VDI

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24th International VDI-Congress

June 12 and 13, 2024, Baden-Baden, Germany

Dritev

The leading international congress for electrified powertrains, systems, components and methods

Main topics:

- Design and architecture of vehicle drive systems
- Thermal management, operating behavior, acoustics
- E-machine and power electronics
- Methods and simulation
- CO_2 neutrality and sustainability
- Transmissions and fluids

Dritev interactive

Poster exhibition | Speakers Corner | Dritev Summer Night | Car presentation | Workshops

Meet international experts from:

ARRK, Audi, AVL, BORGWARNER, BOSCH Invented for life, CLAAS, FEV, FZG, GKN AUTOMOTIVE, Henkel, HOERBIGER because performance counts, Schaeffler powertrain, Inmotive, MASCHINENBAU We engineer future IMS, INFINAVION Technology, vkm, IVD, MAGNA, mts Consulting & Engineering GmbH, MY InnoTrinsic, OPEL, SCHAEFFLER, STELLANTIS, TU Graz Graz University of Technology, TECHNISCHE UNIVERSITÄT DARMSTADT, TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY, TUM, Valeo, vitesco TECHNOLOGIES, VW, WZL RWTH AACHEN UNIVERSITY, ZF

Workshops (in German)

- Design und Entwicklung nachhaltiger technischer Systeme
- Digital Twins zur Virtualisierung in der Fahrzeugentwicklung

Accompanying event

8th International VDI Conference

Powertrain Systems in Mobile Machines 2024

Program Overview

Only held in German!

Workshops
Tuesday, June 11, 2024, Kongresshaus Baden-Baden, Germany

09:00 - 17:00	Digital Twins zur Virtualisierung in der Fahrzeugentwicklung (01ST022024)	Design und Entwicklung nachhaltiger technischer Systeme (01ST807024)

1st Congress Day
Wednesday, June 12, 2024

				Accompanying conference **Powertrain Systems in Mobile Machines 2024**
09:00	Welcome address			
09:20	Plenary speeches with subsequence discussion (Auditorium)			
11:20	Coffee break and visit of the exhibition			
12:00	E-engine	Inverter	Cooling/Fluids	Energy and propulsion systems
13:00	Lunch and visit of the exhibition			
14:30	Drive concept	NVH	Thermal management	Powertrain transformation
16:00	Coffee break and visit of the exhibition			
16:45	Transmission	Simulation	Hybrid	Implementation of hydrogen fuel cell systems
18:15	End of the 1st congress day			
18:45	Dritev Summer Night			

2nd Congress Day
Thursday, June 13, 2024

				Accompanying conference **Powertrain Systems in Mobile Machines 2024**
08:30	AI methods	Sustainability	Drive concept 2	Electric drive concepts
10:30	Coffee break and visit of the exhibition			
11:15	Transmission 2	E-engine 2	Inverter 2	Implementation of electric drivetrain systems
12:45	Lunch and visit of the exhibition			
14:15	Plenary speeches with subsequence discussion (Auditorium)			Electric drives in different application
16:00	Awarding of the Best Presentation Award for Young Engineers (Auditorium)			
16:05	Closing remarks			
16:15	End of the congress			

Program

1st Congress Day
Wednesday, June 12, 2024

08:00 Registration

Auditorium – Plenary

09:00 Opening and welcome address

Dipl.-Ing. Konstantin Neiß, Mercedes-Benz AG, Germany and

Dipl.-Ing. Thomas Pfund, Schaeffler Automotive Buehl GmbH & Co. KG, Germany

Plenary speeches
Dipl.-Ing. Konstantin Neiß, Mercedes-Benz AG

09:20 CLEPA President – 163 days in office – an interim assessment

- CLEPA's significant role in the process of shaping more modern and sustainable automotive mobility
- Ensuring that all stakeholders interests are taken into account during this process
- Summary of the first half of 2024
- Outlook on upcoming challenges and potential starting points

Dipl.-Ing. Matthias Zink, President of CLEPA, CEO Automotive Technologies, Schaeffler AG, Herzogenaurach, Germany

09:45 Crucial success factor for the turning point in mobility: Market-wide interfaces

- A convincing customer experience is essential for a successful mobility changeover
- Future traffic will be purely electrically powered
- We need a highly complex system comprising of generation and transportation of renewable energies up to easy charging in day-to-day life and while travelling with additional digital capacities and data security

Jürgen Stein, Chief Innovation & New Business Officer, EnBW Energie Baden-Württemberg AG, Karlsruhe, Germany

10:10 Next steps – Electric mobility

- Powertrain undergoing technology overhaul
- Improve customer experience
- Adding to emotional appeal

Dr. Karsten Bennewitz, Head of Powertrain and Energy System Development, Volkswagen AG, Wolfsburg, Germany

10:35 Drivetrain technology in agricultural machines – traditionally innovative

- Development of drivetrain technology
- Drivetrain challenges in agricultural applications

Dipl.-Ing. Jan-Hendrik Mohr, CEO, CLAAS Gruppe, CLAAS KGaA mbH, Harsewinkel, Germany

11:00

Plenary discussion
Dipl.-Ing. Konstantin Neiß, Mercedes-Benz AG

11:20 Meet & Greet – Coffee break in the exhibition area and car presentation

12:00 Change to the parallel sessions

Dritev

Your international technology congress for powertrain developers in Baden-Baden, Germany!

VDI

Program

E-engine
Dr. Henning Wöhl-Bruhn,
Volkswagen AG

Inverter
Dr. Hristian Naumoski,
Mercedes-Benz AG

Cooling/Fluids
Dr.-Ing. Thomas Casper,
Dr. Ing. h.c. F. Porsche AG

12:00

E-motor development according to Design to Line (D2L)
- Bosch D2L approach: Continuous improvement of the existing modular E-motor design kit sMG Gen2 with new technologies on existing production facilities
- Design: Clear boandary conditions through line rules from manufacturing for development
- Line: Flexible production facility concept offers the possibility of integrating new technologies
- Presentation D2L approach for the new technology features direct cooling, rotor bandage and shortened winding head, significantly improving the E-motor KPIs power density, efficiency and sustainability

Dipl.-Ing. Thomas Böker, Director eMotor, Robert Bosch GmbH, Schwieberdingen, Germany, Co-Authors: Dr. rer. nat Thilo Leineweber, Dr.-Ing. Peter Fischer, both Robert Bosch GmbH, Stuttgart, Germany

Advanced power electronics topologies drive efficient HV architectures
- Wide-bandgap technologies enables advanced and efficient inverter topologies
- Analyses of PWM losses of electric machines in a wide range of inverter switching frequency
- Advanced inverter topologies increase reliability and drivability in L4/L5 autonomous vehicles
- Electric drivetrain efficiency optimization for more range and longer lifetime

Dr.-Ing. Ayman Ayad, Senior System Engineer & Expert Power Electronics, Co-Authors: Dr.-Ing. Anatoliy Lyubar, Dr.-Ing. Philip Brockerhoff, all Vitesco Technologies GmbH, Regensburg, Germany

How EV transmission fluids can enable greater sustainability, greater efficiency, and greater durability of electrified powertrains
- General effects on various properties when comparing ultra-low viscosity fluids with conventional transmission fluids
- How EV transmission fluids can contribute to a higher drivetrain efficiency while keeping hardware protection at the highest possible level
- Strategies for reducing carbon intensity through optimized formulations that take different raw material sources into account

Dr. rer. nat. Christian Nörnberg, Technologist PD Driveline & Advanced Electrification Fluids, Co-Author: Dr. Thomas Hellwig, both Castrol Germany GmbH, Hamburg, Germany

12:30

Comparison of technologies and materials for E-Drive systems ander new cooling aspects
- Phase Change Cooling as mandatory technology for BEV cost reduction
- Impact of new Phase Change Cooling system on the parameters of e-powertrain
- Optimize e-motor designs for new magnet and winding materials
- Low costs and weight combined with high efficiency, performance and sustainability

Dipl.-Ing. Volker Ambrosius, Senior Technical Consultant Electrification System, Co-Authors: Dr.-Ing. Mathias Lindner, Dr.-Ing. Christoph Danzer, all IAV GmbH, Stollberg, Germany

Increased performance and efficiency using optimized pulse patterns
- Motor control
- Efficiency
- Modulation

Simon Klacar Ph.D., Principal Engineer Propulsion System, InfiMotion Technology, Gothenburg, Sweden

Efficient and sustainable dielectric fluids for direct battery and e-motor cooling
- Lower operating temperatures in batteries and e-motors demonstrated by test results
- Optimized dielectric properties for better insulation
- Abuse testing results and safety enhancement
- Sustainable formulation options

Dipl.-Ing. (FH) Thomas Kraft, Geschäftsentwicklung E-Mobility, Co-Authors: Dr. Jasmin Schießl-Kerbeck, Marcel Paris, all Fuchs Lubricants Germany GmbH, Mannheim, Germany

13:00 **Time for Business Lunch** – Meet & Greet in the exhibition area with car presentation

Drive concept
Alexander Krick,
Volkswagen AG

NVH
Dr. Norbert Alt,
FEV Europe GmbH

Thermal management
Dr. Jörg Gindele,
Magna PT International GmbH

14:30

New high voltage Xin1 eAxle range
- Scalable high voltage eAxle Xin1
- Modular architecture (800V/400V – EESM/PMSM) with high level of component integration
- Best in class eAxle for power density without compromise on efficiency and CO_2 emissions
- Remanufacturing and reparability

Eric Hamon, PEM eAxle & System Platform Cluster Director, R&D Powertrain Electrified Mobility, Valeo, Creteil, France

Merits of using harmonic current injection in electric drives to reduce torque ripple, improve NVH behavior, and more
- Current control for harmonics in an electric drive
- Improved NVH behavior
- Reduced torque ripple
- Inverter temperature balancing

Dr. rer. nat. Michèle Hirsch, Development Engineer, Function Development, Co-Author: Dr.-Ing. Gunther Götting, both Robert Bosch GmbH, Stuttgart, Germany

Efficiency potential of mono-fluid drivetrain thermal management for battery electric vehicles
- Efficiency
- Holistic thermal management
- Battery electric vehicles
- Energy losses

Bernd Morhard, M. Sc., Research Associate, EHL Tribocontact and Efficiency, Co-Authors: Bjarne Schwarz, M. Sc., Lukas Pointner-Gabriel, M. Sc., Dr.-Ing. Thomas Lohner, Prof. Dr.-Ing. Karsten Stahl, all Institute of Machine Elements, Gear Research Center (FZG), TUM School of Engineering and Design, Technical University of Munich, Garching, Germany

Program

15:00

ONE EDU: Efficiency, cost and space advantages of highly integrated multi-components solution

- The ultimate integration of sophistication and functionality for any EV application needs
- A groundbreaking solution, incorporating up to 8+ essential subcomponents within a single, sleek housing
- hofer powertrain dives into details about the benefits of such solutions and explains how they can change the course of EV powertrain development

Dipl.-Ing. Klaus Wawra, Technical Project Manager/Site Director Vienna, Co-Authors: Sebastian Hilger, Markus Schmid, all hofer powertrain AG, Nürtingen, Germany, Dr.-Ing. Thomas Hackl, Hofer AG, St. Ulrich bei Steyr, Austria

On the effects of electric components on gearbox noises

- Early-stage analysis of NVH behavior in gearboxes is commonly done using time-based multibody simulations, but new challenges arise due to the interplay between mechanical and electric components like e-motors, inverters, and controllers
- The paper uses multibody simulations to assess the impact of electric and mechanical components on both structural and airborne noise in gearboxes, highlighting the complex interactions between these elements

Marc Janousek, M. Sc., Analysis- and Support Engineer, Advanced Simulation Technologies, Co-Authors: Benjamin Schmelzle, M. Sc., Denis Werner, M. Sc., Dr. Rainer Fiereder, all AVL Deutschland GmbH, Mainz-Kastel, Germany

Testing, simulation and validation for designing battery safety materials

- Electric vehicle
- Battery
- Safety
- Thermal runaway

Dr. Keon Woo Lee, eMBA, Senior Manager PD Battery Solutions, Automotive Components, Henkel AG & Co. KGaA, Dusseldorf, Germany

15:30

Novel clutchless transmission advancements using tangential spiral transition geometry provides imperceptible shifting and unintrupted torque at higher speeds

- Spiral sprocket segments elongate the shift duration and precisely command the chain transition even more smoothly than previous ingear transmissions
- Uninterupted shifts with high torque motors are demonstrated
- Efficiency is further improved making this 2-speed more efficient than commercial single-speed gearboxes
- Breakthrough in actuation technology dramatically reduces noise and increases durability

Tony Wong, CTO, Product Development, Inmotive, Toronto, Canada

3D tolerance analysis of gearbox components: Tolerance optimised design taking into account noise radiation due to gear meshing

- 3D system tolerance analysis and system design as a basis for acoustic design of gearboxes
- Derivation of important design features and gear tooth corrections based on results of tolerance analyses for improved gear acoustics
- Presentation of the methodology based on a practical example from the field of E-mobility

Maximilian Zinner, M. Sc., Leading Expert Powertrain, Co-Authors: Dr. Jan Reger, Dr. Bernd Somschor, all ARRK Engineering GmbH, Munich, Germany

Development of efficient thermal management systems for HEVs, BEVs and FCEVs using co-simulation on the HiL-ThermoLab testbed

- Development and testing of thermal operating strategies
- Development of innovative thermal management systems
- Development and use of new test systems (HiL-ThermoLab testbed)

Luis Vincent Fiore, M. Sc., Research Assistant, Institute for Internal Combustion Engines and Powertrain Systems, Co-Authors: Prof. Dr. techn. Christian Beidl, both Technical University Darmstadt, Germany, Prof. Dr. Günter Hohenberg, IVD-Deutschland GmbH, Darmstadt, Germany

16:00 **Meet & Greet** – Coffee break in the exhibition area with car presentation

Transmission
Dipl.-Ing. Georg Bednarek,
Stellantis AG

Simulation
Dr.-Ing. Thomas Hackl,
Hofer AG

Hybrid
Prof. Karl Viktor Schaller,
Technische Universität München

16:45

High reduction hypoids – High reduction, high speed and also high efficiency?

- High reduction hypoids
- Experimental investigations
- Efficiency
- High speed

Lorenz Constien, M. Sc., Research Assistant, Co-Authors: Alexander Drechsel, M. Sc., Dr.-Ing. Josef Pellkofer, Prof. Dr.-Ing. Karsten Stahl, all Institute of Machine Elements, Gear Research Center (FZG), TUM School of Engineering and Design, Technical University of Munich, Garching, Germany

Parameter study on the influence of driving cycle and powertrain parameterization on fuel consumption of wheel-hub driven vehicles

- Backwards simulation of the drivetrain of wheel hub driven vehicles to determine fuel consumption
- Driving cycles for designing the drivetrain of wheel hub driven vehicles
- Parameter study on influence of driving cycle and powertrain parameterization on consumption

Tobias Peichl, M. Sc., Research Associate, Institute for Mechatronic Systems (IMS), Co-Author: Prof. Dr.-Ing. Stephan Rinderknecht, both Technical University Darmstadt, Germany

The next AUDI 48V hybrid powertrain generation with BorgWarner's integrated electric drive system

- 48V system architecture as a holistic approach (Audi)
- Fulfillment of performance, efficiency and weight requirements while ensuring the integrability into the existing double clutch powertrains (Audi)
- Design of the electric machine, inverter, integrated driveline, & control software (BorgWarner)
- Comparison of the total system performance against the provided system requirements (BorgWarner)

Florian Then, M. Eng., Project Management All-Wheel Drive Systems, Powertrain Generator, Development Transmissions/Powertrain, Audi AG, Ingolstadt, Germany and **Caleb Secrest, Ph.D.** Engineering Manager, Electrification Controls – Platform & Innovation, Power Drive Systems, BorgWarner, Noblesville, USA, Co-Authors: Dipl.-Ing. (FH) Daniel Brückel, Christian Glück, B. Eng., Dipl.-Ing. Sachin Pangaonkar, all Audi AG, Ingolstadt, Germany, Ashish Jain, M.S., Cong Ma, Ph.D., BorgWarner, Noblesville, USA, Piero Caporuscio, M. Sc., BorgWarner, Auburn Hills, USA

17:15 **Gear efficiency optimization – Macro and micro geometry design for stepped planetary gear stages**

- AI-based design of the macro geometry of a stepped planetary gear stage for an optimized operational behavior
- Simulation of the operational behavior in multi body simulation
- Robust micro geometry design considering dynamic misalignments due to manufacturing and assembly deviations

Christian Westphal, M. Sc., Group Leader Gearbox NVH, Co-Authors: Dr.-Ing. Jens Brimmers, M. Sc., Prof. Dr.-Ing. Christian Brecher, all Werkzeugmaschinenlabor WZL, RWTH Aachen University, Germany

A MBSE approach for virtual verification and validation of e-drives with digital twins

- Digitalization and focus on electric vehicles
- Introduction of digital twins along the V-model using MBSE
- Simulation requirements/SysML architecture models for overall system simulation models
- End-to-end process: From requirements to model construction to virtual release (inc. DevOps)

René Honcak, M. Sc., Head of Digital Twin | Electrified Powertrain Technology, ZF Friedrichshafen AG, Munich, Germany

The new EDCT P2 hybrid transmission scalable for both 48V/320V Stellantis hybrid models application

- One Transmission concept addressing two hybrid powertrains (Mild hybrid & High Voltage hybrid)
- Fully integrated edrive variants
- Best driveability
- 50 % of low speed city driving in 100 % ZEV mode, 20 % CO_2 reduction compared to predecessor

Arnaud Vasseur, M. Sc., EDCT Project Chief Engineer, Stellantis, Carrieres-Sous-Poissy, Frankreich, Co-Author: Gunther Bismans, M. Sc., Punch Powertrain PSA e-Transmissions, Sint-Truiden, Belgium

17:45 **From single contact to mechatronic system – examples of series applications of planetary roller gears in automobiles**

- Classification and function of a synchronised planetary screw drive
- System architectures – examples of the technical variability and use of the SPWG
- Deep dive: Excerpt from the design of the SPWG using the example of radial clearance – from system behaviour to contact analysis

Dr.-Ing. Simon Merz, Validation and Verification Engineer, Schaeffler Technologies AG & Co. KG, Herzogenaurach, Germany, Co-Author: Dipl.-Ing. Reiner Voss, Schaeffler Technologies AG & Co. KG, Schweinfurt, Germany

Transferring superior vehicle functions for energy & motion control to the software-defined vehicle

- Software driven vehicle functions will enable superior drivability and significant benefits regarding efficiency, safety, dynamics, and convenience
- Magna's software technology plays a vital role in electric powertrain systems
- Insights into Magna's software platform for advanced and predictive vehicle functions for energy & motion control

Dipl.-Ing. oec. Julius Meinecke, Senior Manager, Product Management, Connected Powertrain, Magna Powertrain, St. Valentin, Austria

DHT's in modern mobility and the hybrid-strategy for multi-mode powertrains

- The growing relevance of Dedicated Hybrid Transmissions (DHT)
- The future-proof hybrid strategy for the automotive market
- Optimization of fuel consumption
- Worldwide trends for hybrid vehicles

Faramarz Rahnama, B. Sc., Design Engineer, Co-Authors: Razif Mokhti, Karsten Loock, all hofer AG, Wolfsburg, Germany

18:15 **End of the 1st congress day**

18:45 **Dritev Summer Night at Kurhaus Baden-Baden – The place you have to be!**

2nd Congress Day
Thursday, June 13, 2024

AI methods
Dr.-Ing. Keiwan Kashi,
GKN Driveline International GmbH

Sustainability
Dipl.-Ing. Volker Heinz,
BorgWarner Drivetrain Engineering GmbH

Drive concept 2
Prof. Dr.-Ing. Stephan Rinderknecht,
Technical University of Darmstadt

08:30

Thermal digital twin using Reduced Order Model (ROM) and Artificial Intelligence (AI) in high voltage power electronics of electric vehicles
- Reduced Order Model Algorithms, Arnoldi Method
- Mathematical modelling and 1D system thermal network model
- Artificial Intelligence algorithms
- Online simulation and software integration

Prabhakaran Alagarsamy, M. Eng., Expert-System Thermal Management, Group Components, Volkswagen AG, Ingolstadt, Germany, Co-Author: Dr. Avakian Artjom, Group Components, Volkswagen AG, Kassel, Germany

Systems thinking, sustainability, life cycle analysis, electric vehicles, drivetrain, electric machines
- A holistic strategy to embed ESG into the fabric of product development to deliver value to our customers, reducing the total cost of ownership with improved product performance
- The European Commission Sustainable Product Policy estimates that 80 % of a products environmental impact is determined at the design stage. Systems engineering unlocks this potential
- Using design principles for sustainability (DfS) and LCA to reduce not only Cradle-to-gate embedded emissions but also enable Cradle-to-cradle whole-life impact reduction and develop a circular economy
- Drive train design optimisation for performance, cost and sustainability

Sean Worrall, MBA, B. Eng., Chief Engineer Product Sustainability, GKN Automotive, Abingdon, UK

Value Engineering: Max. power density and cost reduction through technology change in eDrives
- Innovative technologies and engineering solutions, offering potential cost savings through component optimization and new materials
- Progress with the Form Litz Wire technology that increases motor power by over 25 %
- Higher efficiency and lower costs, making it a game-changer for electric vehicles with GaN solutions

Dipl.-Ing. Fredrik Haag, Head of Business Development eDrive, hofer powertrain, Nürtingen, Germany, Co-Author: Dr.-Ing. Thomas Hackl, Hofer AG, St. Ulrich bei Steyr, Austria

09:00

Machine-learning based approach for the holistic optimization of bearing concepts in electric drives
- Electric drive synthesis
- Bearing design
- System optimization
- Machine Learning

Marie Hermanns, M. Sc., Development Engineer and **Mathias Derksen, M. Sc.,** Development Engineer, both Technical Development of electric drives, power electronics and transmissions, Group Components, Volkswagen AG, Baunatal, Germany

The path to carbon-neutral steel component
- Challenges in procuring "green" steel
- Carbon-neutral forging and heat treatment
- The relevance of material selection for sustainability
- Compensating residual CO_2 through certificates

Dipl.-Phys. Dirk Neumayer, Manager, Richard Neumayer GmbH, Hausach, Germany

Customized EDU systems from micro mobility to heavy-duty applications
- High diversity of electric drive unit systems
- Electric bike drive unit
- Passenger car drive unit
- Heavy duty drive unit

Dipl.-Ing. Ralph Johan Louis Fleuren, Product Manager, Electric Powertrain, Co-Authors: Dr. Michael Stapelbroek, both FEV Europe GmbH, Aachen, Germany, Nikita Morozov, RWTH Aachen, Germany

09:30

Develop efficiently and save resources with engineering AI and the Robust Design method – practical examples and AI live demo on NVH, inverter and battery
- Engineering AI creates valid prediction models based on a small number of samples as early as the development phase
- Best settings for product functionality over service life and stable, resource-efficient manufacturing processes
- With the Robust Design method systematically and securely to robust products and stable processes

Dipl.-Ing. (FH) Frank Thurner, Head of Digitalization with Engineering-AI in Development & Production, mts Consulting & Engineering GmbH, Fürstenfeldbruck, Germany

Decarbonization strategy of Stellantis
- Global carbon footprint and corporate net-zero commitment
- Decarbonization roadmap & strategic plan

Dipl.-Ing. Igor Zivkovic, Technical Manager/ Technical Fellow, Stellantis Germany GmbH, Rüsselsheim, Germany

Magna's next gen eDrive portfolio, concept and technologies
- Introducing Magna's next generation of eDrive
- Implemented technologies and solution approaches and their benefits
- Holistic optimization of the system and operating strategy

Dipl.-Ing. (FH) Daniel Prix, Senior Manager, AE Power Systems and Advanced Functions, Co-Authors: Dr. Daniel Lindvai-Soos, Dr. Ewald Robeischl, all Magna Powertrain GmbH & Co KG, Lannach, Austria

Program

10:00 **Quality improvement through AI-based usage of production and field data analytics**
- Data collected in manufacturing process and transmission lifetime
- From data to information – AI ready infrastructure
- Insights through dashboards to support decision making process

Jens Saberi, M. Sc., Senior Manager Software Systems Solutions, Magna PT Software Systems Solutions GmbH, Untergruppenbach, Germany

Carbon footprint minimization of electric powertrains by multi-objective design optimization
- Carbon footprint minimization of electric axle drives in a multi-objective manner
- Obtain best suitable solution covering sustainability, performance, package and cost
- Sweet spot between production emissions and in-use energy efficiency gains

Dipl.-Ing. Dr. techn. Martin Hofstetter, Research Group Leader, Institute of Automotive Engineering, Co-Authors: Dipl.-Ing. Dominik Lechleitner, Assoc. Prof. Dr. Mario Hirz, all Technical University of Graz, Austria

The innovative cooling system of the new ID.7 electric drive
- Cooling system
- E-Drive /E-Motor
- Thermal management

Dr.-Ing. Steffen Rothe, Development Engineer, Technical Development of electric drives, power electronics and transmissions, Co-Authors: Dipl.-Ing. Sebastian Gorges, Dipl.-Ing. Martin Hoffmann, all Group Components, Volkswagen AG, Baunatal, Germany

10:30 **Meet & Greet** – Coffee break in the exhibition area with car presentation

Transmission 2
Dipl.-Ing. Daniel Borowitza, BMW AG

11:15 **Innovative dog clutch with an electromagnetic actuator for more efficient and cost-optimized gearbox architectures**
- Structure and function of the electromagnetic dog clutch
- Efficiency and installation space advantages in the respective applications
- Design and testing of the overall system
- Scalability: Development of a modular system

Konrad Lory, Head of Product Management, Co-Authors: Dipl.-Ing. Markus Sauter, MBA, Peter Echtler, all HOERBIGER Antriebstechnik GmbH, Schongau, Germany

11:45 **Optimized driving dynamics of electrically powered vehicles by active limited slip differentials**
- Driving dynamics of BEV
- Torque distribution in drivetrains
- Comparison different solutions

Jan Haupt, Chief Engineer Component Development, Co-Author: Dr. Christoph Gillen, both GKN GmbH, Lohmar, Germany

12:15 **Ultra Compact Drive – Future development of co-axial solution with integrated differential**
- Coax systems
- ZF prototypes with InDi
- Challenges during the UCD design
- Compactness of UCD

Dipl.-Ing. Tamás Gyarmati, Team Leader Integration and Mechatronics, Co-Authors: Matthias Reisch, Philip Dötschel, all ZF Friedrichshafen AG, Friedshafen, Germany

E-engine 2
Dipl.-Ing. (FH) Udo Sommerhalter, Valeo Powertrain Systems Business Group

Next generation of electric machines for electric vehicle applications
- Motivation of choosing Woand Rotor Synchronous Machines (WRSMs) in modern EVs
- Technical benefits and challenges associated with developing WRSMs
- Understand the trade-offs between performance, cost-effectiveness and Life Cycle Analysis
- Considering emerging technologies in power transfer to the rotor assembly

Dr. Mahdi Tousizadeh, Technical Specialist – Motor Control, Systems Engineering, Co-Authors: Dr. Mike Solmelidis, Rick Townend, all GKN Automotive, Abingdon, UK

Design and analysis of a novel oil cooling solution for an ultra-high power density permanent magnet motor
- Interior permanent magnet motor
- High power density
- High torque density
- Oil cooling

Dr. Andreas Andersson, Lead Engineer Electric Drive, R&D, propulsion hardware and system, Co-Authors: Dr. Håkan Sandquist, Dr. Simon Klacar, all InfiMotion Technology Europe AB, Gothenburg, Sweden

Automated design optimization of axial and radial flux motors for e-powertrains
- Multi-fidelity modeling of electric machines
- Powertrain architecture design
- System optimization methods and algorithms
- Transmission design

Dr. Ir. Theo Hofman, Associate Professor, Mechanical Engineering, Co-Author: Ir. Olaf Borsboom, both Eindhoven University of Technology, Eindhoven, The Netherlands

Inverter 2
Ebtissem Bouguila, M. Sc., Mercedes-Benz AG

Non-isolated onboard charger with three-phase and single-phase operation mode and increased power density
- OBC state of the art and standardization
- Presentation of a new OBC topology with optimal power density
- Modulation with low common mode generation
- Three- and single-phase operation

Milad Khani, M. Sc., Research Associate, Institute for power electronics and control of drives, Co-Authors: Steffen Frei, M. Sc., Prof. Dr.-Ing. Gerd Griepentrog, all Technical University of Darmstadt, Germany

Trends for ultra-compact inverters in e-drive systems
- High power and reduced weight by 800V e-drive systems
- Advantages and limitations of SiC semiconductors in inverters
- Beneficial inverter integration in electric vehicle drives
- Design example for an ultra-compact e-drive inverter

Dipl.-Ing. (FH) Gerhard Müller, Head of Advanced Development Power Electronics Co-Authors: Dr.-Ing. Thomas Lannert, Dipl.-Ing. Michael Kohr, all ZF Friedrichshafen AG, Friedrichshafen, Germany

Efficiency increase of eDrives by use of multilevel inverters and permanent magnet synchronous motors
- Interactions between inverter and motor
- Three level inverter function compared to two level
- Measurement setup and configured topologies
- Impact on efficiency and performance

Jürgen Sierts, Engineer Pre-development and Research, Robert Bosch GmbH, Schwieberdingen, Germany, Co-Authors: Jan Allgeier, Fabian Stamer, both Robert Bosch GmbH, Renningen, Germany

12:45 **Time for Business Lunch** – Meet & Greet in the exhibition area with car presentation

Program

Auditorium – Plenary
Dipl.-Ing. Thomas Pfund, Schaeffler Automotive Buehl GmbH & Co. KG

14:15 Opel's Strategy to Electromobility

- Stellantis commits to achieve Carbon Net Zero by 2038
- Main lever to carbon neutrality is electrification
- Every new Opel model purely electric as of 2025
- Affordable technology across the portfolio and meeting customers' expectations are key to meet this target

Dipl.-Ing. Georg Bednarek, Director Regulations & Certification, Opel Automobile GmbH/Stellantis, Rüsselsheim, Germany

14:45 Reaching the next level in sustainability – a circular economy approach for electric powertrains from Bosch

- Circular economy enables a company to develop its business within planetary boundaries
- Recycling has great circular economy potential for electric vehicle powertrains
- Bosch is working on business models for for several ReX-strategies, like for example recycling, and thus is developing and thus developing a more robust and sustainable business

Dipl.-Ing. Thomas Triboulet, Sustainability Director, Electrified Mobility: Sustainability, Co-Authors: Marika Schmidt, Julian Pleli, all Robert Bosch GmbH, Schwieberdingen, Germany

15:15 Innovation and development in human-machine time: A new level of innovation and development through neuroscience-based methods and targeted AI integration

- AI and humans in innovation processes: study results of an output comparison
- Relevance for "High Performing Development": Adaptation of structures, processes to create a basis for new cooperation and collaboration between humans and AI in the context of innovation, development and problem solving
- The neuroscientific perspective on humans - prerequisite for high-level human output: Under what conditions do humans develop "high-performing" impulses and solutions? What are neuro-boosters, what are neuro-brakes?

Dr. Karin Koert-Lehmann, Founder Rethink & Move, Founder, MY InnoTrinsic, Krefeld, Germany

15:45 Plenary discussion
Dipl.-Ing. Thomas Pfund, Schaeffler Automotive Buehl GmbH & Co. KG

16:00 Awarding of the Best Presentation Award for Junior Engineers

16:05 Closing remarks

16:15 End of the congress

Scientific support of the congress

The VDI Society Product and Process Design (GPP)

The VDI Society Product and Process Design (VDI-GPP) and its technical divisions provide all sectors with verified knowledge on the design of products and processes and their optimization in terms of quality and the time- and cost-benefit ratio. This verified knowledge covers the entire product lifecycle, from the product idea and product development, marketing and service to recycling using optimized methods, tools and systems, including the necessary information technology. This ensures the successful connection of market and technology for the purpose of sustainable growth and profit. The VDI-GPP – as the largest technical division in the VDI – provides a platform for specialist discussion and cooperation ranging from the technological state of the art and continuous improvement to trends in development. The task of the VDI-GPP is to concentrate the extensive range of services of the VDI in these fields, display them in summary and constantly improve them. This also includes the lively exchange of ideas with other VDI societies. The activities of the society are planned and coordinated by an advisory board staffed with decision-makers working on an honorary basis.

www.vdi.de/gpp

The VDI Society Automotive and Traffic Systems Technology (FVT)

The VDI Society Automotive and Traffic Systems Technologies (FVT) with its five Technical Divisions offers a home for engineers from a wide range of disciplines in the fields of "road", "rail", "air" and "water" transport. Through active interplay with the working groups of the VDI Regional Associations, the students and young engineers as well as the other VDI Technical Societies, the VDI FVT is networked nationally and internationally with other cooperation partners. The stated task of the VDI FVT is to strengthen the perception of the engineering profession and to establish the VDI as a technical-scientific opinion leader in professional circles, politics and society. The aim here is to promote the interaction of the various mobility areas and to provide technical impetus, as well as to develop perspectives for cross-sectional topics relating to "People and Mobility" and "Means of Transports and Infrastructure".

www.vdi.de/fvt

Dritev interactive – Adding value to your business

Poster Exhibition*

Let yourself get inspired by those presenting and feel free to enter into the discussion

Support of future-robust construction cit development for electric traction motors using model-based systems engineering
Philip Müller-Welt, M. Sc., Academic Employee, Institute of Product Engineering (IPEK), Karlsruher Institut für Technologie (KIT), Karlsruhe, Germany

Experience and procedure for measuring magnetic properties of hard magnets
Dipl.-Ing. Peter Gebauer, Materials Development E-Mobility, Schaeffler Technologies AG & Co. KG, Herzogenaurach, Germany

Innovative test bench concept as enabler for flexible and innovative production scenarios
Dipl.-Ing. Ralph Heckmann, Vice President Sales, teamtechnik Maschinen and Anlagen GmbH, Freiberg/Neckar, Germany

Optimization of acoustics and efficiency in helical gears for electromobility
Kai von Schulz, M. Sc., Academic Employee, IPSE – Institute of Product- und Service Engineering, Furtwangen University, Germany

Novel Multi-Functional Shift System for Improved EV Efficiency & Performance
John Jennings, Director of Innovation & eMobility, Amsted Automotive, Saginaw, USA

Integration of flexible cooling solutions into plastic composite battery enclosures for xEV applications
Erik Elbaek, M. Sc., Development Engineer – Thermal Systems, Kautex Textron GmbH & Co. KG, Bonn, Germany

Fast and reliable parametrization of an inverter test system with the e-motors type plate data
Dr.-Ing. Patrick Winzer, Head of Application Software Design, AVL SET GmbH, Wangen im Allgäu, Germany

Spatial Computing for development and test of software defined vehicles
Dr. Felix Pfister, Business Development Manager, IPG Automotive GmbH, Karlsruhe, Germany

Dynamic motor drive: New control software increases EV efficiency substantially
Jean Rosenzweig, Director DMD Customer Programs, Tula Technology, Inc., San Jose, USA

Tailor-made high-current contacts
Dipl.-Chem. Heiko Müller, Director Corporate Materials and Process Analysis und Dr. Benjamin Hertweck, Senior Vice President Corporate R&D, beide KERN-LIEBERS Group of Companies GmbH & Co. KG, Schramberg, Germany

*Februrary 2024

Speakers Corner

Ask the drive system experts

Do you still have questions? You are welcome to meet our speakers in the speakers corner following the sessions. Straightforward, subject-specific and instantaneously.

Dritev Summer Night

Your networking hub for the international powertrain community

Your networking spot for the international powertrain community: Meet colleagues and project partners and use the informal atmosphere to get to network anew.

Car Presentation

Powertrain systems with an emotional appeal

Whether it's a serial production vehicle, a fancy roadster or an eyecatcher – even the best drive unit needs its customised appearance. Experience the latest vehicle concepts and find out more from experts on site about the special features of the vehicles and the integration of the different drive solutions.

The following vehicles will be shown*:

- VW ID.7 Tourer
- Infimotion
- Stellantis
- Tula EESM DMD – Tesla Model 3
- Mercedes-Benz EQE
- Mercedes-Benz CLE

*February 2024

Program of the accompanying Conference

Powertrain Systems in Mobile Machines 2024

Chair: Prof. Dr. Ludger Frerichs, Director, Institute of Mobile Machines and Commercial Vehicles (IMN), Technische Universität Braunschweig, Germany

Visit for free

1st Conference day
Wednesday, June 12, 2024

09:00 Plenary speeches with CLEPA, EnBW, Schaeffler, CLAAS (Details on page 3)

11:00 Plenary discussion

11:20 Meet & Greet – Coffee break

11:55 Opening of VDI Conference Powertrain Systems in Mobile Machines 2024
Prof. Dr. Ludger Frerichs

Energy and propulsion systems

12:00 Use of renewable energies for agricultural machinery
Dipl.-Geoökol. Henning Eckel, Kuratorium für Technik and Bauwesen in der Landwirtschaft e. V. (KTBL)

12:30 Electrify Africa: A systematic approach to boost mechanization and access to electricity in emerging regions
Dipl.-Ing. Holger Lange, Volkswagen AG

13:00 Time for Business Lunch

Powertrain transformation

14:30 Infinitely variable transmission development using electric drive system
Roger Burjes, B. Sc., Deere & Company

15:00 Introduction of alternative drives in tractors of different performance classes
Dr. techn. Jürgen Karner, CNH Industrial Österreich GmbH

15:30 Construction equipment drivesystems: Focus on hydrogen
Stefan Peters, M. Sc., Liebherr-EMtec GmbH

16:00 Meet & Greet – Coffee break

Implementation of hydrogen fuel cell systems

16:45 High-power fuel cells for heavy-duty hydrogen mobility
Prof. Dr. Christian Mohrdieck, Hyzon

17:15 Excavator with fuel cell electric powertrain – challenges of the conversion
Dipl.-Ing. (FH) Dieter Farthofer, AVL List GmbH

17:45 From system model to operational environment: Testing H_2-hybrid drives for mobile machinery
Jan de Vreeden, M. Sc., MSE, RWTH Aachen University, Germany

18:15 Safety and functional safety in the conception of hydrogen tank systems
Duy Cuong Nguyen, M. Sc. Angewandte Physik, ITK Engineering GmbH

18:45 Get-together: Dritev Summer Night

2nd Conference day
Thursday, June 13, 2024

Electric drive concepts

08:30 Electrification of the drivetrain of an all-wheel-drive municipal equipment carrier
Dipl.-Ing. Malte Braunschweig, Hako GmbH

09:00 Evolution of transmission technology for electric off-highway machines
Joachim Van Dingenen, M.Sc., Dana Inc., Off-Highway Drive and Motion Systems

09:30 Local zero emission solution for mobile compact cranes
Thomas Speh, M. Eng., Liebherr-Electronics and Drives GmbH

10:00 Electrification concepts in the field of tension of the operational business: A practical example
Dr.-Ing. Michael Philipp Schmitt, DINTEC GmbH

10:30 Meet & Greet – Coffee break

Implementation of electric drivetrain systems

11:15 Electrical machines for mobile machinery – application-specific requirements, design, and layout
Dr.-Ing. Thomas Finken, Bosch Rexroth AG

11:45 Improved synergies: how to achieve the perfect match between battery, thermal management and drive train
Dipl.-Ing. (FH) Stefan Eichler, Danfoss Editron Oy, **Christian Kiemer, M. Eng.,** Webasto Thermo & Comfort SE

12:15 Immersion cooling battery technology with focus on safety and lifetime
Dipl.-Ing. (FH) Helmut Kastler, Kreisel Electric GmbH

12:45 Time for Business Lunch

Electric drives in different application

14:15 Electrified powertrain for a medium size wheel loader
Dipl.-Ing. (FH) Rico Glöckner, ZF Friedrichshafen AG

14:45 Sustainable powertrains for special foundation equipment
Dr.-Ing. Hans-Philipp Otto, BAUER Maschinen GmbH

15:15 "An electrification journey" – Developing and fine-tuning a system platform for electric off-highway machines
Dipl.-Ing. (BA) Florian Madlener, Kramer-Werke GmbH and **Luca De Pascali, Ph.D.,** Dana Inc., Off-Highway Drive and Motion Systems

15:45 Closing remarks
Prof. Dr. Ludger Frerichs, Technische Universität Braunschweig

Joint plenary session

16:00 Awarding of the best presentation for junior engineers

16:15 End of the International VDI congress

Sign up and details
www.vdiconference.com/01TA807024

Program Committee

The brains behind the Congress – The Program Committee

1st row from left to right

Dr. Norbert Alt, COO & Executive Vice President, FEV Europe GmbH, Aachen, Germany

Dipl.-Ing. Georg Bednarek, Director Regulations & Certification, Stellantis N.V., Rüsselsheim, Germany

Prof. Dr.-Ing. Yves Burkhardt, Head of the Institute for Electrical Energy Conversion – Electrical Drive Systems, Technical University of Darmstadt, Germany

Dipl.-Ing. Daniel Borowitza, Head of Advanced Development Chassis and Drive Systems, BMW AG, Munich, Germany

Dr.-Ing. Thomas Casper, Manager Combustion- & Hybrid-Drivetrain-system, Transmission and Hybridcomponents, Dr. Ing. h.c. F. Porsche AG, Weissach, Germany

Dipl.-Ing. (FH) Andreas Deimel, Head of Transmission/Powertrain Development, Audi AG, Ingolstadt, Germany

Dr. Jörg Gindele, Senior Director Advanced Engineering & E-Propulsion Systems, Magna PT International GmbH, Untergruppenbach, Germany

Dr.-Ing. Thomas Hackl, Chief Technical Officer, Hofer AG, St. Ulrich bei Steyr, Austria

Dipl.-Ing. Volker Heinz, Global Engineering Director Product Cost and Sustainability, BorgWarner Drivetrain and Battery Systems Drivetrain Engineering GmbH, Heidelberg, Germany

Dr.-Ing. Keiwan Kashi, Vice President Engineering – ePowertrain, GKN Automotive, Lohmar, Germany

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Dipl.-Ing. Alexander Krick, Head of Technical Development E-Drive, Power Electronics & Transmission, Volkswagen AG, Group Components, Kassel, Germany

Dipl.-Ing. Thomas Landsherr, Vice President, Engineering Driveline, MAN Truck & Bus SE, Munich, Germany

Dr.-Ing. Jens Lüder, Vice President Engineering, Robert Bosch GmbH, Stuttgart, Germany

Dr.-Ing. Florian Mulzer, AGCO Transmission Specialist, AGCO GmbH, Marktoberdorf, Germany

Dipl.-Ing. Konstantin Neiß, Director Electric Drive Systems & Center of Competence Electric Drive Units Mercedes-Benz AG, Stuttgart, Germany (Chair)

Dipl.-Ing. Thomas Pfund, President Business Unit E-Motors, Schaeffler Automotive Buehl GmbH & Co. KG, Bühl, Germany (Vice Chair)

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Dr.-Ing. Gerd Rösel, Head of Innovation, Electrification Solutions Division, Vitesco Technologies GmbH, Regensburg, Germany

Dr. Christoph Sasse, Vice President Electrified Powertrain Technology, ZF Friedrichshafen AG, Friedrichshafen, Germany

3rd row from left to right

Prof. Dr.-Ing. Karl Viktor Schaller, Honorary Professor, TUM School of Engineering and Design, Technical University of Munich, Garching, Germany

Dipl.-Ing. (FH) Udo Sommerhalter, MBA, Customer Chief Eng., Valeo Powertrain Systems Business Group, Bietigheim-Bissingen, Germany

Prof. Dr.-Ing. Karsten Stahl, Full Professor, Institute of Machine Elements, Director, Gear Research Center (FZG), TUM School of Engineering and Design, Technical University of Munich, Garching, Germany

Dipl.-Ing. Carsten Weber, Manager, Propulsion Systems Research & Advanced Engineering, Ford Werke GmbH, Cologne, Germany

Dr. Henning Wöhl-Bruhn, Head of Technical Development, Inverter Electric Drives, Volkswagen AG, Wolfsburg, Germany

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POWDER METALLURGY REVIEW

VDI-Workshops, Tuesday, June 11, 2024

9 a.m. - 5 p.m., Kongresshaus Baden-Baden

Workshops are only held in German!

Digital Twins zur Virtualisierung in der E-Fahrzeugentwicklung

Ihre Leitung: René Honcak, M. Sc., Head of Digital Twin | Electrified Powertrain Technology, ZF Friedrichshafen AG, München

Zielsetzung

Die Zukunft der Automobilindustrie ist digital – and die Entwicklung von Elektrofahrzeugen führt diesen Wandel an. Doch wie lässt sich sicherstellen, dass die elektrisch angetriebenen Fahrzeuge effizient, sicher and umweltfreandlich sind? Unser Spezialtag „Digital Twins zur Virtualisierung in der E-Fahrzeugentwicklung“ vermittelt Ihnen Technologien and Methoden in formpraktischen Anwendungsbeispielen, um diese Herausforderungen erfolgreich zu meistern.
Sie erfahren, wie Digital Twins den gesamten Entwicklungsprozess – von der Konzeption bis zur virtuellen Produktvalidierung – begleiten and welche Rolle in diesem Zusammenhang das Model-based Systems Engineering spielt.
Der Workshop bietet Ihnen die Chance, sich mit Gleichgesinnten auszutauschen and gemeinsam Herausforderungen and Lösungen aufzuspüren. Nach Besuch des Spezialtags verstehen Sie, wie sich mithilfe von Modellen, Simulationen and Künstlicher Intelligenz Elektrofahrzeuge schneller, kostengünstiger and umweltfreandlicher auf den Markt bringen lassen.

Inhalte des Spezialtages

- Digital Twins in der E-Fahrzeugentwicklung
- MBSE für Digital Twins
- Künstliche Intelligenz für präzise Modellentwicklung
- Herausforderungen and Lösungen
- Praxisbeispiele and Diskussionen

Mehr Details unter: www.vdi-wissensforum.de/01ST022024

Design und Entwicklung nachhaltiger technischer Systeme

Ihre Leitung: Dipl.-Ing. Sascha Ott, Direktor in der Institutsleitung des IPEK – Institut für Produktentwicklung and Geschäftsführer des Zentrums Mobilitätssysteme am Karlsruher Institut für Technologie (KIT)

Zielsetzung

Nachhaltigkeit fängt bei der Produktentwicklung an: Nachhaltigkeit wird in den letzten Jahren oft in Zusammenhang mit Generationengerechtigkeit and Bio-Ökonomie genannt. So haben die Vereinten Nationen mit den „Sustainable Development Goals“ (SDG) Ziele zur nachhaltigen Entwicklung global auf ökonomischer, sozialer sowie ökologischer Ebene definiert. Doch Nachhaltigkeit ist vor allm auch eine Chance für die Unternehmen, ihre Produkte kostengünstiger and ökologisch verträglicher herzustellen and diese erfolgreich am Markt zu positionieren.
Der VDI-Spezialtag „Design and Entwicklung nachhaltiger technischer Systeme“ vermittelt Grandlagen and Methoden zur Umsetzung von Nachhaltigkeitsanforderungen in der Produktentwicklung. Sie lernen u.a. die grandlegenden Begriffe and die rechtlichen Rahmenbedingungen (ESG-Environmental, Social and Governance Anforderungen, Lieferkettengestaltung) kennen and erfahren, wie Sie bereits beim Produktdesign die Grandlagen für eine Kreislaufwirtschaft legen. Zahlreiche Beispiele aus der Praxis and interaktive Trainingseinheiten geben Ihnen wertvolle Impulse für die Umsetzung in Ihrem Unternehmen.

Inhalte des Spezialtages

- Grandlagen der Nachhaltigkeit – Begriffe and Herangehensweisen
- Durch geschickte Planung die Rohstoff-, Energie- and Ressourceneffizienz Ihrer Produkte steigern
- Nachhaltigkeit als Basis für Rohstoffeffizienz and CO_2-Reduzierung
- Design-for-Nachhaltigkeit: Stoffkreisläufe mit entwickeln
- Kreislaufwirtschaft etablieren
- ESG-Zertifikate – mit Nachhaltigkeit punkten and wirtschaftlich erfolgreich sein

Mehr Details unter: www.vdi-wissensforum.de/01ST807024

Exhibition & Sponsoring

A highlight of Dritev in Baden-Baden is the accompanying exhibition. Representing the entire supply chain for transmissions and drivetrains - including conventional transmissions, hybrid concepts, and electrified drivetrains - in the realm of mobile applications such as passenger cars, commercial vehicles, and mobile machinery, the Dritev exhibition serves as a cross-industry information platform. Congress participants will gain a comprehensive overview of key providers in the development, simulation, and production of drives, transmissions, and components. In addition to the exhibiting companies at Dritev, the exhibition area also features products, simulations, and a parallel conference showcasing technologies and services in the field of drive technology for mobile machines.

Your benefits as exhibitor and sponsor:

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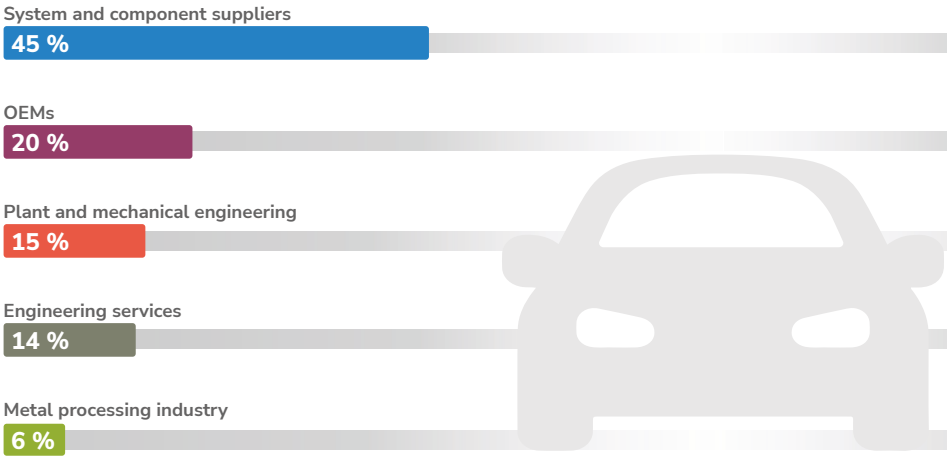
The participants – Your customers

Attendees by company type



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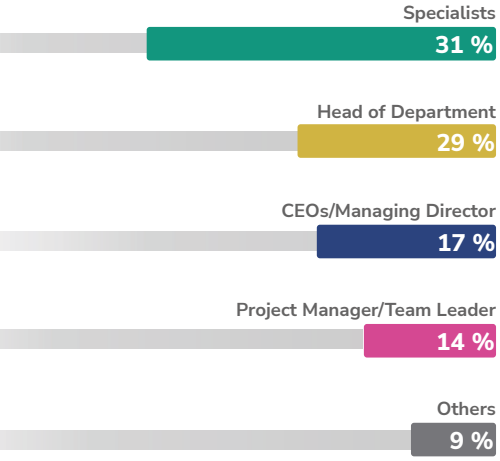

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February 2024

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☐ **Congress/conference, June 12 - 13, 2024** **Please select one event only.**

☐ **International VDI-Congress „Dritev“** (01TA805024)	☐ **International VDI Conference "Powertrain Systems in Mobile Machines"** (01TA807024)

☐ **Workshop, June 11, 2024** **Please choose one workshop only.** Workshops will only be held in German.

☐ Workshop 1 **„Digital Twins zur Virtualisierung in der Fahrzeugentwicklung“** (01ST022024)	☐ Workshop 2 **„Design und Entwicklung nachhaltiger technischer Systeme“** (01ST807024)

Please select price category (price p. p. plus VAT):	Congress/Conference	Workshop	Combi price Congress/Conference + one Workshop
Participation fee	**EUR 1,990.-**	**EUR 1,290.-**	**EUR 3,130.-**

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www.vdiconference.com/terms-and-conditions/

Venue:
Kongresshaus Baden-Baden, Augustaplatz 10, 76530 Baden-Baden, Germany, www.kongresshaus.de/en
Accommodation: A limited number of rooms have been reserved for congress participants.
A reservation form can be found at www.dritev.com

Information: The price includes congress documents (e-book), coffee breaks, beverages during breaks, lunches and the evening reception (congress).

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