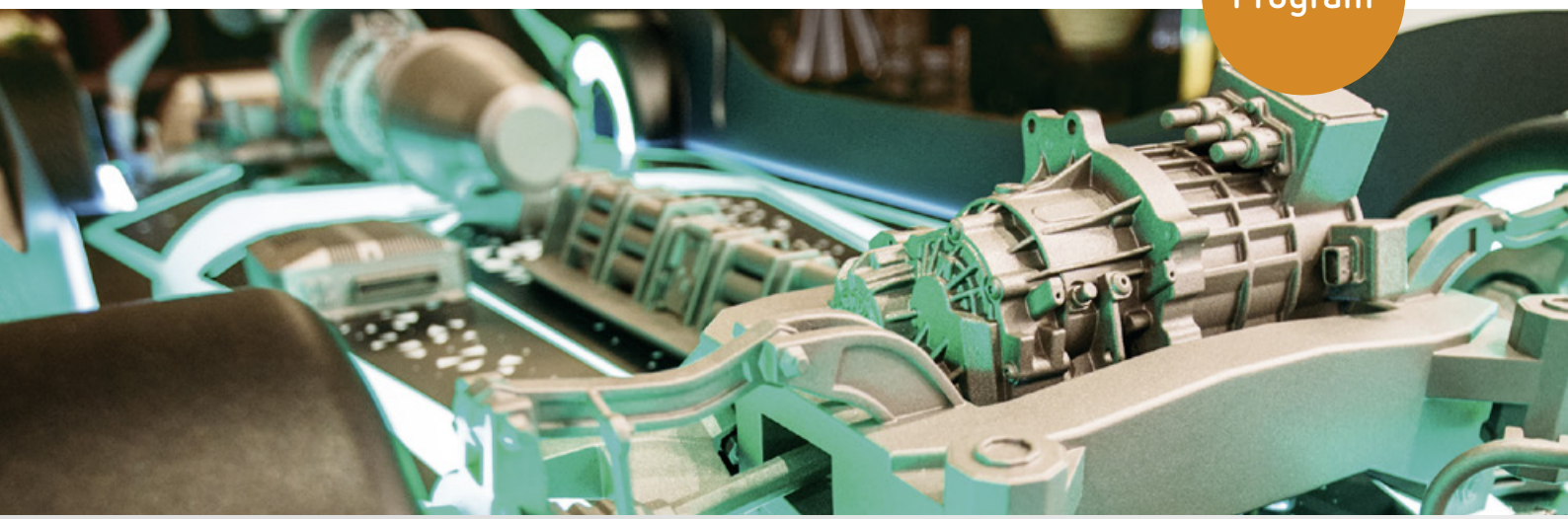
Program



# E-MOTIVE by FVA

11th International

## Expert Forum on electric vehicle drives and e-mobility

4 – 5 September, 2019 in Schweinfurt, Germany

Unterstützt von
Supported by

## Programmausschuss | Program Committee

**Dr. Tobias Böhm**

Head of Electrified Drivetrain,
Group Research Volkswagen AG,
chair Board E-MOTIVE

**Martin Nitsche**

Stellvertretender Geschäftsführer
FVV – Forschungsvereinigung
Verbrennungskraftmaschinen e.V.

**Ian Faye**

Director Public Funded Projects,
Gasoline Systems,
Robert Bosch GmbH

**Alexander Raßmann**

FVA – Forschungsvereinigung
Antriebstechnik e.V.
Projektmanagement E-MOTIVE

**Dr. Steffen Henzler**

Leiter Vorentwicklung Triebstrang
& Elektroantriebe
Daimler AG

**Dr. Andreas Siebinger**

Head of Engineering
Magna Powertrain AG & CO. KG

**Manfred Herrmann**

Project Manager Electrification
and Battery Systems
Opel Automobile GmbH

**Dr. Ralf Stopp**

Leiter SHARE am KIT (Schaeffler Hub
for Automotive Research in E-Mobility
am Karlsruher Institut für Technologie)

**Harald Hofmann**

Head of Advanced Development
Valeo Siemens eAutomotive
Germany GmbH

**Dr. Bernd Vahlensieck**

Forschung und Entwicklung
ZF-Konzern
Vorentwicklung und Konstruktion
Leiter Antrieb, ZF Friedrichshafen AG

**Wolfgang Klüpfel**

Head of Technology (CTE)
Kion Group
Linde Material Handling GmbH

**Dr. Achim Wiebelt**

Director Corporate Advanced
Engineering
MAHLE International GmbH

## Willkommen | Welcome

Sehr geehrte Damen und Herren,

den Wandel gestalten – Industrie und Forschung im Dialog rund um elektrische Fahrzeugantriebe.

Der Wandel der Mobilität ist in vollem Gange. Die Klimaziele der Politik und die Digitalisierung von Gesellschaft und Industrie sind zentrale Treiber für die Elektromobilität. Der zukünftige Antriebsstrang wird durch die Weiterentwicklung und Integration neuer Technologien bestimmt.

Das E-MOTIVE Expertenforum greift diese Themen auf und bietet Fachleuten aus Industrie und Wissenschaft vom 4. – 5. September 2019 eine Plattform zum Dialog.

Rund 270 Teilnehmer und Spitzenreferenten aus Automobil- und Zulieferindustrie sowie führenden Forschungsinstituten kommen zum Austausch über aktuelle Themen und Trends im Bereich elektrischer Fahrzeugantriebe zusammen.

Es erwarten Sie Ergebnisse aktueller Forschungsprojekte aus dem E-MOTIVE Innovationsnetzwerk und Berichte führender Unternehmen über Erfahrungen aus der industriellen Praxis.

Ihr Programmausschuss

Ladies and gentlemen,

shaping change – a dialog between research and industry on electric vehicle drives.

The evolution of mobility is in full swing. Political environmental objectives and the digitalisation of society and industry are key drivers of electro-mobility. The future drivetrain will be determined by the further development and integration of new technologies.

The E-MOTIVE expert forum on 4-5 September, 2019 in Schweinfurt, is focused on these issues and offers experts from research and industry a platform for dialogue.

Around 270 participants and top speakers from the automotive industry and subcontractors as well as leading research institutes will come together to discuss current topics and trends in the field of electric vehicle drives. You can expect the results of current research projects from the E-MOTIVE innovation network and reports from leading companies on experiences from industrial practice.

The Program Committee

## Organisation

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**Veranstaltungsort | Location**
Mercure Hotel
Maininsel 10-12
97424 Schweinfurt, Germany

**Inhaltliche Träger | Contents responsibility**
Forschungsvereinigung Antriebstechnik e. V. (FVA)
Forschungsvereinigung Verbrennungskraftmaschinen e. V. (FVV)
Lyoner Strasse 18, D-60528 Frankfurt

**Veranstalter | Organiser**
FVA GmbH, Lyoner Strasse 18, D-60528 Frankfurt
Weitere Informationen unter | More information at
e-motive.net
fva-net.de

Bildquellen | Image sources: www.mariobrunner.com

# Programmübersicht | Program overview

## Mittwoch, 4. September 2019 | Wednesday, 4. September 2019

### Großer Saal

| | |
|---|---|
| **9:30 – 10:00** | Begrüßung \| Opening |
| **10:00 – 12:00** | Keynotes |
| **12:00 – 13:00** | Mittagspause \| Lunch break |
| **13:00 – 15:00** | Antriebssystem \| Drive System |
| **15:00 – 15:30** | Kaffeepause \| Coffee break |
| **15:30 – 18:00** | E-Motor \| E-Motor |

### Kleiner Saal

| | |
|---|---|
| **13:00 – 15:00** | Brennstoffzelle \| Fuel Cell |
| **15:00 – 15:30** | Kaffeepause \| Coffee break |
| **15:30 – 18:00** | Batterie \| Battery |

**18:00** **Vortragsende 1. Tag | End of presentation day 1**

**Abendveranstaltung | Evening Event**

**19:00** Bustransfer vom Mercure Hotel | Bus shuttle from Mercure Hotel

**19:30** Empfang im Restaurant Hirschkeller | Reception at the Restaurant Hirschkeller

## Donnerstag, 5. September 2019 | Thursday, 5. September 2019

### Großer Saal

| | |
|---|---|
| **8:30 – 11:00** | Fertigungstechnologie<br>Manufacturing Technology |
| **11:00 – 11:30** | Kaffepause \| Coffee break |
| **11:30 – 13:30** | Mechanisches und Mechatronisches System<br>Mechanical and Mechatronic system |
| **13:30 – 14:30** | Mittagspause \| Lunch break |
| **14:30 – 16:00** | **Plenar-Session \| Plenary Session** |
| **16:00** | Veranstaltungsende<br>End of conference |

### Kleiner Saal

| | |
|---|---|
| **8:30 – 11:00** | E-Motorsystem und Leistungselektronik<br>E-Motorsystems and Power electronics |
| **11:00 – 11:30** | Kaffepause \| Coffee break |
| **11:30 – 13:30** | Simulation, Entwicklungsmethoden<br>Simulation, Development Methods |
| **13:30 – 14:30** | Mittagspause \| Lunch break |

Veranstaltungsende Kleiner Saal
End of conference Kleiner Saal

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Branchendienst für Elektromobilität

H2 Zwei
DAS MAGAZIN FÜR WASSERSTOFF UND BRENNSTOFFZELLEN

VISION mobility

## Mittwoch, 4. September 2019 | Wednesday, 4. September 2019

### Großer Saal

9:30 Begrüßung | Opening

Dr. Tobias Böhm
Head of Electrified Drivetrain, Group Research Volkswagen AG,
Chair Board E-MOTIVE, Germany

**Keynotes**

10:00 *Auf dem Weg zur $CO_2$-neutralen Mobilität und wie ZF dazu beiträgt*
*On the way to $CO_2$-neutral mobility and how ZF contributes*

Bert Hellwig
Head of System House E-Mobility, ZF Friedrichshafen AG, Germany

10:30 *Antriebslösungen für Morgen – Effizienz trifft Fahrerlebnis*
*Powertrain solutions for tomorrow – Efficiency meets driving experience*

Manfred Homm
Head of R&D E-Mobility,
Schaeffler Automotive Buehl GmbH & Co. KG, Germany

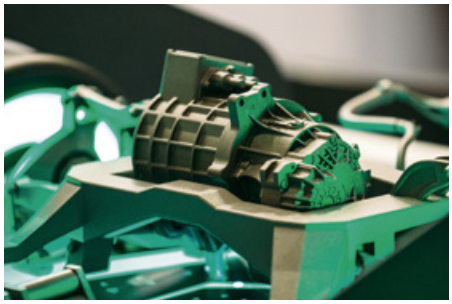
11:00 *Die Automobilindustrie im Umbruch*
*Game Changer for the Automotive Industry*

Bernd Stephan
President – SKF Automotive & Aerospace, SKF Group, Germany

11:30 *E-Mobility aus Sicht der Schmierstoffindustrie*
*E-mobility – the point of view of the lubricants industry*

Dr. Lutz Lindemann
Member of the Executive Board (CTO), FUCHS PETROLUB SE, Germany

12:00 Mittagspause | Lunch break



## Mittwoch, 4. September 2019 | Wednesday, 4. September 2019

### Großer Saal

### Antriebssystem | Drive System

Moderation | Session chair:
Dr. Tobias Böhm, Volkswagen AG, Germany

13:00 Doppel-E-Antrieb mit Range-Extender – Effizientes Mehrgang-E-Antriebskonzept mit hohem Schaltkomfort | Two-Drive-Transmission with Range-Extender – Efficient Multi-Speed Electric Powertrain Concept with high Shift Comfort

Felix Langhammer
Technical University, Institute for Mechatronic Systems in Mechanical Engineering Darmstadt (IMS), Germany

13:30 Hochintegrierte elektrische Achsantriebseinheit Highly Integrated Electric Axle

Dipl.-Ing. Johannes Lange
Dr. Ing. h.c. F. Porsche AG, Germany

14:00 Design und Validierung eines 48V-Hochleistungs-antriebs für die Mobilität von Morgen | Design and validation of a 48V high-performance traction drive system for the mobility of tomorrow

Holger Oechslen, Daniel Rieger
MAHLE International GmbH, Germany

14:30 Erste Effizienz- und Dynamikstudie zum innovativen elektromechanischen Hyper-Hochdrehzahl-Antriebsstrang Speed4E | A First Efficiency and Dynamics Analysis of the Innovative Hyper-High-Speed Electromechanical Powertrain Speed4E

Bernd Morhard
Technical University of Munich, Gear Research Centre (FZG), Germany

15:00 Kaffeepause | Coffee break

### Kleiner Saal

### Brennstoffzelle | Fuel Cell

Moderation | Session chair:
Dr. Achim Wiebelt, MAHLE International GmbH , Germany

PEMFC Stack- und Systemtechnologie der ElringKlinger AG | PEMFC stack- and system technologies of the ElringKlinger AG

Dr. Ewald Wahlmüller
ElringKlinger Fuelcell Systems Austria GmbH, Austria

Bedarfsgerechte Technologieentwicklung einer nutzungszenariospezifischen Brennstoffzelle für Nutzfahrzeuge | Need-based technology development of a scenario specific fuel cell for commercial vehicles

Dr. Christoph Baum
Fraunhofer Institute for Production Technology (IPT), Germany

Brennstoffzellen Range Extender für leichte Nutzfahrzeuge | Fuel cell range extender for light commercial vehicles

Marc Düvel
Volkswagen AG, Germany

Brennstoffzellensystemsimulation – Membranfeuchtemanagement | Fuel Cell System Simulation – Membrane Water Management

Sören Tinz
RWTH Aachen University,
Institute for Combustion Engines (VKA), Germany

15:00 Kaffeepause | Coffee break

## Mittwoch, 4. September 2019 | Wednesday, 4. September 2019

### Großer Saal

#### E-Motor | E-Motor

Moderation | Session chair:
Hristian Naumoski, Daimler AG, Germany

**15:30** Entwicklung einer positionssensorlosen Regelung für elektrische Antriebe in Automobilanwendungen
Solving issues on position sensorless control for electrical drives in automotive applications
Joao Bonifacio, ZF Friedrichshafen AG, Germany

**16:00** Modellierung und Einflussparameter der Mehrphasenströmung in Elektromotoren | Modeling of multi-phase flow in electrical motors
Christopher Beck, Daimler AG, Germany

**16:30** Fremderregte Synchronmaschine mit zusätzlichen Permanentmagneten als Traktionsantrieb
Electrically Excited Synchronous Machine with Additional Permanent Magnets for Traction Application
Hongfei Lu, Karlsruhe Institute of Technology (KIT), Institute of Electrical Engineering (ETI), Germany

**17:00** Innovative und schnelle Simulationsmethode des elektrischen und mechanischen Rippels von Gleichstrommaschinen | Innovative and fast simulation method for the electrical and mechanical ripple of DC machines
Chris Penndorf, ESI GmbH, Germany

**17:30** Optimierter Motorentwurf unter Berücksichtigung von elektromagnetischen und mechanischen Anforderungen | Optimized Motor Design Integrating Electro-magnetic and Stress Simulation
Dr.-Ing. Bogdan Funieru, DS Deutschland GmbH, Germany

**18:00** Veranstaltungsende 1. Tag | End of presentation day 1

### Kleiner Saal

#### Batterie | Battery

Moderation | Session chair:
Manfred Herrmann, Opel Automobile GmbH, Germany

The Full Charge – Effiziente und leistungsstarke Lösungen für die Elektromobilität | The Full Charge – Efficient and Powerful Solutions for Electric Mobility
Felix Zöchling, Webasto SE, Germany

Front Loading Ansatz bei Zellchemie Wechsel in der Batterie Entwicklung | Front Loading Approach in battery development for changing cell chemistry
Dr. Bernhard Brunnsteiner, AVL List GmbH, Austria

Modellierung thermisch-elektrischer Wechselwirkungen im Batteriemodul mittels IPEK-X-in-the-Loop-Ansatz | Modeling of thermal-electrical interactions in a battery module using the IPEK-X-in-the-Loop-Approach
Martin Eisele, Karlsruhe Institute of Technology (KIT), IPEK – Institute of Product Engineering, Germany

Quantifizierung von Fehlerraten in Lithium-Ionen Batterien mittels stochastischer Simulationen
Quantifying failure-rates in lithium-ion batteries with stochastic simulation
Philipp Dechent, RWTH Aachen University, Institute for Power Electronics and Electrical Drives (ISEA), Germany

Erhöhung der Sicherheit in Li-Ionen-Batterien mit Berstscheiben und Berstmembranen
More protection for Li-Ion-Batteries with rupture disks and membrane
Volker Buchmann, Hugo Benzing GmbH & Co. KG, Germany

Veranstaltungsende 1. Tag | End of presentation day 1

**Abendveranstaltung | Evening Event**

**19:00** Bustransfer vom Mercure Hotel | Bus shuttle from Mercure Hotel
**19:30** Empfang im Restaurant Hirschkeller | Reception at the Restaurant Hirschkeller

## Donnerstag, 5. September 2019 I Thursday, 5. September 2019

### Großer Saal

### Fertigungstechnologie
### Manufacturing Technology

Moderation I Session chair:
**Dr. Thomas Bobke**, SKF GmbH, Germany

8:30 Validierung einer spritzgegossenen Statornutkühlung für hochleistungsdichte Synchronmaschinen mit konzentrierter Einzelzahnwicklung I Validation of Injection Molded Stator Slot Cooling for High Power Density Synchronous Machines with Concentrated Single-Tooth Winding

Andreas Langheck
Karlsruher Institut of Technology (KIT),
Institute of Electrical Engineering (ETI), Germany

9:00 3D-Metalldruck Kühler für die Leistungselektronik
3D printed metal cooler for power electronics

Dr. Thomas Ebert
IQ evolution GmbH, Germany

9:30 Neue Technologien zur Bestimmung weich- und hartmagnetischer Werkstoffeigenschaften in elektrischen Antrieben und eMobility Anwendungen
New Measurement Technologies for Soft and Hard Magnetic Materials used in Electric Drives and Automotive Applications

Lukasz Mierczak
Dr. Brockhaus-Messtechnik GmbH & Co. KG, Germany

### Kleiner Saal

### E-Motorsystem und Leistungselektronik
### E-Motorsystems and Power electronics

Moderation I Session chair:
**Ian Faye**, Director Public Funded Projects, Gasoline Systems, Robert Bosch GmbH, Germany

Überlast- und Alterungsüberwachung von leistungselektronischen Wandlern I Overload and Degradation Monitoring of Power Electronic Converters

Christoph H. van der Broeck
RWTH Aachen University, Institute for Power Electronics and Electrical Drives (ISEA), Germany

Fehlerdiagnose in Asynchronmaschinen anhand der Drehzahlabhängigkeit des Stromspektrums
Fault Detection in Induction Machines Using the Speed Dependency of the Current Spectrum

Stefan Quabeck
RWTH Aachen University, Institute for Power Electronics and Electrical Drives (ISEA), Germany

Akustisches Verhalten zweimal dreiphasiger permanenterregter Synchronmaschinen in Traktionsantrieben I Acoustical behavior of dual three-phase permanent magnet synchronous machines in electrical traction drives

Daniel Keller
Daimler AG, Germany

## Donnerstag, 5. September 2019 | Thursday, 5. September 2019

### Großer Saal

### Fertigungstechnologie
### Manufacturing Technology

Moderation | Session chair:
Dr. Thomas Bobke, SKF GmbH, Germany

10:00 Produktionstechnische Herausforderungen im elektrischen Antriebsstrang | Production Challenges for the electric powertrain

Dr.-Ing. Florian Sell-Le Blanc
Aumann Espelkamp GmbH, Germany

10:30 Quantifizierung von Wertschöpfungsstrukturverschiebungen und strategische Neuorientierung mithilfe von Diversifikationsanalysen
Quantification of value added structure shifts and strategic reorientation by means of diversification analyses

Paul Scholz
Fraunhofer Institute for Production Technology (IPT), Germany

11:00 Kaffeepause | Coffee break

### Kleiner Saal

### E-Motorsystem und Leistungselektronik
### E-Motorsystems and Power electronics

Moderation | Session chair:
Ian Faye, Director Public Funded Projects, Gasoline Systems, Robert Bosch GmbH, Germany

Auslegung und Prüfung von Kurzschlussläufer-Asynchronmaschinen hoher Leistungsdichte mit gegossenem Kupferkäfig und hochfestem, verlustarmen NO-Elektroblech | Design and test of squirrel cage induction machines with high power density, cast copper cage and high-strength low-loss Noelectrical steel

David Schmitz, Uwe Schuffenhauer
breuckmann eMobility GmbH, Germany

Kennfeldbasierte Bestimmung optimaler Rotortopologien permanenterregter Synchronmaschinen
Characteristic Map based Determination of Optimum Rotor Topologies of Permanent Magnet Synchronous Machines

Dr. Jakob Jung
IAV GmbH, Germany

Kaffeepause | Coffee break

„Die $CO_2$ Ziele bis 2050 können nur mit Hilfe der Elektromobilität erreicht werden. Das ist ein echter Game Changer für die Automobilindustrie. Der Umstieg auf elektrische Antriebe in Fahrzeugen hat weitreichende Konsequenzen – sowohl für OEM's als auch für die Zulieferindustrie. Die gesamte Wertschöpfungskette wird sich neu definieren müssen. Das E-MOTIVE Expertenforum bringt die richtigen Experten zusammen, um diesen wichtigen und wirtschaftlich bedeutenden Umbruch zu beleuchten und zu diskutieren."

"Our 2050 $CO_2$ goals can only be achieved with the help of electric mobility. This is a real game changer for the automotive industry. The switch to electric drives in vehicles has far-reaching consequences – for OEM's as well as the supplier industry. The entire value chain will have to be redefined. The E-MOTIVE Expert Forum brings the right experts together to examine and discuss this important and economically significant change."

**Bernd Stephan, President – SKF Automotive & Aerospace, SKF Group, Germany**

## Donnerstag, 5. September 2019 I Thursday, 5. September 2019

### Großer Saal

#### Mechanisches und Mechatronisches System
#### Mechanical and Mechatronic system

Moderation I Session chair:
Dr. Bernd Vahlensieck, ZF Friedrichshafen AG, Germany

**11:30** Verwendung bestehender und neuer AT und DCT Fluide als Kühlmedium der Hybrid-Elektromotoren
Use of existing and new AT and DCT fluid technology in hybrid transmission designs as a coolant

Dr.-Ing. Arthur Petuchow, Afton Chemical GmbH, Germany

**12:00** Effiziente E-Drehmoment Verwaltung: E-Mobility Fluide mit Reibwertperformance für Limited Slip Differentiale und Torque Vectoring I Efficient E-torque handling: E-mobility fluids with friction performance for limited slip differentials und torque vectoring

Thomas Kraft, FUCHS SCHMIERSTOFFE GMBH, Germany

**12:30** Das Wälzlager im elektrifizierten Antriebsstrang – Anforderungen und Lösungen I The rolling bearing in the electrified power train – requirements

Thomas M. Wolf, SKF GmbH, Germany

**13:00** Wandel im Antriebsstrang – Transformation im Maschinenbau und bei Zulieferern I Change in the powertrain – Transformation in mechanical engineering and supplier companies

Eckhard Hörner-Marass
2H.IM Executive Interim Management GmbH, Germany

**13:30** Mittagspause I Lunch break

### Kleiner Saal

#### Simulation, Entwicklungsmethoden
#### Simulation, Development Methods

Moderation I Session chair:
Harald Hofmann, Valeo Siemens eAutomotive GmbH, Germany

Deep Learning für die Rotor- und Statortemperatur-schätzung in elektrischen Motoren I Deep Learning for Rotor and Stator Temperature Estimation in Electric Motors

Wilhelm Kirchgässner, Dr.-Ing. Oliver Wallscheid,
Paderborn University, Power Electronics and Electrical Drives (LEA), Germany

Neuronale Netze in der Komponentenmodellierung von hybriden Antriebssträngen I Using Neural Networks in HEV Powertrain Component Modeling

André Mayer, Daimler AG, Germany

Die Notwendigkeit einer Gesamtsystemsimulation von verzweigten Hochvolt-Bordnetzen in Elektro- und Hybridfahrzeugen I The importance of an overall system simulation for branched highvoltage vehicle electrical systems

Sebastian Raab, University of Applied Sciences Würzburg-Schweinfurt, Technology Transfer Center for E-Mobility (TTZ-EMO), Germany

Bewertung verschiedener Dedicaded Hybrid Transmission (DHT) im WLTC und 3F-Kundenzyklus
Evaluation of different Dedicaded Hybrid Transmission (DHT) in the WLTC and 3D customer cycle

Johannes Hengst
Technical University of Braunschweig,
Institute of Automotive Engineering (IFF), Germany

Mittagspause I Lunch break

Veranstaltungsende Kleiner Saal
End of conference Kleiner Saal

## Donnerstag, 5. September 2019 I Thursday, 5. September 2019

### Großer Saal

Plenar-Session I Plenary Session

Moderation I Session chair:
Alexander Raßmann, Forschungsvereinigung Antriebstechnik e.V. (FVA), Germany

14:30 Zellfertigung in Deutschland – Chancen für die Elektromobilität in Europa
German cell production – Chances for electromobility in Europe

Christian Adamczyk
BMZ GmbH, Germany

15:00 Der Bedarf an nachhaltigen Antriebsstranglösungen aus der Sicht eines bedarfsgerechten Mobilitätsdienstleisters I The need for sustainable powertrain solutions from the perspective of a demand-responsive transport provider

Jakob Kammerer
ioki GmbH, Germany

16:00 Veranstaltungsende I End of conference


BEARING WORLD
by FVA

3rd International FVA-Conference
The Expert Forum for Bearings – Rolling and Plain Bearings!
31 March – 1 April, 2020 in Hannover, Germany

Sponsor

## Fuchs

FUCHS, with 58 operating companies and over 5,000 employees in more than 45 countries the world›s largest independent lubricant manufacturer, develops, manufactures and markets lubricants and related specialties.

Our global customers include automotive suppliers and OEMs.

Here E-Mobility redefines the automotive industry, including the demands placed on lubricants and related products used in the production and operation of vehicles. In addition to the existing requirements for lubricants, there are new requirements, especially with regards to material compatibility and electrical continuity.

Highly efficient drives also offer approaches for innovative thermal management concepts.

Together with the automotive and automotive supplier industry, FUCHS finds the right solution for the corresponding drive. As a lubricant manufacturer, FUCHS stands for performance and sustainability, for safety and reliability, for efficiency and cost savings.

FUCHS stands for a promise: Technology that pays off.

Sponsor

SCHAEFFLER

## Schaeffler Group

The Schaeffler Group is a globally active automotive and industrial supplier. By delivering high-precision components and systems in e-mobility, engine, transmission and chassis applications, Schaeffler Group is already shaping the “Mobility for tomorrow”.

The consumption and emissions targets of the future can only be fully met through electrification of the drivetrain. As a result, Schaeffler offers products across the full bandwidth of electrification options – from 48-volt hybrids and plug-in hybrids to drives for purely electric vehicles. This broad spectrum of knowledge makes Schaeffler an expert partner to the various markets and customers it serves. Schaeffler is also one of the co-founders and one of the most notable and successful players in Formula E. Schaeffler has been contributing its know-how to the development of the powertrain of Team Audi Sport ABT Schaeffler’s race cars since 2015. In doing so, the company demonstrates its expertise in forward-thinking technologies and presents ideas for sustainable mobility for tomorrow in the innovative electric racing series as well.

The technology company generated sales of approximately 14.2 billion Euros in 2018. With around 92,500 employees, Schaeffler is one of the world’s largest family companies and, with approximately 170 locations in over 50 countries, has a worldwide network of manufacturing locations, research and development facilities, and sales companies. With more than 2,400 patent registrations in 2018, Schaeffler is Germany’s second most innovative company according to the DPMA (German Patent and Trademark Office).


Sprints from 0 to 100 km/h in 2.7 seconds. All electric and ready for series production.

The Champion of 2017. In 2018, a double victory in Berlin. The Audi Sport ABT Schaeffler team has won countless Formula E races. For us, it is not just a sport. It is testing the drive technology of the future on the race track. We’re putting electric drives on the road, ready to-go into production. Interested? Find out more online: **www.schaeffler.com**

SCHAEFFLER

Sponsor

# SKF

Pure electric vehicles (EVs) and hybrid vehicles are reaching the automotive mainstream. For the industry, the electrification of automotive powertrains represents the biggest technological shift for a generation. Expertise from SKF is helping leading automotive OEMs and suppliers tackle many of the challenges they are encountering along the way.

SKF eDrive ball bearings, for example, have been developed specifically to address the need for consistently low friction, high speed and high power density in EV and hybrid vehicle electric machines. The bearings use an energy efficient polymer cage, optimized raceway geometry, and a validated long life, wide temperature grease. Combined, these advanced design features help enable longer drive system service life and extend battery range. Hybrid bearings have a number of advantages in EV applications, too. In addition to a longer service life and improved resistance to vibration, these bearings also have excellent electrical insulation characteristics, protecting drivetrain components from damage caused by stray electrical currents.

Apart from this, SKF has developed Rotor Positioning Sensor-Bearing Units that simplify assembly and improve reliability in electric powertrain applications. They use a patented design that allows very precise management of the sensor-bearing unit air gap. As a result, the units are insensitive to severe magnetic field disturbances, and can withstand application vibration and high continuous temperatures.

SKF EV and hybrid vehicle solutions can be fully customized to suit the needs of specific customer vehicle and powertrain programs, and SKF's experienced application engineers are able to offer intensive support from initial development through to series production.

## Are you developing an electrified drive train?

### We can help you with our expertise.

At SKF, we have a wealth of experience from our long-standing cooperation with renowned pioneers in electric mobility, as well as versatile engineering services and a tailor-made range of bearings for innovative drive train concepts, making us your ideal development partner. Together, we can identify the bearing technology required for particular applications and create the appropriate solutions at an early stage.

**You can rely on us,**
**bearings are our world.**

www.skf.com

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Sponsor

## ZF

ZF is a global technology company from Germany and supplies systems for passenger cars, commercial vehicles and industrial technology. By delivering Next Generation Mobility, we are on the Road to Vision Zero – mobility with zero accidents and zero emissions. With its comprehensive technology portfolio, the company offers integrated solutions for established vehicle manufacturers, mobility providers and start-up companies in the fields of transportation and mobility. ZF focusses on four fields of technology: Vehicle Motion Control, Integrated Safety, Autonomous Driving and Electric Mobility.

For local emissions-free transport vehicles, all-electric drives are the only option. ZF supplies these drives for passenger cars, trucks and buses as highly efficient system solutions, among them hybrid systems, electric motors and power electronics.

In order to make vehicles equipped with combustion engines considerably more fuel efficient, ZF is a pioneer in the field that continues to rely on modular plug-in systems for vehicle hybridization. This means the electric drive can handle average daily driving distances on its own. Furthermore, ZF is not only making its transmissions, steering systems, braking systems and actuators more efficient through electrification, it is also making preparations for implementing autonomous drive functions. ZF continually enhances its systems in the areas of digital connectivity and automation in order to allow vehicles to see, think and act.

In 2018, ZF achieved sales of €36.9 billion. The company has a global workforce of 149,000 with approximately 230 locations in 40 countries. ZF invests over six percent of its sales in research and development annually.


# Zero Emissions. Unless you want them.

Our technologies are helping to contribute to a significant reduction in traffic emissions. Although we can't control the way things smell on the inside – yet.

At ZF, we're working hard on Vision Zero – a world without accidents and emissions. Our solutions for drivetrain electrification of a diverse array of vehicle systems bring us a lot closer to this goal. **zf.com/efficiency**


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## Aussteller Industrie 2019 | Exhibitors Industry 2019

breuckmann eMobility GmbH

BaSyMo - Modular Battery System

Brockhaus Messtechnik GmbH & Co. KG

EA Elektro-Automatik GmbH & Co. KG

ESI GmbH

FUCHS SCHMIERSTOFFE GmbH

FVA GmbH

Hottinger Baldwin Messtechnik

LangSys GmbH

Schaeffler Technologies AG & Co. KG

SKF GmbH

Stiefelmayer-Lasertechnik GmbH

ZES ZIMMER Electronic Systems GmbH

ZF Friedrichshafen AG

## Aussteller Institute 2019 | Exhibitors Institutes 2019

RWTH Aachen University, Institute for Power Electronics and Electrical Drives (ISEA), Germany

RWTH Aachen University, Institute for Combustion Engines (VKA), Germany

Technical University Darmstadt, Institute for Mechatronic Systems in Mechanical Engineering (IMS), Germany

Friedrich-Alexander-Universität Erlangen-Nürnberg, FAPS Institute for Factory Automation and Production Systems, Germany

Albert-Ludwigs-Universität Freiburg, Institut für Mikrosystemtechnik (IMTEK), Germany

Leibniz Universität Hannover, Institute for Drive Systems and Power Electronics, Germany

Leibniz Universität Hannover, Institute of Machine Design and Tribology (IMKT), Germany

Karlsruhe Institute of Technology (KIT), Institute of Thermal Process Engineering (TVT), Germany

Karlsruhe Institute of Technology (KIT), wbk Institut of Production Science, Germany

Technical University of Munich, Gear Research Centre (FZG), Germany

Technical Hochschule Nürnberg, Institute for Power Electronic Systems – ELSYS, Germany