key properties of processing promoters are to facilitate the mixing and processing as well as to improve the filler dispersion. Green chemistry is increasingly gaining in importance. Rhein Chemie presents a new processing promoter based on renewable resources. Its ability to improve its CO₂ footprint as well as its properties, e.g. extrusion, are highlighted in different applications.

Cluster morphology of silica and silanization, Part I: MD simulation
Dr. Michael York, research fellow, Momentive Performance Materials, USA

Controlling the dispersion of precipitated silica in rubber compounds is a significant challenge for achieving consistent mechanical property improvements in polymer nanocomposites. Silica aggregates are immiscible with the organic elastomeric phase. To prevent silica flocculation, the silica surface is hydrophobized by grafting amphiphilic silane molecules. However, the silica aggregates exhibit self-assembly into anisotropic structures depending on the amount of grafted silane per nm² of silica surface area, which directly affects the mechanical properties of the rubber. Simulations suggest that this self-assembly reflects a balance between the energy gained during silica re-flocculation and the entropy of distorting the grafted OPTES molecules.
Cluster morphology of silica and silanization, Part II: experimental evaluation
Jorge Lacap, senior scientist, expert for materials evaluation, Continental Reifen Deutschland GmbH, Germany
The optimal level of silanization is a relevant question for optimal product performance. Before hydrophobization, the strong silica-silica interactions induce non-linear effects in the rheological behavior of the rubber compound. FT-Rheology shows a systematic reduction of the non-linearity with increasing level of silanization. The non-linearity increases again after reaching the optimal surface coverage. TEM imaging of silica clusters performed before, after and at the optimal level of silanization show changes in cluster morphology rearranged during mixing. Both types of experiments, TEM and FT-Rheology, were conducted on an experimental SSBR compound using 3-octanoylthio-1-propyltriethoxy silane (OPTES).

Simultaneous DMA and DEA on elastomer composites
Dr Sahbi Aloui, application engineer, Netzsch Gerätebau GmbH, Germany
The realization of the required properties profile of tires is based on a molecular understanding of the interaction between their components. Characterizing the finished products under load offers a more realistic consideration of the tire performance based on deep insights into the inner structure and the dynamic of the elastomer composites. Only a simultaneous dynamic/mechanical and dielectric analysis using DILEXOR allows rubber formulaters and finished parts manufacturers a better understanding of damage effects caused by large strains, long-term dynamic loads and high temperatures.

Get a grip: performance of naphthenic oil in winter tires
Dr Kamjar Alavi, senior technical advisor, Ny nas AB, Sweden
Naphthenic tire oils have been gaining market share not only thanks to their excellent HSE properties but also due to their high performance as plasticizing oils in tire compounds. While the benchmark low rolling resistance helps increase fuel efficiency, especially in winter tires, naphthenic oils help achieve increasing grip and traction at very low temperatures. In this work, we have reviewed the performance of selected oils in given winter tire formulations and will show how the use of naphthenic oils as plasticizers will contribute to designing high-performance winter tire compounds.

HRS produced from RHA and its impact on car PCT
Paulo Garbelotto, director of sales and marketing, Orzazsil Silicas, Brazil
Orzazsil is one of the first companies producing high-performance silica from RHA, by an effluent-free production process. European tire labeling has focused on displaying information on the fuel efficiency, wet grip and external rolling noise of tires. However, it has recently been shown that tire abrasion and tear contribute considerably to the pollution of the environment by microplastics. Tear and wear resistance of a car tire tread compound can be improved without significantly compromising rolling resistance and wet grip behavior when a highly reinforcing silica made from rice husk ash (Orzazsil-HR200MP) is used.

Performance improvement by replacing NXT silane with polymeric functional additives
Vikram Mills, technology manager, Honeywell, UK
NXT silanes improve rolling resistance beyond the standard first-generation silanes. However, this creates new challenges in terms of a drop in dynamic stiffness and tread responsiveness. This study looks at the effect of functional polyurea additives in improving dynamic stiffness when NXT silane is partially replaced in a silica low-rolling-resistance tire tread compound.

Effect of lithium-catalyzed BR on the performance properties of tire compounds
Dr Mridul Dasgupta, senior scientist, HASETRI, India
Polybutadiene rubber (BR) is one of the most important rubbers used in tires. It imparts excellent wear resistance to the tread and fatigue life of the sidewall compound of a tire. Different catalyst systems of polymerization govern the microstructure of BR: cobalt, nickel, neodymium give high-cis, whereas lithium gives low-cis BR. Though high-cis BR is widely used in tires, lithium-catalyzed low-cis BR is being tried to meet the challenging requirements of tires. This paper reveals a comparative study of the effect of lithium- and neodymium-catalyzed BR on static and dynamic mechanical properties, and the wear and fatigue crack growth resistance of tread and sidewall compounds of tires.

Characterization of filler dispersion by dynamic mechanical analysis
Dr Saikat Das Gupta, chief scientist - vice president, JK Tyre & Industries Limited, India
The physical properties of filler-rubber composites are greatly affected by the distribution of filler, filler properties and polymer-filler interactions. Understanding of filler dispersion in polymer-filler composite is one of the major research works to establish the properties of tires, such as rolling resistance, grip and mileage. Several characterization techniques are available to understand the filler dispersion in polymer-filler composites, viz. electrical conductivity measurements, bound rubber evaluations, mechanical properties measurements, carbon black surface properties study, small-angle x-ray scattering (SAXS) and nuclear magnetic resonance (NMR) spectroscopy. The primary objective of this paper is to introduce a new characterization technique.

FEAR rheology for rubber materials: the rubber screw rheometer
Dr Myung-Ho Kim, president, MKE Co, Korea
FEAR – Fast, Easy, Accurate, Reliable – measurement is the key feature of this device. A new rheology measurement for rubber compounds and virgin rubber has been conducted using the rubber screw rheometer. This device has a new viscometric flow analysis of single-screw extruders to measure shear viscosity, which is based on the ‘closed discharge’ extrusion characteristic equation. It uses a small amount of materials – batch operation. The measured viscosity is a function of shear rate; thus, it can be used for quality control and process design. Measurement results for the relaxation time and scorch time are also exhibited.

Optimization of compounds filled with treated silica
Dr Lucas Dos Santos, senior research associate, PPG Silica Products, USA
More stringent performance demands are leading to an increase in the use of highly dispersible silica in tire compounds. However, conventional silica technology has a variety of production and performance limitations. Agilon Performance Silicas are treated precipitated silicas that overcome the manufacturing limitations associated with conventional HDS/in-situ silane technology, enabling expansion of the tire magic triangle and reducing VOC emissions. This paper discusses how appropriate silica surface modifications result in a new performance silica technology platform that overcomes these limitations. Results will be presented on how to compound treated silica to increase mixing efficiency and optimize compound performance.
Stream 4 **New Developments in Steel and Non-Steel Cord Reinforcement**

Promoting steel cord adhesion – replacing cobalt salts with hexamethylene bis-Bunte salts  
**Jeffrey Lin, associate scientist, Eastman Chemical Company, USA**

Replacing cobalt salt in a tire's steel cord compound with hexamethylene bis-Bunte salt (DHTS) gives comparable steel cord adhesion (SCA) relative to the cobalt salt-containing compound. Based on results, good SCA can be attained with reduced cobalt salts and is generally within the experimental error with a cobalt-neodecanate-containing compound, and slightly better in the case of steam and salt water. Also, brass-to-rubber interfaces were studied using x-ray photoelectron spectroscopy (XPS), with data indicating the presence of DHTS and in-situ-generated reducing agent. This suggests the Cu and Zn oxidation state can be modulated, leading to improved adhesion.

**HYDROSHOT – high-accuracy coupling force control for thin calendered products**  
**Mario Sacchi, R&D chief technology officer, Comerio Ercole SpA, Italy**

During the production of thin rubberized textile and steel cord webs, which are increasingly required in the calendering field, it is very important to achieve the best quality coupling between rubber sheets and cords. HYDROSHOT is a sophisticated tool to calculate the optimal coupling force between the rolls #2 and #3 and monitor the gap value, always providing process reliability. The contrast force is constantly controlled and compared with set-point and achieved by hydraulic cylinders. With HYDROSHOT the position control is always active, granting a survey of the deviation from the thickness desired value always in terms of ±1 micron.

**Big data and IoT in tire cord processing**  
**Thomas Soika, sales manager, Benninger Zell GmbH, Germany**

These days, requirements for machine availability as well as sustainability and product reliability call for stronger attention. Therefore, machines and processes are observed and monitored at all times. Thus, huge amounts of data are available at any time and anywhere without borders. Smart IoT solutions make processes transparent and support operators of installations in securing their production, protecting their machines and providing the best quality all times.

**Fracture analysis of steel cord for tire forensic analysis**  
**Dr Barun Samui, scientist, Harishankar Singhania Elastomer and Tyre Research Institute (HASETIRI), India**

Systematic analysis of service-failed tires is of paramount importance to understand the root causes of the tire failure and take appropriate corrective measures. During the investigation it often becomes extremely challenging to hypothesize the sequence of events that might have occurred prior to the ultimate failure, and it becomes difficult to pin down the root cause of failure. The characteristic nature of ruptures at the fracture point of steel cord filaments is linked to specific causes. The present study is focused on forensic analysis of service-failed tires where steel cords were eventually fractured, to identify the root causes of failure.

**Roland SIS Vision – the magic eyes in steel cord**  
**Philipp Rott, R&D project manager, Roland Electronic GmbH, Germany**

In a project funded by the Federal Ministry for Economic Affairs and Energy, Roland Electronic GmbH is pursuing innovative new ways of online quality monitoring on steel cord cutting lines used in tire production. With a new type of high-resolution magnetic field sensor, the wire distances, offset and EPDM/EPI inside the rubber can be reliably monitored at full production speed. After the steel cord is analyzed, it is visualized in an easy-to-use interface, similar to an x-ray image. Roland’s main focus is on easy integration, high process reliability, integrated measurement system analysis and auto calibration.

Stream 5 **Developments in the Design of Tires**

**Virtual design and submission – the Michelin way to accelerate development**  
**Patrick Pallot, tire design fellow, Michelin, France**

Shortening the development loops while ensuring the product performance is a key challenge for vehicle and tire designers. For many years, Michelin has been engaged in developing tire FEA simulation for all tire performances. Based on illustrations on noise, rolling resistance and handling, the presentation will show how to ensure efficient virtualization of the tire-vehicle development, thanks to Michelin's expertise in tire simulation and design over the full panel of tire-vehicle performance, as well as the ability to establish the link between tire design and the tire model delivered to the OEM.

**Analysis of the influence of tread wear on tire characteristics**  
**Benjamin Schäfer, scientific researcher, Institute for Automotive Engineering (ika), Germany**

The simulation of tire characteristics depends on the reproducibility of the measurements used for the parameterization process. The rubber abrasion of these measurements is known to affect some of the tire's key attributes such as cornering stiffness. Using different 3D scan methods, the Institute for Automotive Engineering developed a procedure to investigate the influence of tread wear produced during different parameterization measuring programs on these tire characteristics. The results are then used to improve the parameterization process by defining tread wear thresholds.
What happens in the tire contact patch?
Marzieh Salehi, PhD candidate, University of Twente, Netherlands
The presentation explains how a tire grips the ground. The actual area under load determines the contact pressure and governs proper grip or friction, which is key for safety. Among all specimen geometries for rubber frictional measurements, a wheel shape sample is of great interest. In the first step, the static contact areas and pressures of Grosch wheels on various surface roughness were measured and compared with those of the corresponding real tires. The effect of the in-rubber properties on the contact area was investigated to enhance the insight into the tire contact patch.

Tribological parameters affecting the lifetime expectancy of tractor tires
Maedeh Faghiri, PhD candidate, Institut für Maschinenelement, Konstruktion und Fertigung, Technische Universität Bergakademie Freiberg, Germany
Studying tribological parameters like friction and wear in block rubber in contact with soil can help to reduce wear in tractor tires or other off-road vehicles, which could be used in tire design optimization. In this study, we investigated the effect of rubbers like SBR and NR and real tire material, angle, velocity and normal load on tribological properties in contact with soil. This study provides significant information that can be used by tire developers to extend the lifetime expectancy of off-road tires like tractor tires by minimizing wear in contact with soil.

Wear effect on motorcycle tire behavior
Elisabetta Leo, CTO, Soluzioni Ingegneria, Italy
Some measures of tire wear and tire stiffness, as well as wear impact on maximum grip, are referred to in some scientific papers. The most widely used empirical model (Pacejka Magic Formulae) includes the effect of tire inflation pressure, but the effect of tire wear is not considered yet. The aim of this paper is to quantify the effects of tire wear on tire longitudinal and lateral behavior, to propose a modification of Pacejka Magic Formulae and to understand the influence on the motorcycle lateral and longitudinal dynamic. To achieve this target, numerical and experimental investigations were carried out.

Will Martian rovers ever run on rubber tires?
Dr Rafal Anyszka, researcher, University of Twente, Netherlands
Designing rubber materials that could withstand harsh Martian conditions is a challenging task. Space radiation severely damages the chemical structure of rubber macromolecules, and the low average temperature limits the types of applicable rubbers only to those exhibiting very low glass transition temperatures. However, the advantages provided by the unique elastic and damping properties of rubber have become more attractive in view of the Curiosity rover wheel damage that occurred during Mars exploration, which was due to the poor elastic performance of aluminum used for the tires’ construction. This triggers the question: is it technologically feasible to develop rubber compounds for Martian rover tires?

Stream 6 Business Strategy – Organizational Reform in the Tire Industry
Practical issues around organizational reform for a risk-averse industry
Paul Frobisher, director, Strategic Innovation Ltd, UK
The paper addresses some of the practical issues the speaker has encountered in his time as a consultant to vehicle makers and tire makers as these companies prepare for large changes in their business models related to the mobility revolution. The tire industry is notoriously risk-averse and resistant to change. The speaker seeks to address the challenges of effecting rapid and effective change in an industry that has traditionally been dominated by traditional thinking and people who sometimes prefer continuity to change.

Current status and future of the global tire industry
David Shaw, chief executive, Tire Industry Research, UK
This paper is designed for the management and strategy stream. It looks at the mid-term future of the tire industry, focusing on the drivers for change, including legislation, societal pressure, economics, regional development and changes in the mobility sector. It discusses the state of the industry today, covering all aspects of the value chain, including an analysis of the latest financial results and how the downturn has affected larger companies and smaller ones, as well as the impact of regional development.
Stream 1 Tire Technology for the Vehicle Revolution (continued)

Challenges raised by high-load-capacity tires
Bruno Guimard, original equipment pre-development program manager, Michelin, France
Throughout the history of the automotive industry, engineers have worked to implement more features in a limited package, offering more space for drivers and passengers. The emerging electrification of vehicles requires additional space for the batteries while significantly increasing the load of the vehicle. Moreover, OEMs want to keep the possibility to offer a range of wheel diameters for the end customer, especially for sport derivatives. The presentation explains how high-load-capacity tires offer a significant degree of freedom for BEV and PHEV, the XL+ experimental standard proposal, use cases for HLC tires, and technical challenges for HLC.

Tire-road friction estimation using intelligent tires
Utkarsh Gupta, graduate research assistant, Center for Tire Research, Virginia Tech, USA
Currently, all the existing driver-assist systems lack knowledge of the tire-road contact characteristics and estimation of road friction. This information has a direct effect on vehicle safety and control. A novel approach, based on intelligent tire technology, was developed in this study for tire-road friction estimation. A sensor-fusion algorithm for real-time friction estimation was developed to integrate acceleration data from the two instrumented intelligent tires to reduce the lag between the two tires under different driving maneuvers. Consequently, signal processing and machine learning algorithms were developed to do pattern recognition and estimate the coefficients of friction.

Tire simulation and development at Jaguar Land Rover
Jan Prins, technical specialist, Jaguar Land Rover, UK
The presentation will provide an overview of tire simulation activities at Jaguar Land Rover, including recent success in so-called ‘virtual submissions’, where tire models are created in advance of physical tire submissions, to speed up development and hit the ground running with tires much closer to final specifications.

Tire/road friction: a skid resistance tool based on contact modeling
Dr Malal Kane, senior researcher, Ifsttar, France
This paper introduces a new tool for tire/road skid resistance prediction. The tool is based on modeling the dynamic-viscoelastic-rough-lubricated contact. It takes into account all parameters related to tire, road and contact operating conditions: at the tire side, the tools take into account its geometry (width, rim diameter, flank height, tread pattern and depth), inflation pressure, rubber material (viscoelasticity). At the road, its texture is taken into account via the surface topography. At the contact interface, the dry or wet condition can be taken into account. The operating conditions are taken into account via the load, speed and slip ratio.

A comparison of road texture measurement technologies and their effect on Persson’s friction model
Marco Furlan, tire CAE and modeling engineer, Jaguar Land Rover, UK
Rubber friction models developed by B N J Persson predict the coefficient of friction as a function of rubber material properties, sliding speed, contact pressure and surface roughness. In this work we present an overview of some of the current technologies used for surface roughness characterization, comparing their strengths and weaknesses. Data is presented for common 1D and 2D surface parameters such as MPD, RMS, Ra and the Power Spectrum Density, and their influence on the predicted coefficient of friction using Persson’s model is discussed.

Tire NVH engineering through dedicated lumped parameter model
Gie Van der Linden, senior engineer, Siemens Industry Software, Belgium
With the rise of electric powertrains in the automotive industry, tire noise has become an important part of the ‘new’ composition of the NVH signature of vehicles. Automotive OEMs and tire manufacturers are looking for methods to get an early-stage assessment of the tire NVH performance in a full-vehicle context. In this presentation, we will explain how full-vehicle road noise can be predicted using a test-based, lumped-parameter tire NVH model. This approach enables parameter studies toward resulting interior noise performance and can support target setting on the component (tire) and vehicle level.

Tire testing and modeling requirements for self-driving vehicles
Mateo Gladstone, director, R&D, Calspan Corporation, USA
Automated driving, electrification and shared mobility are shifting the requirements for tire performance. This in turn affects how tires are being tested and modeled to support the development of new tires and vehicles. A self-driving vehicle’s ability to plan and control the vehicle path is heavily dependent on tire force and moment properties, for which existing testing and modeling methodologies can be adapted. However, new technologies such as Tire-as-a-Sensor and road perception and friction estimation require new testing and modeling methods. Examples for both car and truck tires are presented and discussed.

Looking behind the horizon: potential future tire materials
Gert Heinrich, university professor/consultant, Leibniz-Institut für Polymerforschung Dresden eV, Germany
We present recently developed advanced rubber and fiber concepts and discuss their potential application in future tire technologies. We focus on mechno-adaptive rubbers (MAR) and low-cost and sustainable lignin-based carbon fibers. MARs exhibit intrinsic adaptive properties – i.e. the composite itself can exhibit adaptable characteristics. CF-based reinforcing cords, strands and strips could find applications in tire applications, if prepared with tailor-made properties and sustainable technologies.
**Stream 3 Understanding the Role of Polymer, Filler and Compound Additives (continued)**

### Tire test results with new functionalized SSBRs

**David Hardy**, technical service and development manager, Arlanxeo Deutschland GmbH, Germany

Functionalizing butadiene rubbers is a proven method employed to improve their interaction with silica fillers. This results in the enhancement of dynamic performance in passenger tire tread compounds particularly to optimize energy losses. Own tire testing data based on several SSBRs will show that this results in reduced rolling resistance and also that other important tire properties that are not covered by the tire label, such as handling/cornering, are affected.

### Functionalized butadiene rubber for tire applications

**Dr Kilian Wüst**, technical manager, Arlanxeo Deutschland GmbH, Germany

Introducing specific functional groups into butadiene rubber allows for improved interaction with fillers, resulting in better filler dispersion and improved dynamic properties in tire applications. Recent developments for functionalizing rubber are presented and the effects on critical tire properties are discussed.

### Next-generation modified silica for optimized tire compound development

**Dr. Joachim Bertrand**, director, Behn Meyer Europe GmbH, Germany

Behn Meyer will present its latest surface-modified silicas. These are optimized to shift the magic triangle further up and optimize low-VOC and easy-to-mix compounds. Compound lab data will be presented showing an SSBR/BR PC tire tread example with 20-25% higher abrasion resistance at a higher level of skid and rolling resistance than current silica-silane combinations. During mixing, almost no volatiles are emitted and mixing time is as short as for a standard CB compound. These new candidates are optimum for low-energy-consuming compound production and will optimize properties demanded by the coming generations of electric cars.

### Carbon black and silica – challenges and opportunities

**Paul Ita**, president, Notch Consulting, USA

The paper will look at reinforcing fillers carbon black and precipitated silica, including current demand levels, opportunities, product news and supplier developments.

### Compounding of silica/silane systems in natural rubber – part II

**André Wehmeier**, head of rubber technology group, Evonik Resource Efficiency GmbH, Germany

The first part of "Compounding studies with silica and silanes in NR" was delivered at Tire Technology Expo Conference 2019. Optimum silane levels, especially regarding tensile tests, have been established, dependent on the CTAB surface area of silica. But the adjustment of silica should not be performed in a linear way. In particular, the highest-surface-area silica needs much more silane than expected, resulting in an optimum of modulus and simultaneous elongation at break values on the carbon black level. This second part deals with these optimized silica/silane systems and further optimizations based on a DoE including the accelerator systems.
Assessing the crosslink density of rubber vulcanizates using three different approaches
Marcin Sek, PDEng student, University of Twente, Netherlands
The determination of crosslink density in rubber vulcanizates remains a complex issue in practice. This presentation gives a concise overview of the commonly used laboratory measurement techniques for crosslink density. It draws attention to the equilibrium swelling and Mooney-Rivlin mechanical approaches in comparison to a recently developed method called Temperature Scanning Stress Relaxation (TSSR). The advantages and disadvantages of these techniques are discussed for unfilled and filled compounds with various curing systems.

Alleviating marching modulus in silica-filled tread compounds
Dr Wisut Kaewsakul, assistant professor, University of Twente, Netherlands
Marching modulus in the vulcanization of rubber compounds is undesirable, since it causes the final properties of the vulcanizates to be unstable. This characteristic exhibits a gradual increase in modulus due to a continuous occurrence of the cross-linking reaction, leading to problems in indicating the optimum cure time of a compound. In silica-filled SBR/BR tread compounds including a silane coupling agent, marching modulus occurs to various degrees depending on the quality of mixing of the compounds. This presentation reviews the factors contributing to the marching modulus with suggestions for how to alleviate this phenomenon.

Tailoring natural rubber compounding and processing for aircraft tire treads
Dr Wilma Dierkes, associate professor, University of Twente, Netherlands
The properties needed for aircraft tire treads are significantly different to the ones required for passenger car or truck tires, for which improvements mainly focus on a better balance of rolling resistance, wet skid resistance and wear resistance. Aircraft tires experience severe operation conditions during service: the temperature can reach the critical temperature of polymers, thus accelerating tread wear and aging. To reduce this temperature degradation, the material should have a low hysteresis. This presentation will focus on the influence of the type of filler and will include adjustment of the processing conditions for optimization of aircraft-tire-related properties.

Is the Velcro concept feasible for an alternative silica/polymer coupling?
Anke Blume, full professor, University of Twente, Netherlands
A new concept for an alternative silica/polymer coupling system was introduced to the tire industry in 2019 to overcome the disadvantages of the current system. Currently, if the relatively stiff covalent sulfur bridge of the silica/silane/polymer connection is broken, there is no possibility to reconnect. As a consequence, a completely different coupling concept was considered, mimicking the Velcro system known from nature. The tangled and cross-linked rubber macromolecules act as molecular loops, and relatively long elastomer brushes grafted on the silica surface act as molecular hooks. The in-rubber properties will be presented to show the efficiency of this new system.

Automated crack growth analyses of rubber for tire applications
Dr Radek Stocek, head of R&D, PRL Polymer Research Lab, Czech Republic
Knowledge about load-dependent fatigue crack growth (FCG) behavior is vital to estimate the lifetime of tires. Therefore most companies are using dynamic testing appliances to load rubber samples by observing the FCG. Historically, it has been necessary to use highly educated staff to perform the analysis. In this work, we explain how a methodology can be successfully implemented to control the FCG analysis fully automatically. Once the samples are fixed, the measurement is started and works in a self-controlled way until the end. This makes research and development more efficient.

Premixing possibilities for silica and additives
Guido Veit, business unit manager, Zeppelin Systems GmbH, Germany
The paper will cover ways to reduce the complexity of adding raw materials; material preparation and handling; and new concepts in rubber mixing.

Disruption in the tire wholesale and logistics value chain
Theo de Vries, director sales and marketing Europe and CIS, TBC Corporation, Netherlands
The paper identifies some of the huge inefficiencies in the tire wholesale activity, and offers some high-level approaches to resolving those inefficiencies. The proposed approaches require a high-level rethink of the business models and profit margins of the whole industry. The paper proposes disruptive change, in the sense that the tire industry has continued with limited change, despite size proliferation and huge changes in the wider logistics industry. The paper offers some ideas for bringing the tire industry into the 21st century of data analytics.

Data analytics as a profit driver in wholesale
Tim Eisenmann, chief analytics officer, American Tire Distributors, USA
The paper focuses on how data analytics can be used to remove inefficiencies in the tire wholesale and logistics activities and drive substantial increases in profitability. The speaker has wide experience in the application of data analytics to distribution networks, and is bringing that expertise into the tire industry as part of a corporate restructure story. That story has involved deep changes in management, corporate organization and corporate vision in creating a revitalized business based on focused application of data analytics.
No pallets: a study on revolutionizing tire storage and logistics

Tony Leikas, CEO, Pesmel Oy, Finland

Extensive research shows that a high level of automation and process integration in tire warehousing results in considerable capacity and efficiency increases. Using digital technology, tire logistics and storage processes can be improved, reducing management of end-of-life tires. Meanwhile, legislators and vehicle makers look to tire makers to help reduce fuel consumption and environmental footprint. The World Business Council for Sustainable Development (WWFSD) Tire Industry Project (TIP) drives action and research on potential human health, environmental and social impacts of tires throughout their lifecycle. TIP will share an overview of the work that it coordinates on behalf of leading tire manufacturing companies.

Stream 6 Business Strategy (continued)
Afternoon: Business Models to Fit the Tire Industry of the Future

Science-driven: a sector-based approach to sustainability
Anne-Cécile Remont, director, Tire Industry Project, WBCSD, Switzerland

Interest in tires has never been greater. Public bodies are more active on topics such as tire and road wear particles (TRWP), sustainable sourcing of natural rubber and the footprint, sorting at feed, simplifying layout and, most importantly, disposing of pallets altogether. These features are now available in high-bay, fully automated warehouses with integrated conveying systems that link production lines right through to transporting vehicles in the dispatch area. The study highlights data from automated tire warehousing, and the results are verified through proof of concept at a European tire plant.

Stream 7 Tire Manufacturing – Making the Most of New Technologies

How to design/bring up to date a rubber mixing facility for modern formulations
Guido Veit, manager – plastics and rubber plants business unit, Zeppelin Systems GmbH, Germany

With rising complexity in the mixing room due to new raw materials and more flexible production, our customers need innovative, secure, trouble-free instalments that offer flexibility and reliability, with the ability to handle new products, including recycled materials, and different liquids at the same time.

New technology for efficiency and material saving in tire production
Alexander Bleider, project engineer tire application, UTH GmbH, Germany

In tire production, increasing amounts of unvulcanized rubber are being produced. Reasons for this are, for example, the frequent changeovers resulting from an increasing product variety and rubber mixing batches that are out of specification. For financial and environmental reasons it is desirable to return these valuable raw materials to the production process. This process must be cost-effective and, in order to meet quality demands, the material must be treated gently. The TRP Reworker system, which is based on the UTH Two-Roll Plasticizer, incorporates new technology that combines several proven processes. This continuously operating reworking system offers new advantages.

From power to empowerment
Håkan Angerbjörn, global industry sector manager, Bosch Rexroth, Sweden

Your mixing process is the key to rubber quality and productivity. Learn how you can improve both with the latest ideas and technology from Bosch Rexroth. Our Hägglunds hydraulic drive solutions can help you get more from your rubber mixing, and the worldwide presence of our Hägglunds service experts gives you maximized uptime and peace of mind. Connect your machines and use our innovative solutions to optimize your system. This will unlock opportunities to fine-tune the operation of your rubber mixing, enhance your production and improve your energy efficiency. Stay in control, increase productivity and maximize uptime.

Improving the nitrogen curing system using its conventional drawbacks
Azadeh Anjomshoa, tire engineer, Barez Industrial Group, Iran

In this study, a common nitrogen curing system that is a well-known method for tire curing was improved. Two major problems with the nitrogen curing system are higher total curing time and the temperature difference between the top and bottom of the curing bladder. In our proposed method, we solved these two problems and also eliminated steam waste in the curing cycle. In this new method, we took advantage of high energy condensate creation at the first step of curing. By circulating this condensate in the bladder using a special process we can optimize the curing cycle. The results show a 40% reduction in total curing time.

The evolution of RPO chemistry
Mary Ann Abney, global technical marketing manager – process oils, Ergon Inc, USA

Chemistries for rubber and tire applications have continued to change as the regulatory environment and performance demands have changed. In parallel, the refining industry is evolving and changing the product offerings. This presentation will give an overview of how things have evolved and how things will change in the future, impacting your RPO supply. We will provide you with the information you need to navigate the changing landscape.

Heat transfer bladders
Dr Reza Limoochi, technology tire and compound expert, Iran Tire Co, Iran

Rubber is naturally non-conductive, which results in loss of energy during heating and increased time for curing tires. In this article we discuss nanoparticles that would...
lead to good heat transfer in bladders with advanced high technology, and the conditions for better properties and aging durability of the bladder and its endurance.

Optimization of strainer processes
Johannes Jennissen, GM, Rade GmbH, Germany
The presentation will discuss optimization of strainer processes through product-specific sieve packages, sieve support and dies. A system is presented that is tailor-made and adapted to the conditions of an existing plant. With this development, the active screening areas can be increased by up to 50%. The economic effect of the system can be verified by means of a specially developed laboratory test prior to conversion.

State-of-the-art floor-mounted hydraulic tire curing press
Ganeshraja Karuppusamy, manager, Larsen & Toubro Limited, Rubber Processing Machinery, India
A new floor-mounted hydraulic tire curing press has been developed to vulcanize passenger car tires, which doesn’t need a pit for installation. This was possible due to the innovative compact bladder control mechanism, which reduces the height of the machine by one meter, thus reducing civil work cost for the industry. Machine safety can be achieved more easily at one floor level instead of both pit and floor, reducing machine costs. The telescopic design adopted for the supply of cure media eliminates the need for hoses – a modular design approach enhances ease of maintenance. These presses save roughly 156 tons of CO₂ per trench.

Progress in rheometry: updating of RPA and new test development
Michele Scacchi, field applications engineer, Alpha Technologies UK, Italy
Although the closed die gap geometry of the RPA 2000 is the only setup that allows obtaining reproducible and meaningful results with many elastomers from the rheometric point of view, the closed test cavity does not meet the theoretical requirements for simple shear flow in terms of boundary conditions. The new Premier RPA+ model equipped with Alpha's patent-pending PDM system can reduce the deviation from the traditional rotational rheometers with an open die gap geometry, increasing the repeatability and reproducibility. The shear startup flow test was validated on the commercial Premier Mooney to characterize complex branching patterns.

Unmanned component handling and weighing with robotics
Jake Norman, head of innovation, APRIL Robotics, UK
Handling and weighing components by hand is a high cost to tire manufacturing businesses. Currently, many companies weigh out powders by hand, exposing operators to H&S risks and businesses to human error and product failure. The presentation will share how advanced technology and robotics can address these issues by removing the human operator from the process. Following work with the University of Lincoln, APRIL has developed and commercialized the APRIL Weighing Machine, which automatically stores and weighs out components to a works order.

Control your tire mold cleaning process better
Ahmet Erdogan, global key account manager - tire, Cold Jet BVBA, Belgium
Highly complex molds are used in the production of tires, which have to meet the requirements of customers, authorities and technical specifications. Cold Jet’s automated system utilizes finely controlled particles of dry ice via Cold Jet’s patented Particle Control System. The PCS precisely cuts the dry ice into diamond-shape particles from 3mm to 0.3mm and every size in between to achieve superior cleaning of the molds. The automated system applies Dry Ice 4.0 - IoT connectivity to measure and control the tire mold cleaning better than ever before, and can operate inside and outside the vulcanization press.

Sustainable and energy efficient cooling for tire production
Kamila Kuftowska, sales manager international, Efficient Energy GmbH, Germany
Within the plastics and rubber industry, process cooling is a crucial topic to ensure stability and quality of production. The continued cooling of manufacturing processes consumes high amounts of energy which represents a considerable part of the operational costs. With increasing prices of natural resources and energy the efficient and smart usage of energy for process cooling is of utmost importance. Also, due to the implemented F-Gas Regulation each manufacturing company is forced to think about future-proof and sustainable cooling. With natural refrigerants such as water (R718) companies will be able to face all these challenges.

Digital transformation – actionable insights to improve your tire curing
Pascal Lamonerie, director business development automotive and tire EMEA, Emerson, France
Optimizing machine efficiency in your tire application is key, as is being flexible to adapt to changes in demand. One of the areas where there is a lot to be gained in production efficiency is tire curing. Using modern technologies, or Industrial Internet of Things (IIOT), will give you insights into the performance of your machines and what you can do to improve efficiency. Attend this presentation to discover how monitoring your tire curing process can give you actionable insights that enable you to improve efficiency and tire curing performance, as well as reduce material scrap.

Increasing manufacturing efficiency to increase turnover in a challenging sector
Mathias Poetter, VP sales automotive, Identec Solutions AG, Austria
With the ongoing challenges and changes that the tire building industries are facing, real-time location of vehicles and goods throughout the whole production process has become a recurring theme. In the complex process of tire manufacturing, the shop-floor logistics necessary in getting the right material to the right tire building machine at the right time are immense. This process is costing most tire manufacturing plants millions of euros annually, due to four big issues. The speech will improve your understanding of the industry’s demands and how to meet industry expectations to deliver visibility in the tire manufacturing process.

Automatic tire inspection machine using cameras
Deepan Chakravarthi Prabakaran, assistant manager - electrical design (new products), L&T Rubber Processing Machinery, India
In the tire manufacturing process, the tire is inspected visually by humans for any abnormalities such as incomplete mold fill, exposed cords, blisters, etc. This way of checking the tire leads to fatigue, human error and reduced throughput. Automatic tire visual inspection machines handle the tire in an innovative way so that no part of the tire is hidden from the eight cameras, which are positioned appropriately based on...
the size of the tire. Images of the sidewall, tread and inner bead area of the tire are captured and processed to inspect the tire quality. The machine can handle a wide range of tire sizes.

High-speed 3D multi-sensor alignment for critical rubber and tire applications

Martin Sandén, territory manager, LMI Technologies, Germany

The use of laser triangulation line profilers is well-established for scanning and measurement in rubber and tire applications. Laser profilers deliver highly accurate 3D geometry data at factory production speeds despite the challenge of scanning black, shiny materials. This talk presents approaches on how to build multi-sensor configurations to scan wide rubber materials in order to measure both thickness and width. Also discussed are methods for collecting profiles to build 3D surface scans of tire sidewall and radial regions using rotational layouts for detecting bulge and dent defects or verifying embossed OCR patterns.

Reduce your opex without impacting your performance

Dan Paul, global business leader - tire industry, Rockwell Automation, USA

This session will focus on multiple strategies that can help tire manufacturers and tire machine builders build more tires by focusing on improving equipment reliability and machine uptime while minimizing manufacturing and maintenance COGS (cost of goods sold). How a control system that runs machines in a typical tire environment survives has a major impact on operational metrics that are important to every tire manufacturer. We will discuss how two simple strategies deliver better control system reliability, which leads to better machine performance and results in improved operational metrics.

Stream 8 Modeling the Tire, Vehicle and Road

TameTire improvements for virtual design, from thermomechanical to multiperformance model

Alexis Trelles, tire performance analysis, Michelin, France

Vehicle handling performance is finally evaluated by humans. To reduce the development time, OEMs are increasingly using dynamic driving simulators for design evaluation without real prototypes. However, especially for high-performance vehicles, standard tire models like Magic Formula cannot simulate precisely enough the impact of the tire on vehicle handling. Developed by Michelin for almost 15 years, TameTire is a real-time thermomechanical tire model accurately predicting forces and torques. The most recent TameTire improvements will be presented here, including a better rendering of performance evolution as well as wear, grip consistency and rolling resistance predictions.

A review of recent developments in tire durability simulation

Dr William Mars, president, Endurica LLC, USA

Tire durability simulation methods have developed rapidly during the last decade to overcome several barriers. Critical plane analysis has solved the problem of how to compute the impacts of multiaxial stress and deformation mode on fatigue. Total and incremental fatigue solvers now enable durability analyses to be solved for a single operating condition, for multi-step testing schedules or for residual fatigue life. Non-linear material behaviors such as strain crystallization and temperature dependence can be specified and taken into account. The methods are applied to show how development and regulatory tire durability tests can now be simulated.

Light in the dark – laser applications in the tire industry

Olav Schulz, managing director, SLCR Lasertechnik GmbH, Germany

SLCR Lasertechnik GmbH is a highly specialized manufacturer of customized machines for laser surface treatment. With more than 20 years’ experience in a vast variety of industries, SLCR has built up strong expertise in the fields of laser material processing, automation and sensor technology. In this paper, SLCR presents its state-of-the-art solutions for various applications in tire production, including innerliner cleaning (complete and selective), engraving, uniformity and mold cleaning. With its long presence in the tire industry and a new generation of machinery in place, SLCR has field-proven how the footprint can shrink and efficiency can increase.

Competitive manufacturing: impact of the latest automation technologies

Paolo Gambarino, European industry manager, SMC Corporation, Italy

The tire market is putting a big emphasis on cost reduction. Automation systems can assist tire manufacturers and their machine builders in meeting this challenge. The presentation will introduce the latest developments in terms of energy efficiency, space reduction and smart flexibility designed to boost machinery competitiveness. Practical examples and case histories will be shown to inspire and help engineers to achieve these goals.

Estimating tire characteristics

Mark Harris, manager tire research, fka, Germany

Since tires are not always available and testing programs for the parameterization of tire models require a significant investment of time and resources, it is often desirable to start with an estimated model in the early development phase. Methods for improving the quality of these early estimated models will be discussed.

A real-time motorcycle tire thermal model for motorsport applications

Flavio Farroni, CEO and co-founder, MegaRide - an official UniNa spin-off company, Italy

Nicolò Mancinelli, Ducati Corse, Italy

The work – an output of the cooperation between the motoGP team Ducati Corse and the UniNa/MegaRide vehicle dynamics team – deals with the development of a real-time physical model conceived with the aim of predicting the local tire temperature distribution, which is fundamental for a vehicle design and setup management focused on the optimization of grip performance. The presentation will describe the structure of an innovative version of the thermoRIDE model, characterized by 16 ribs, eight inner layers and an optimized computational strategy. Particular attention will be given to the identification of the thermal parameters, the implementation process and the experimental validation.
Velocity and temperature influence on tire and vehicle handling performance
Willem Versteden, product manager, Siemens Digital Industries, Netherlands
Further digitization of the vehicle development process requires, among other things, higher accuracy as well as a broader scope of operating conditions to be captured by tire models. Siemens Digital Industries has developed an extension of the MF-Tyre/ MF-Swift tire model that considers the influence of rolling speed and tire temperature on the tire performance. The modeling approach including main assumptions taken and the validation with indoor and outdoor tire measurements is discussed. Furthermore, emphasis is given to the impact of changing tire characteristics on vehicle handling performance.

Developing an advanced tire hydroplaning model using integrated analytical-FE approaches
Ashkan Nazari, graduate research assistant, PhD candidate, Virginia Tech, USA
This work is mainly focused on the tire and its interaction with the wet pavement to address hydroplaning considering the roughness of the wet surface and its effect on the friction coefficient. In this work, using a profilometer, the surface roughness for different surfaces is measured in dry and wet conditions. Persson’s friction theory is used to estimate the sliding friction coefficient and validated in the lab using a linear friction tester. The friction coefficient is used as an input for an FSI model to predict cornering force.

Stream 9 New Materials for Tire Performance Improvement

Special functionalized SSBR and its effect on silica dispersion
Daisuke Hayata, assistant manager, Asahi Kasei Corporation, Japan
In order to reduce rolling resistance (RR) for better fuel efficiency of tires, the use of solution-polymerized styrene-butadiene copolymer (SSBR) in combination with silane/silica systems in tire treads is successful. Although it is generally difficult for silica to be well-dispersed in hydrophobic rubber matrix due to its high hydrophilicity, Asahi Kasei has developed special functionalized SSBRs that give better silica dispersion due to their unique functionalization technology. In this presentation, the interaction between SSBRs and silica and the positive effect on silica dispersion will be discussed.

New Exxpro specialty elastomer 3563 with superior impermeability for tires
Dr Sunny Jacob, elastomer technology advisor, ExxonMobil Chemical, USA
Isobutylene elastomers are of great commercial importance in tire applications due to their notable low gas permeability properties attributed to their efficient molecular packing. Brominated isobutylene-co-para-methylstyrene (BIMSM) elastomers are a special class of isobutylene elastomers synthesized by random cationic polymerization of isobutylene and p-methylstyrene (pMS), followed by a selective bromination of the methyl group of the para-methylstyrene units. BIMSM elastomer, commercially known as Exxpro specialty elastomer 3563, to meet the growing market demands and requirements for low maintenance, low inflation pressure loss rate (IPLR) tires and tires for connected autonomous shared electric vehicles.

The performance of new viscoelastic modifiers from a renewable resource
Jochem Vervekle, senior technical associate, Kraton, Netherlands
Kraton Corporation is a long-term supplier to the tire and rubber industry, supplying products that improve tire performance and enhance the processing of tire compounds and rubber chemicals.

Asahi Kasei has developed a new functionalized SSBR known as Exxpro specialty elastomer 3563, which has superior impermeability for tires. This elastomer is particularly useful in tire applications due to its low gas permeability properties. The interaction between SSBRs and silica is also discussed, highlighting the positive effect on silica dispersion.

New plasticizers for improved service life of tire curing bladders
Dr Volker Boerger, head of chemistry and technology, Schill+Seilacher, Germany
The service life of curing bladders is an important property in tire production. Tire manufacturers have a big interest in running a curing bladder for as long as possible in order to produce as many tires as possible with one curing bladder. However, due to extreme temperatures and repeated flexing cycles, the lifetime of a bladder is limited. One reason is an unwanted migration of traditional plasticizers out of the article, which is leading to stiffness issues. The presentation offers new plasticizer types for an extended service life of bladders. Finally, a cost advantage is achieved.

Hydrothermally carbonized lignin as sustainable filler for tire-tread application
Priyanka Sekar, PEng, University of Twente, Netherlands
The tire industry’s increasing emphasis on sustainability can be met by new fillers. Based on this, the modification of lignin was developed as it offers abundance, eco-friendliness and a renewable nature. This study focuses on investigating the reinforcing behavior of a TESPT modified lignin-based filler in an SSBR/BR blend in comparison with CB and silica/TESPT. With mechanical strength comparable to the reference compounds, the lignin-based filler compound exhibits significantly improved dynamic properties. Tailor-made recipes allow the mechanical and dynamic properties to be varied to the desired level and to replace conventional fillers.

SSBR/LiBR for eco tires with ZSE’s outstanding technologies
Kenji Watanabe, team leader, ZS Elastomers Co Ltd, Japan
ZS Elastomers (ZSE) has many outstanding technologies that can provide a wide variety of SSBR/LiBR. These technologies contribute to improvement of rolling resistance, wet grip, and vehicle handling performance.
abstraction resistance and processability. Thus, our polymers cover a wide range of tire design, such as winter, all-season, summer, HPT and race tires. In this presentation, we will introduce the effect and mechanism of ZSE’s technologies, and the products to which those technologies are applied.

Stream 10 Tire Testing for the Next Generation of Vehicles

An improved test method for all-seasons and winter tires
Mauro Martino, wheels and tires - designer responsible, FCA Italy, Italy
For all-seasons/winter tire development for vehicle OEMs based in Europe, a snow testing session in Scandinavia is needed. Winter testing is possible and economically convenient only in northern Europe in a small timeframe. Therefore, winter tire development is not achievable outside these boundary conditions. A prediction of snow performance during spring/summer/autumn testing is not feasible. This study aims to identify different sets of winter tire design parameters with the same snow performance, same rolling resistance and same rolling noise, to be tested on different dry/wet surfaces.

Study of WLTP coast-down variability given by tire and wheel
Andrea Carzana, R&D tires specialist, FCA Italy, Italy
The vehicle physical coast-down is a critical step in the emissions calculation with WLTC. Tires’ effect on the overall resistive force opposing the movement derives from the parabolic curve of vehicle deceleration. Nevertheless, several factors affect tire performance during coast-down and increase the variability of the results, and not all of them are related to the tire rolling resistance. This study aims at understanding the conditions under which the tire performs the best and provides the lowest resistance, and how this can be translated into a more effective deceleration leading to emissions benefits.

Novel methodology to determine the hyperelasticities of tire rubber constituents
Bharath Anantharamaiah, research engineer, Applus IDIADA, Spain
A methodology has been developed to simulate the tire static behavior and estimate its constituent hyperelasticities based on the measured tire responses (radial, longitudinal and lateral stiffness) for the applied static loads. First, a simplified tire numerical model with standard rubber material properties is modeled that can substantively predict the necessary tire static responses. These responses are compared against the actual physical tire responses that are measured using a kinematic and compliance (K&C) test rig. Finally, a DoE and an optimization process are performed by sampling the rubber hyperelasticities to simulate the FE model and match the tire static test responses precisely.

Measurement of rotating tire lateral stiffness applying contact force measurement
Kazuki Kido, vehicle dynamics analysis specialist, A&D Company Ltd, Japan
The delay of tire lateral force is an important component in vehicle dynamics and is known to be caused by the lateral stiffness of the tire. Generally, lateral stiffness is measured in a static state, so there are very few examples of lateral stiffness measurement during tire rotation. The proposed method makes it possible to measure the force, displacement and stiffness values of the tire footprint in a distributed manner by measuring the force distribution on the contact surface during tire rotation.

Velocity measurements of the water flow in tire grooves
Damien Cabut, PhD student, Ecole Centrale de Lyon, France
Hydroplaning occurs when a tire encounters more water than it can scatter. Hydrodynamic pressure builds up in front of the tire and induces loss of surface friction, which diminishes the available braking force that it can generate in an emergency braking, for example. Therefore, it is crucial for tire designers to optimize tread designs to ensure the best water evacuation without compromising any other performance. In this work, a measurement method based on particle image velocimetry is proposed to measure the velocity field in the grooves of a worn tire rolling through a water puddle.

Investigation of rubber indentation depending on load and speed
Jacopo Cugliari, PhD student, German Institute of Rubber Technology, Germany
To determine the influencing parameters on tire tread properties and especially the friction behavior, it is necessary to investigate the contact conditions between rubber and rough track. In this work, the gap between a model substrate and contacting tire tread compounds is investigated with respect to normal load and sliding speed. A new experimental technique based on laser distance measurements is used to determine the relaxation of a rubber block pressed into asperities, and thus the depth of rubber indentation in static and dynamic conditions. In this way, the results allow a validation of the contact theories and FEM simulations.

Surface influence on wet and dry traction
Kenny Erdner, lead tests prep engineer, GCAPS, USA
This is a study to find the influence of surfaces on EU wet grip graded tires. Testing of the five letter graded tires, A to F, were performed on 120 grit sandpaper and on GCAPS asphalt surfaces using the LTRe force and moment indoor laboratory tire tester. Testing methods included EU wet grip braking, dry braking, wet and dry lateral and speed influence to see how the label grades correlate between testing methods of outdoor to indoor laboratory testing results.
AWARDS FOR INNOVATION AND EXCELLENCE

On the second evening of the conference and exhibition (February 26, 2020) there will be an entertainment-packed evening where we will present the Awards for Innovation and Excellence.

Delegates, exhibitors and their guests will have free access to this event.
China's tire industry
David Shaw, chief executive, Tire Industry Research, UK
This paper is designed for the management and strategy stream. It looks at the changes in China's tire industry, and especially the rise of the most significant players based in China. The paper covers the main players in China's tire industry. It also looks at China's government policy and how governmental decisions outside China – such as tariffs – have affected both the industry and the strategic thinking within the industry. In particular, it gives insights into the likely future direction of some of the top players as they emerge onto a more global stage.

Stream 8 Measuring friction to predict tire behavior on different road surfaces
Alexander O'Neill, research engineer, University of Surrey/Jaguar Land Rover, UK
Most tire models used in vehicle dynamics simulations are parameterized with data obtained on a flat-track, where the tire is commonly driven on sandpaper. The resultant models are typically inaccurate at higher slips, where conditions are dominated by the rubber-road friction characteristics. To improve such tire models, this paper explores the use of tread rubber friction measurements obtained with a purpose-built rubber friction measurement system. Friction measurements were performed under controlled conditions and incorporated into a brush-type tire model. Preliminary results indicate the benefits and potential of detailed knowledge on the frictional behavior for accurately modeling tire forces and moments.

RIDEsuite: real-time multi-physical modular tire
Aleksandr Sakhnevych, CTO / vehicle dynamics researcher, MegaRide / UniNa, Italy
RIDEsuite enables a further necessary step toward the real-time modeling of tire-road interaction phenomena in offline and online environments. The software products, consisting of a high-performance full-wheel thermal model, a dynamic Magic-Formula-based model, a multi-contact envelope-based model and a wear degradation model, are perfectly integrated into a plug-and-play solution, and also allow the partners to perform hybrid simulations with their own third-party modules thanks to the specially designed modules. RIDEsuite is a completely modular system allowing the enhancement of real-time simulation for tire performance and vehicle setup optimization, and helping vehicle dynamicists to achieve automotive excellence.

Physical models for truck tire/road characterization and thermal analysis
Andrea Sammartino, modeling and validation engineer, MegaRide Srl, Italy
The presentation focuses on the development of a tool named TRICK4TRUCK, for the commercial heavy vehicles field, which allows the study of vehicle dynamics and tire characteristics using the truck as a moving lab, returning a sort of virtual telemetry that includes forces and slips useful to predict and simulate the real tire behavior. The procedure introduced is part of a larger research activity, the aim of which has been the development of a truck tire thermal model that is able to predict temperatures based on both outdoor track sessions and indoor tests, which provides fundamental information on the material's thermal and viscoelastic characterization.

Numerical evaluation of tire heat generation and temperature distribution using SSHT
Rajesh Nagose, senior manager/solution consultant, Dassault Systèmes, India
Tire performance highly depends on temperature rise during operations because rubber material properties are highly temperature and frequency dependent. Hysteresis loss or viscous energy dissipation is the main contributor to the tire heating as the tires are subject to cyclic loading. This work aims to evaluate tire heat generation and temperature distribution using the steady-state heat transfer (SSHT) solution. The parallel rheological framework (PRF) material model captures the viscous energy dissipation and this output is used to evaluate heat sources for thermal simulation. Heat transfer analysis is performed using this heat source and surface film coefficients boundary conditions.

An overview of an extended tube model for hyperelastic material
Shivam Mangal, manager - advance engineering, ATC Tires Pvt Ltd, India
Modeling of hyperelastic material (rubber-like) with various material models has always excited the research community. Selection of a material model has a considerable impact on the simulation output of a component. This selection depends on the availability of an experimental test setup. Uniaxial test setup being the most common across industries, the Yeoh model has been the engineers' choice as it represents other modes of deformation well, even with uniaxial test data. Similarly, an extended tube model also gives Yeoh-like benefits with a better fit between theoretical and experimental data.

The importance of non-pneumatic tires (NPTs)
Dr Amirhossein Shahdadi, manger of innovation product department - Barez Innovation Center, Barez Industrial Company, Iran
Nowadays, due to the widespread use of non-pneumatic tires (NPTs) and their considerable advantages, investigating...
the mechanical behavior of these tires is very interesting and is receiving increasing attention. One of the most important missions of the Barez Innovation Center is developing airless tires. Considering this topic, the researchers at the Barez Innovation Center have analyzed the static and dynamic behavior of a kind of NPT that includes honeycomb spokes by developing a 3D finite-element model. Our next step is trying to obtain an optimized model and then comparing its results with those of the previous one.

**Prediction of the cure status of radial truck tires using finite element analysis**

Mohammadreza Hosseinikhani, tire engineer, Barez Industrial Group, Iran

In this research work, the finite element method in conjunction with an in-house-written code for solving the heat conduction equation and the rubber cure kinetics was implemented to simulate the radial truck tire curing process. Also taken into account were the anisotropy of the heat transfer properties of rubber composites, the dependence of the properties of rubber compounds on the temperature and the extent of cure, and the time-varying boundary conditions including the post-cure of the tire. The results showed good correlation with experimentally measured data, which confirmed the accuracy and applicability of the method.

**Stream 9 New Materials for Tire Performance Improvement (continued)**

**Evaluation of Exxpro 3563 in tire innerliner applications**

Dr Sujith Nair, senior market developer, ExxonMobil Chemical, USA

In this presentation, we will discuss the factory processing characteristics and tire performance of a new Exxpro grade (Exxpro 3563) possessing high levels of pMS, tailored toward innerliner applications. It was found that Exxpro 3563 had lower permeability, better filler dispersion, higher green strength, better heat resistance and better dimensional stability than halobutyl-based innerliners. Tires manufactured with Exxpro 3563 innerliners had lower inflation pressure loss rates (IPLR) than those based on halobutyl innerliners. It is believed that this advantage in air retention will result in better overall tire performance.

**Development of new high-strength SBR for high-durability tires**

Takumi Adachi, research and development specialist, JSR Corporation, Japan

In recent years, the trend in the automotive industry has been a push for a drastic reduction of CO₂ emissions in response to global warming concerns. The tire industry has sought to do its part with the development of fuel-efficient tires. Additionally, as electric vehicles and autonomous driving technology spread rapidly, high durability performance is in greater demand. Responding to these new market demands, we have developed a new high-strength SBR that shows significant improvement in tensile strength compared with general SBR and natural rubber.

**New products for advancing performance, manufacturability and sustainability**

Jeff Silveria, global segment manager - tire, Cabot Corporation, USA

Improving tire performance without introducing processing complexity is a critical challenge within the tire industry. This presentation introduces commercially available products that enable superior tire performance and outstanding value across a number of applications. By innovating in multiple directions – materials, manufacturability and business models – tire manufacturers can achieve sustainability goals while delivering differentiated product performance. Improvements can be achieved at a variety of scales while avoiding common drawbacks. Cabot’s new products reduce required mixing energy and time, improving process throughput.

**Cut and chip properties of tire rubber compounds**

Dr Arup Saha Deuri, head of R&D, BKT, India

The functionality of rubber is used in tire applications becomes particularly important when it is subjected to unpaved/rough terrain, because the sharp edges of stones will gradually cut the rubber parts. This study examined many factors that could maintain initial wear characteristics but prevent cutting and chipping problems. NR/SBR blends in different ratios, their physical and mechanical properties and the role of silica, carbon black, aramid fiber and basalt fiber are studied here.

**High-performance modified nanoclay and its application in the rubber industry**

Hai Li, application technology manager, JiangSu CheeShine Performance Materials Co Ltd, China

The presentation will present a high-performance modified nanoclay used in tire tread, innerliner and sidewall, showing lower Payne effect, excellent air permeability, lower rolling resistance performance with excellent mechanical properties. The modified nanoclay can also be used in conveyor belts and rubber tubes with excellent properties.
Stream 10 Tire Testing for the Next Generation of Vehicles

How can we meet tire model assumptions during testing?
Dr Christian Bachmann, senior manager tire technology, Ika GmbH, Germany
Tire characteristics are strongly dependent on various influencing parameters (e.g. inflation pressure, temperature, wear, etc). This presentation will discuss the challenges to solely identify certain tire properties without changing the operating conditions during testing in order to meet the assumptions of the (usually simplified) tire simulation models.

Acoustic and dynamic blocked force measurements of tires and suspensions
Andreas Schilp, managing director, AZL-Technology Center GmbH, Germany
With regard to electric vehicles, road noise is becoming increasingly important for overall driving comfort. In the development process, dynamic simulation models of a rolling tire are still a big challenge. We present test setups and example test results for the measurement of suspensions and tire/rim combinations on exactly the same excitation, e.g. a rough roller surface on a chassis dyno. Measurement results can be the dynamic blocked forces, blocked moments and the radiated sound power. Using these test benches, optimum data can be created for the validation of simulation models, the setup of hybrid models and system optimization.

Rolling resistance prediction based on asphalt properties
Judith Bertomeu, test engineer, Applus IDIADA, Spain
This paper discusses how pavement performances, in terms of driving energy demand, are influenced by asphalt properties. A deeper knowledge of asphalt characterization results in better laboratory reproductions, providing more realistic and reliable results when testing under controlled environments. The investigation was carried out as a three-party partnership project between Sorigué as pavement builder, Norcontrol as pavement tester and IDIADA as vehicle tester. This collaboration enabled the teams to share their knowledge in each specific area and provided a view of the whole vehicle-pavement-tire combination when considering rolling resistance.

Tire exploitation in tough conditions
Miroljub Petkovic, sales enablement manager EES, Goodyear, Serbia
Tire exploitation is followed on 30 trucks in very heavy working conditions – 8x8 and 8x4 vehicles. Exploitation is followed to the smallest detail per truck position. The presentation will discuss the influence of truck alignment, position on the vehicle, tire pressure and different tread pattern on tire exploitation life.

Temperature influences on the snow friction of tire tread blocks
Michael Hindemith, research engineer, Leibniz University Hannover, Institute for Dynamics and Vibration Research (IDS), Germany
Real snow roads are exposed to changing conditions such as unstable temperatures or variable snow conditions. These changes have a significant influence on the snow friction of a tire tread block. We intend to quantify these effects experimentally by means of targeted parameter studies. For the parameter studies, we investigate the behavior of a tread block on a linear rolling test rig with variable slip ratios on snow roads. The results show that the temperature has a considerable influence on the snow friction of a tread block. The phenomenon can be explained physically by the temperature-dependent strength of the snow.

Investigating road-tire-chassis interaction on a test rig for longitudinal dynamics
Dirk Engel, professor, HAW (University of Applied Sciences) Hamburg, Germany
In this presentation, self-excited full-vehicle oscillations – in this context referred to as ‘power-hop’ – will be introduced. First results of full-vehicle measurements will be shown, followed by the presentation of a specially built test rig. This ‘longitudinal dynamics test rig’ (LDP) has been drafted and designed at the Institute for Automotive and Powertrain Engineering (IPAS) of Helmut-Schmidt-Universität (HSU) in Hamburg. Measurement results in different conditions (tarmac, concrete, dry, wet) concerning power-hop will be shown, before a new transparent surface setup is introduced that allows an insight into the tire contact patch.

PhotoGAUGE: a unique tire profile measurement tool for the field
Dr Shankar Subramanian, chief technology officer, PhotoGAUGE, USA
Making accurate 3D scans of tires in the field and deriving quantitative wear patterns are challenging tasks for which no solutions have been available until now. PhotoGAUGE’s TyreGAUGE, based on photogrammetry, computer vision and cloud computing, is a unique portable solution that fits in a backpack and allows engineers to measure a tire patch in two to three minutes and obtain customized tire profile maps, not just scans. These maps are invaluable in understanding irregular wear and for validation of numerical models. Our cloud-based subscription also provides data warehousing of all reports and analytics on the accumulated data.
Stream 11 Enhancing Tire Value for Vehicles with RFID, Intelligence and Tire Regulation

The impact of aquaplaning on driving safety – the accidentology viewpoint
Frederic Biesse, tire performance analysis expert, Michelin, France
Although the hydroplaning phenomenon has been known since the 1960s, it is almost impossible to find any scientific estimation of its real impact on vehicle accidents, especially in Europe. In this study, thanks to the GIDAS database and a physical analysis of all suspected hydroplaning accidents, it was possible to compute the probability of an accident case being in a full hydroplaning situation. This allowed for a precise estimation of the real importance of full hydroplaning situations on accident occurrence, which appears to be a much rarer accident cause.

Analysis of tire-related influencing factors on the indirect tire pressure monitoring system
Wenrui Han, research associate, TU Dresden, Germany
To improve the understanding and to further reduce development efforts for indirect tire pressure monitoring systems (ITPMS), the tire-related influencing factors on the ITPMS need to be further investigated. The presentation will give an overview of vehicle-free development of ITPMS, and discuss measurement-based analysis of the tire-related influencing factors on the ITPMS such as tire stiffness, tire wear, wheel load, etc; model-based analysis of the tire-related influencing factors on the ITPMS; and a summary and outlook.

Technical solutions and innovative approaches in the complex truck market
Mario De Martino, product development and open innovation engineer, Prometeon Tire Group Srl, Italy
The industrial tire business is becoming more demanding, and just supplying tire is not enough to be competitive and survive in the truck business. The presentation will show how PTG, thanks to its new approach based on collaborations and open innovation activities together with a strict exchange of information, is achieving its final goal: stronger know-how, fully dedicated to OTR, agro, bus and truck, to enhance the integration between tire, vehicle and internal/external monitoring systems. This leads to a stronger capability to predict performances in all the new virtual tools to quickly characterize tire models under real operational conditions to accelerate co-design and OE collaborations.

Complete data integration from sensor level to MES
Andreas Morbitzer, key account manager - tire industry, Pepper+fuchs Vertrieb Deutschland GmbH, Germany
Tire manufacturing is now able to leverage intelligent sensor data across all information levels. In the past, complete data integration in production processes was not possible due to the lack of intelligent sensors and infrastructure. Both technologies are growing rapidly, having now a broad range of smart field devices like proximity switches, photoelectric sensors or RFID, known as Sensorik 4.0. At the same time, new opportunities for transmitting data are being introduced in industry, such as IO-Link, OPC UA and MQTT. For the tire production industry, these standards offer a wide range of new advantages, including entire track and trace of automated material flow, complete documentation of all produced goods, and plant-wide condition monitoring of components and assets. This results in higher competitiveness based on cost savings, increased quality and transparency. Today, the key to success is the intelligent combination of a large number of various field data, their direct integration and timely availability. The presentation will include conceptual and practical solutions for the tire industry.

Better safety with real-time alarms for worn tires
Geoff Haswell, CTO, Fyyster AS, Norway
In the EU, tires worn beyond the legal limit are a contributory factor in thousands of accidents per year. Fyster addresses this issue with a tread monitoring system that warns stakeholders in real time at a pre-set level before a tire becomes illegal. The system measures actual tire tread depth, which is more accurate than inferring tread depth from other vehicle data.

ANEW tires – Angular Navigation Early Warning tires
Rajesh Gaddipati, solution architect, Fujitsu Consulting India Pvt Ltd, India
The aim of this project is to help tire manufacturing companies to design a set of sustainable solutions to ward off various road mishaps, to output an intercept to identify an overtaking vehicle, and to signal a quick estimate of all forms of rough road topples. In this pursuit, inside the tire we will affix well-calibrated, cost-effective, non-cumbersome mechanical semi-micro tools such as a magnetometer (compass) and gyroscope, which will work together to help input to an edge computing instrument to output a quick intercept to the driver.

Tire tread acceleration signals from dry and wet road surfaces
Alan Bennetts, director, Bay Systems, UK
Smart tires, those with sensors embedded, can make driving safer but only if we can interpret their signals correctly. Putting R&D grade instrumentation inside the tire sets the benchmark for signal quality. The resulting data is presented for tires from different manufacturers and of different rolling resistance running on a variety of road surfaces in both wet and dry conditions. Is this data likely to be more reliable than stability detection using ABS sensors?
Stream 12 Solving the Problem of Waste Tires

Novel rubber recycling options
Dr Georg Bohm, president, Appia LLC, USA
The talk will offer a more detailed understanding of the technical and commercial challenges associated with rubber recycling. It will also discuss new opportunities to convert ground rubber particles of spent tires (an inexpensive filler of marginal value) into a useful new raw material for use in tire compounds and other applications.

Tire-to-tire recycling – a global industry update
Martin von Woflersdorff, advisor, Woflersdorff Consulting, Germany
Tire sustainability can mean many things including CO₂ reduction, ethical manufacturing and the use of recycled and bio-based materials. This presentation will look at tire-to-tire material recycling examples in the whole tire value chain from OEM car builders to tire makers, tire raw material suppliers as well as recycling companies.

Bio-refinery alternative to fossil and vegetable oils in winter tires
Dr Fabio Bacchelli, technical manager, Versalis, Italy
Tire tread compositions containing high-molecular-weight sSBR might be desired for traction on wet road surfaces. For cold-weather service, a current challenge is to reduce the cured stiffness of the rubber compositions, having a lower storage modulus at about -20°C, while maintaining wet traction. Since the need to preserve the environment has become a major driver for the development of tire tread compounds, many attempts have been made to introduce vegetable oils to match performance, processability and sustainability. An important LCA improvement can be achieved using a specifically designed bio-refinery vegetable derivative obtained through a bio-to-bio conversion technology.

Efficient fine grinding of rCB with fluidized bed jet mill
Christian Höfels, process developer, Netzsch Trockenmahtechnik GmbH, Germany
The presentation will discuss: the design of an air jet mill with integrated dynamic air classifier for reproducible product quantities; advantages and disadvantages of low- and high-pressure operation; optimized compressor operation; importance and influences of air generation on the process; reliable results and performance data.

Shaping the retreading process
Alessandro Villa, general manager, TRM - Tyre Retreading Machinery, Italy
The retreading sector is facing major challenges in the coming years to maintain its competitiveness in the market. TRM is shaping a new process model that introduces flexibility and automation in a segment historically characterized by an intense demand for labor, in order to improve efficiency and offer high quality to the end user.

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Sustainable fillers (rCB)
Fredrik Ollofson, sales manager, Scandinavian Enviro Systems AB, Sweden
The ever-growing interest in sustainable technology and the increasingly decisive questions about how greenhouse gas emissions should be reduced mean that there is increasing interest in Scandinavian Enviro Systems’ unique technology in the tire and rubber industry. Sustainable fillers and TPO with high bio content are now really starting to be introduced to the market based on Enviro’s technology. The question now is more linked to capacity than if the ‘new’ products works. The presentation will describe the company’s progress so far, including a brief technology presentation, an introduction to sustainable filler and TPO plus rCB in the tire/rubber industry, capacity/plant establishment and plans for the future.

Achieving a tire circular economy using high-performance sustainable material
Sonia Megert, chief operating officer, Tyre Recycling Solutions, Switzerland
Although material recycling of tire rubber could play a significant role in the treatment of end-of-life tires and decrease the environmental footprint of tires throughout their lifecycle, the amount of tire rubber being truly recycled is still extremely limited. The key issues in creating a truly circular economy are to understand the materials science and to guarantee constant and high quality of recycled products. This paper describes the physics of incorporating rubber waterjet powder into SBR-based compounds. It also looks at strategies to ensure the global availability of high-performance sustainable material.

The rubber technologist – a requalification possibility
Dr Fabian Grunert, postdoc, University of Twente, Netherlands
The automotive sector is facing continuous changes that also directly affect the tire industry. In particular, regulations regarding a reduction in CO₂ emissions related to fuel consumption and rolling resistance force continuous improvement in tire performance. To be able to meet the future requirements of the automotive industry and keep the knowledge of employees up to date, the European DRIVES project was initiated to offer new requalification possibilities. One piece of training being developed is to become a rubber technologist. In addition to the basics of rubber technology, this training includes innovative green technologies considering bio-based polymers, fillers and additives, and recycling possibilities.

*This program may be subject to change
## SPECIALIST SHORT COURSES

### UNIVERSITY OF AKRON 49TH TIRE MECHANICS SHORT COURSE

**FEBRUARY 24, 25, 26, 27, 2020 - €1,875 PLUS GERMAN VAT**

This four-day educational and developmental course will provide engineers and scientists with an in-depth, intense study of the latest developments surrounding tire engineering. The course is designed for practicing engineers, chemists and scientists who are concerned with tires and vehicles and who have an engineering or science background at the Bachelor of Science level. The basic and practical aspects of the mechanics of pneumatic tires will be introduced by internationally-renowned experts in tire mechanics. Extensive, detailed course notes prepared by each instructor will be provided for all participants, along with a 700-page e-book, 'The Pneumatic Tire', edited by Professors Gent and Walter. Those who complete this course will receive a certificate from the University of Akron.

### COMPUTER MODELING OF TIRES WITHIN A FULL VEHICLE SYSTEM AND MODELS IN A SIMULATION ENVIRONMENT

**FEBRUARY 24, 25, 26, 2020 - €1,425 PLUS GERMAN VAT**

This course covers the computer modeling of tires within a full vehicle system. It is aimed at engineers and researchers working in industry or academia. The subject matter will be of primary interest to vehicle dynamicists, for whom the tire is the primary force and moment generation element on the vehicle. Tires are not particularly complex but are deeply counterintuitive; practitioners require an understanding of tire behavior and the range and capability of existing models in order to generate full system models to predict the dynamic performance of a vehicle – both for comfort and for active safety.

The course will start with an overview of the force and moment characteristics generated in the tire contact patch, progress through the way in which these are captured through laboratory testing, and finish with the empirical models for usefully accurate representation. Aircraft tire models will also be covered, as will the development of physical tire models to predict the interaction of the tire with road obstacles and terrain for durability analysis.

### BASIC RUBBER COMPOUNDING COURSE

**FEBRUARY 24, 25, 2020 - €1,075 PLUS GERMAN VAT**

The Basic Rubber Compounding Course will be held concurrently with Tire Technology Expo 2020 in Hannover, Germany, on February 24, 25, 2020 – commencing one day before the expo and main conference. It will be presented by Bob Kind MIMMM, GPRI, technical director of Polymer Recyclers UK, and John Bowen MIMMM, BSc, a consultant formerly of Robinson Bros Chemicals UK. This basic course is designed for all those working in the associated tire industry who wish to know more about the compounding of rubber. It will try to define the concepts in simple terms, but at the same time relate them to actual manufacturing and product circumstances.

### TIRE REINFORCING MATERIALS APPLICATIONS AND FATIGUE TESTING

**FEBRUARY 24, 2020 - €695 PLUS GERMAN VAT**

The course schedule will include the following:
- Tire function, specification and design challenges; rubber reinforcement needs in different tire application fields
- Tire bias/radial construction and their components; trend to radialization
- Load types on the cord (tension/compression, single/reverse bend, adhesion, corrosion, aging), explaining thereby the specific differences between steel and textile cord
- Global reinforcement materials usage overview
- Types of cord stresses and strain in each tire component (bead; ‘carcass’ region is looked at differently in the apex/sidewall/corner regions because of their specific loads; belt; cap ply)
- Steel cord and textile construction and generic material data
- Overview of material-tire component usage matrix

### FUTURE TIRE REGULATIONS REVIEW

**FEBRUARY 24, 2020 - €695 PLUS GERMAN VAT**

The course will be delivered by Lars Netsch of TÜV Süd, who has considerable knowledge of the current tire regulations in Europe and beyond. These are particularly critical as tire labeling and new type approval regulations are introduced. Some indication of the future in terms of tire regulations will be discussed, and a brief outlook on the impact on tires of the EU’s chemical regulation, REACH, will also be given.

FOR MORE INFORMATION

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