Electrified powertrains, electric drivetrains: find the sweet spot between diversity and complexity
The race is on and there are no silver bullets for electrification of drivetrains. All options are on the table. OEMs and suppliers are developing new intelligent electrification concepts and technologies aiming at meeting their customer demands with minimum risk and cost. For this race, the price of entry is very high, but the cost of sitting on the sideline is even higher.

At the 14th annual CTI SYMPOSIUM USA, the latest technology options for intelligent electrified drive solutions will be discussed.

Dr Hamid Vahabzadeh, Advisor, AVL List GmbH, Austria
DAY 1

KEYNOTE SPEAKER

The EV challenge: delivering on expectations

Michael Bly,
Vice President – Head of Global Propulsion Systems Engineering,
FCA FIAT Chrysler Automobiles LLC, USA

PLENARY SPEAKER

The next generation of electric vehicle buyers

Mike Dvorany,
Vice President - Automotive & Mobility,
Escalent, USA

The automatic and electrified transmission portfolio for passenger vehicles

Ramasunder Krishnaswami,
Director, Transmission and Driveline Engineering,
Ford Motor Company, USA

Presentation topic tbd

Adam Kwiatkowski,
Director, Advanced Vehicle Design,
General Motors LLC, USA

Bringing the sports car of the future to the road today

Klaus Zellmer,
President & CEO,
Porsche Cars North America, Inc., USA

PANEL DISCUSSION

Combustion vs. electrification in view of legislation and consumer demand

MODERATOR

Tom Rucker,
President,
Magna International, USA

PANELISTS

Paul Eichenberg,
Managing Director,
Paul Eichenberg Strategic Consulting, USA

Greg Gardner,
TDE Chief Engineer,
Ford Motor Company, USA

Further panelists tbd
PLENARY SPEAKER

Impact on electrification on international lessons learned

Don Hillebrand,
Director, Energy System Division,
Argonne National Laboratory (ANL), USA

Innovative electrified transmissions for next generation mobility

Dr Jörg Trampler,
Director, Engineering Center,
ZF Group North America, USA

Electric drive unit transmissions for passenger cars and light commercial vehicles

Dr Ingo Steinberg,
Group Vice President,
FEV Europe GmbH, Germany

A market segment approach for optimizing hybrid propulsion systems

Paul Diemer,
Director, Electrified Vehicle Architectures,
BorgWarner, USA

Mobility for tomorrow – Change within the automotive industry is inevitable

Patrick Lindemann,
President Transmission Systems & E-Mobility,
Schaeffler Group, USA

TRENDVIEW

BP energy outlook 2020 and solutions for advanced mobility

Dr David Hall,
Distinguished Advisory,
BP International Ltd, UK

PANEL DISCUSSION

System engineering in the age of no compromises

MODERATOR

Jeffrey Lux,
Vice President Transmission Engineering,
FCA FIAT Chrysler Automobiles LLC, USA

PANELISTS

Jamie Arnold,
Director of Engineering
AVL Powertrain Engineering Inc.

Marques McCammon,
President,
Ricardo Inc., USA

Craig Renneker,
Vice President - Driveline Product Engineering,
American Axle Manufacturing (AAM), USA

Christophe Dominiak,
Senior Vice President and CTO,
Dana Inc., USA
# E-DRIVE UNIT I

**Propulsion systems weight outlook**  
Edwin Pope, Principal Analyst, IHS Markit, USA

**What’s the role of the electrification going forward?**  
Greg Pannone, Executive Director, Powertrain Analysis, IHS Markit, USA

**E-drive with 2 e-motors and 2-speed-gearbox with dog clutches**  
Prof. Dr Peter Johannes Tenberge, Director, Institute for Industrial and Automotive Drivetrains, Ruhr-University Bochum, Germany

**Test result high-speed electric drive unit for the next generation**  
Mathias Deiml, Department Manager, AVL Software and Functions, Germany

**Electric drives of tomorrow – innovative 2-speed concepts**  
Dr Stephan Demmerer, Head of Advanced Engineering E-Mobility, ZF Friedrichshafen AG, Germany

**Optimized for the fleet, customizable for every model – an innovative e-axle modular system**  
René Kockisch, Team Manager, IAV GmbH, Germany

**An innovative approach to a coaxial planetary P4 e-axle**  
Joe Palazzolo, eDrive Director, GKN Automotive, USA

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# POWERTRAIN CONTROLS, MODELING & ANALYSIS

**Clutch thermal and sensor modelling by using machine-learning algorithms**  
tbd, Department Manager, FEV Europe GmbH, Germany

**Functional safety emphasis in qualifying AUTOSAR based software components**  
Dhanabal Arunachalam, Functional Safety Architect, Robert Bosch Engineering and Business Solutions Private Limited (RBEI), India

**Simulation of transmission lubrication flows with smoothed particle hydrodynamics (SPH)**  
Jennifer Weiche, Support and Sales Engineer, AVL Powertrain Engineering, Inc., USA

**Fast and accurate modeling of hydraulic control systems using machine learning**  
Yash Bagla, Controls Engineer, Drive System Design, USA

**Model-based angular position sensorless drives of main electric oil pump for transmission**  
Dr Chinchul Choi, Team Lead, Myunghwa Ind. Co., Ltd, South Korea

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# CALIBRATION, TEST AND DEVELOPMENT METHODS

**A virtual calibration toolchain with objective assessment**  
Christopher Burbidge, Global Technical Expert – Transmission Control Software, Ricardo UK Ltd, UK

**Automated calibration and online adaptation of powertrain controllers**  
Kirti Mishra, Graduate Research Assistant, The Ohio State University, USA

**Advanced validation strategy for electrified drivelines**  
Wilhelm Vallant, Product Manager Passenger Car Transmission, AVL List GmbH, Austria

**Test catalog for validation of electric drive unit (EDU) transmissions**  
Thomas Wellmann, Department Manager, FEV North America, Inc., USA

**Simulation of skidding behaviour in electric-vehicle bearings**  
Sanket Joshi, Application Engineer, Romax Technology, USA

**Testing wet plate clutch systems for anti-shudder performance**  
Larry Diemer, Senior Technical Fellow, FCA FIAT Chrysler Automobiles LLC, USA

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# TRANSMISSIONS, AWD

**TR-9070 DCT and TR-9080 DCT dual-clutch transmissions**  
Mathew Memmer, Program Director, TREMEC Corporation, USA

**Development of GM Allison 10-speed heavy duty transmission**  
Chi Teck Lee, Transmission and Drive Unit Technical Specialist, General Motors LLC, USA

**Pushbelt variator module to improve performance of electrified powertrains**  
Gert-Jan Van Spijk, Director Engineering Transmissions, Bosch Transmission Technology, The Netherlands

**Vehicle performance improvement with eLSD System for EV AWD platform**  
Heon Kang, Senior Research Engineer, Hyundai WIA, Republic of Korea

**Power to the wheels – hybrid AWD challenges and benefits**  
Simon Kaimer, Global Product Manager AWD 4WD Attributes and Function, Magna Powertrain, Austria

**Disconnecting AWD single clutch system with eLSD or torque vectoring functionality**  
Craig Renneker, Vice President – Product Engineering
TRANSMISSION COMPONENTS I

Replacing hydraulic actuation in electrified drivelines
Alex Haldane, Senior Engineer, Vocis Ltd, UK

Customized powertrain actuation systems for passenger cars and commercial vehicles
Erik Schreiterer, Team Manager Advanced System Development, IAV GmbH, Germany

Park by wire system for current electric drive units
Brian Campbell, Chief Engineer, FEV North America Inc., USA

High performance polymer gears – a viable solution for future drives?
Ralf Weidig, Global Program Manager Gears, Victrex Europa GmbH, Germany

A technique to maintain compliance of the floating member of a high-speed complex planetary gear train
Scott Sweet, Technical Leader, Ricardo Inc., USA

Full range isolation devices for future HEV
Yusuke Tomita, Manager, EXEDY Corporation, Japan

LUBRICATION

Innovative foil-sensor revolutionizes fluid monitoring in electrified drivetrains
Mario Theissl, University Assistant, Institute of Machine Components and Methods of Development, Graz University of Technology, Austria

Mobil EV hydrocarbon based thermal management fluids for battery electric vehicles
Michael Toohey, Market Development Lead, ExxonMobil Chemical Company, USA

NextGen extended range fluids for multi-speed e-drives
Armin Schenk, Global OEM Manager Driveline, Castrol Driveline Technology Centre, Germany

Assessing proper lubricant corrosion protection for next generation electrified powertrains
Christopher Prengaman, Research Engineer, The Lubrizol Corporation, USA

E-Mobility: How new thermal fluids can enhance battery performance
Dr Volker Null, Technology Manager Thermal Fluids, Shell Global Solutions GmbH, Germany

Get prepared for the main days

INTRODUCTORY SEMINAR
12 OCTOBER 2020

BASICS AND PRACTICE OF HYBRID AND ELECTRIC DRIVES, AUTOMOTIVE TRANSMISSIONS

OBJECTIVE

Newcomers and career changers will get an overview of the basics of conventional, hybrid and electric drives. Different transmission concepts and AWD systems will be illustrated. The concepts will be compared and their benefits for the various vehicle classes and types discussed.

The content of the introductory seminar is presented by highly experienced experts, the schedule allows time for your personal questions and an interactive exchange.

AUTOMOTIVE POWERTRAIN AND DRIVE-TRAIN CONCEPTS

Tasks and characteristics of powertrain, drivetrain and transmissions
Prof. Dr Ferit Küçükyay, Director of the Institute for Automotive Engineering, Technische Universität Braunschweig, Germany

Hybrid drivetrain concepts in comparison
Axel Sturm, Research Associate, Institute for Automotive Engineering, Technische Universität Braunschweig, Germany

Electric drivetrain concepts in comparison
Axel Sturm

TRANSMISSIONS AND ALL-WHEEL-DRIVES

Transmission concepts and components
Gerrit Brandes, Research Associate, Institute for Automotive Engineering, Technische Universität Braunschweig, Germany

All-wheel-drive and differential systems
Marcel Sander, Research Associate, Institute for Automotive Engineering, Technische Universität Braunschweig, Germany

Drivetrain management
Marcel Sander

For details about the timetable and speakers please visit www.drivetrain-symposium.world/us/program
E-DRIVE UNIT II

**Formula E-race transmission 2.0**
Steve Blevins, Project Manager, Ricardo UK Ltd, UK

**A next generation tightly integrated electric axle**
Dr Karel Vergote, Manager Advanced Development, Punch Powertrain N.V., Belgium

**What is next for electric axles**
Markus Steinberger, Director R&D E-Mobility, Schaeffler Group, USA

**Multi-speed electric drive unit for commercial vehicle applications**
Geng Jiantao, Senior Director of Transmission, eKontrol GmbH, Austria
Ralph Fleuren, Product Manager Transmission Systems, FEV Europe GmbH, Germany

**New integrated electric axle for heavy duty trucks**
Jürgen Tochttermann, Lead Engineer, AVL Commercial Driveline & Tractor Engineering, Austria

E-DRIVE DESIGN AND OPTIMIZATION

**Electric vehicle powertrain optimizer**
Muammer Yolga, Department Manager, AVL List GmbH, Austria

**Optimising BEV powertrain components and architecture for maximum efficiency and least cost**
Ajay Lukha, Chief Commercial Officer, YASA Ltd, UK

**Balancing of fatigue, efficiency, and NVH in an electric drive transmission system**
Molly Kampschroeder, Engineer, GKN Automotive, USA

**Noise share characterization of electric drive units**
Jeffrey Pruetz, Manager of NVH and Vehicle Integration, FEV North America Inc., USA

**Highspeed rotor bearing dynamics and validation for 35000 rpm**
Andreas Puntigam, Technical Supervisor Transmission Simulation/Testing, AVL List GmbH, Austria

**Investigation into effects of transmission errors on the dynamic response of a high-speed epicyclic**
Calum Brown, Chief Engineer, Ricardo Inc., USA

HYBRID POWERTRAIN

**Benchmarking of hybrid powertrains**
Christian Sieg, Research Associate, Electric and Hybrid Drives, Institute of Automotive Engineering, Technische Universität Braunschweig, Germany

**A systematic approach to find the ultimate hybridized powertrain**
Dr Stephen Jones, Principal Product Manager Systems, AVL List GmbH, Austria

**Modular and scalable 48 V platform e-drive solutions for CO2 reduction and traction assist**
Dr Thomas Hackl, Director Engineering Building Blocks Electrification, Magna Powertrain, Austria

**Modular and highly functional hybrid platform for subcompact cars up to full-size SUV**
Erik Schneider, Senior Vice President Transmission & Hybrid Driveline & Electrification, IAV GmbH, Germany

**Scalability goes live – Modular hybrid transmission family for high-volume applications**
Dr Carsten Buender, Director Global Product Management, Transmission Systems, Magna Powertrain, Germany

**Future sustainable powertrain platforms**
Dr Christoph Danzer, Manager Powertrain Concepts and Sustainability, IAV GmbH, Germany

E-DRIVES, COMPONENTS

**Light-weighted Orbis Wheels present multiple novel opportunities for OEM**
Marcus Hays, CEO, Orbis, USA

**Powertrain, steering and suspension in a compact corner module for future urban mobility vehicles**
Robert Lewin, Senior Systems Engineer, Protean Electric, UK

**Evolution of 3:1 BEV drivetrains from single-speed to two-speed**
Mike Duhaime, Vice President JJE & President of JJE North America, Jing-Jin Electric North America LLC, USA

**Advancements in electric drive and inverter technology for high performance long range BEV’s**
Harsha Nanjundaswamy, Director, FEV North America Inc., USA

**The coil switching inverter – A step change in powertrain design**
Ari Berger, Chief Technology Officer, Exro Technologies Inc., Canada

**Designing an electrical machine: Just an electromagnetic problem?**
Michael Rubbo, Lead Application Engineer, Motor Design Ltd, UK

**The right e-motor for the job**
Daniel Sayre, Manager eMotor Development, Schaeffler Group, USA
TRANSMISSION COMPONENTS II

Gear baffle optimization – A novel experimental study
Mohammad Hotait, Senior Project Engineer, General Motors LLC, USA

High efficiency oil-pump – Transmission hydraulic efficiency increase through hybridization
Oscar Sarmiento, Head of Advanced Development & Innovation Management, Vitesco Technologies Germany GmbH, Germany

Second generation linear activation system for mechanical clutches
John Kimes, President, Sigma Powertrain Inc., USA

Dry multi-plate clutch – Efficient active torque control in electrified and conventional drivetrains
Falk Nickel, Head R&D, Miba Friction GmbH, Austria

New semi-dry friction solution for highly integrated active torque controlled drives
Volker Föge, Manager – R&D Wet Friction Division, Miba Frictec GmbH, Austria

Low friction bearings for e-drives
Mike Johns, Advanced Engineering Consultant, JTEKT NA, USA

CTI NETWORKING NIGHT
13 OCTOBER 2020

DO NOT MISS THIS OUTSTANDING OPPORTUNITY TO MINGLE WITH ALL PARTICIPANTS, SPEAKERS, EXHIBITORS AND SPONSORS

Make new business contacts in a relaxed atmosphere, discuss the topics of the day with your colleagues and peers while enjoying delicious food and drinks at the CTI NETWORKING NIGHT.

CTI TEST DRIVE

EXPERIENCE TECHNOLOGY IN REAL LIFE

During 13 and 14 October 2020 you have the opportunity to experience the latest transmission and drive technology in series and demonstrator cars. Project engineers will be introducing the special characteristics and advantages of the technologies shown and answer your personal questions.

SHOWCASE YOUR LATEST TECHNOLOGY

Do you have a demonstrator car to show your work in practice? We strongly encourage you, your colleagues, managers, marketing to participate in the CTI TEST DRIVE.

GET IN TOUCH

Sophia Tente
Project Assistant CTI SYMPOSIA
+49 211 88743-3659
sophia.tente@car-training-institute.com
CTI SYMPOSIUM EXPO – MEET YOUR FUTURE CUSTOMERS

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APPLY NOW – DON’T MISS ONE OF THE LAST FEW SPACES.

WHY BECOME A PARTNER?

We will bring you together with authoritative industry experts who come to the show not only for business reasons but who also want to source inspiration, discover new products and benefit from the networking opportunities.

Michael Follmann, Sales Director
+49 211 88743-3729
michael.follmann@car-training-institute.com

Jörg Wiedenhöft, Sales Manager
+49 211 88743-3215
joerg.wiedenhoeft@car-training-institute.com
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**Castrol** provides the oils, fluids and lubricants the world needs, for every driver, every rider and every industry. It’s more than just oil. It’s liquid engineering. The world of transport is going electric and e-fluids have a vital role to play. EV’s play a key part in the mobility revolution and the pathway to decarbonizing transport. Castrol’s e-Fluid expertise extends across land, sea and even space. Castrol has developed a range of e-fluids to meet the needs of vehicle manufacturers. From transmission fluids, to greases and coolants, these fluids enable electric vehicles to run smoothly, efficiently and stay cool.

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High-precision products from Schaeffler help lower fuel consumption and emissions without sacrificing safety, performance or driving comfort. The company’s product portfolio encompasses energy-efficient solutions for conventional ICE drivetrains, innovative products for hybrids and cutting-edge components for electric vehicles. Together with our customers, Schaeffler is shaping the mobility for tomorrow – today.

Schaeffler | [www.schaeffler.com](http://www.schaeffler.com)

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AAM (NYSE: AXL) delivers POWER that moves the world. As a leading global tier 1 automotive supplier, AAM designs, engineers and manufactures driveline, metal forming and casting technologies that are making the next generation of vehicles smarter, lighter, safer and more efficient. Headquartered in Detroit, AAM has over 25,000 associates operating at nearly 90 facilities in 17 countries to support our customers on global and regional platforms with a focus on quality, operational excellence and technology leadership. To learn more, visit aam.com.

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A. J Rose is a precision metal-forming operation that has built a reputation for ingenuity and consistent quality for over 98 years. We collaborate with our customers every step of the way. This includes engineering, in-house tool design and tool build, product testing and analysis, and mass production.


AVL is the world's largest independent company for development, simulation and testing of powertrains (hybrid, combustion engines, transmission, electric drive, batteries and software) for passenger cars, trucks and large engines. The company offers combined solutions of propulsion engineering, simulation software, and testing and instrumentation systems.

AVL | www.avl.com

The brandgroup is specialized in development and manufacturing of cold formed technical springs as well as wire formed parts. We are the leading producer of damping springs for powertrains in Europe. We offer innovative technology and efficient solutions for constantly increasing requirements. For decades our customers appreciates our reliability and knowhow regarding material, development and prototypes. Moreover also our sophisticated manufacturing technologies and analytical capabilities. The brandgroup has several manufacturing sites in Europe and beyond so that we are able to offer products, services and solutions in various imaginable ways.

brandgroup | www.brand-group.com

Buehler Motor is an independent, globally-active company focused on the development and production of mechatronic drive solutions and electric pumps. A leading supplier in the Automotive industry, with more than 1,750 employees at eleven locations worldwide, we are committed to offering world-class products to help to improve the drivetrain efficiency and performance.

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Castrol® provides the oils, fluids and lubricants the world needs, for every driver, every rider and every industry. It’s more than just oil. It’s liquid engineering. The world of transport is going electric and e-fluids have a vital role to play. EV’s play a key part in the mobility revolution and the pathway to decarbonizing transport. Castrol’s e-Fluid expertise extends across land, sea and even space. Castrol has developed a range of e-fluids to meet the needs of vehicle manufacturers. From transmission fluids, to greases and coolants, these fluids enable electric vehicles to run smoothly, efficiently and stay cool.

Castrol | www.castrol.com

Bold engineering produces bold design. Our engineers re-imagine what is possible in motion control. Their innovative ideas lead to patented products such as the Square Ball Universal Joint TM, self-lubricating ball joints and entire bearing assemblies. As a full-service manufacturing partner, we lend our engineering support to automotive and off-road OEMs to quickly turn new product ideas into reality.

CCTY USA BEARING COMPANY | www.cctybearing.com

With decades of familiarity with the market and solid know-how, cb successfully designs flexibility creatively. Wherever disc springs, diaphragm springs and complete subassemblies for vane pumps are involved, we stand for the tightest of production tolerances while being consistently solution-driven. In addition to the DIN disc springs Bauer Springs, Inc. (our subsidiary in the USA) and cb also support you with tailored and customized developments.

Christian Bauer GmbH + Co. KG | www.Christianbauer.com
Dana is a global leader in the supply of highly engineered driveline, sealing, and thermal-management technologies that improve the efficiency and performance of vehicles with both conventional and alternative-energy powertrains. Serving three primary markets – passenger vehicle, commercial truck, and off-highway equipment – Dana provides the world’s original-equipment manufacturers and the aftermarket with local product and service support through a network of nearly 100 engineering, manufacturing, and distribution facilities.

Dana Incorporated | www.dana.com

Delta Research is a world leader in prototype and production transmission components and assemblies. Throughout our 68 year history, our passion has grown for high-precision gears, shafts, carriers, machined housings and inspection services. Come see us for your next EV Transmission Build as our quality and quick delivery is unparalleled.

Delta Research | www.deltaresearch.com

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CORE COMPETITIONS:
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– Experience in changing manufacturing processes.
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TECHNOLOGIES:
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– Stampings
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PLANTS: Germany, Czech Republic, USA, China

Erdrich Umformtechnik GmbH | www.erdrich.de

ERNST GROB AG develops, designs and builds precision machines dedicated to the cold forming of splined and nonsplined workpieces. The manufacture of slotting machines for secondary and finishing operations on cold formed workpieces is yet another core competence of the company.

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Feintool is the technology and market leader in fineblanking and a provider of high-quality and cost-effective fine-blanked and formed steel components and stamped electro sheet metal products. Feintool is globally active at its facilities in Europe, Asia, and North America, producing e-motor laminations and various driveline and drivetrain components.

Feintool U.S. Operations, Inc | www.feintool.com
The FEV Group is an internationally renowned service provider with expertise in consulting and the development and testing of innovative vehicle concepts, all the way up to serial production. In addition to engine and transmission development, vehicle integration, the development of hybrid and electric drive systems, as well as alternative fuels is constantly increasing in importance. Another area of activity includes optimizing electronic control systems and a particular focus is the continued development of autonomous vehicles.

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HORIBA Automotive Test Systems has global leadership in emissions test systems and provides the industry with battery, fuel cell, driveline, engine and brake test systems, wind tunnel balances, data management solutions, test facility automation and turnkey test facilities. Serving the automotive, heavy-duty, off-road, consumer goods, marine, aerospace and locomotive industries.

HORIBA Automotive Test Systems | www.horiba.com

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Hyundai Transys Inc. | www.hyundai-transys.com

Hyundai Wia, Korea's leading auto-part maker affiliated with Hyundai & Kia Motors, provides cutting-edge technologies and products in Powertrain (Engine, Turbo Charger), Driveline (Driveshaft, 4WD/AWD, Axle, e-LSD), Chassis Modules, Forging & Casting Materials and Electrification Systems. Hyundai Wia operates 19 locations worldwide including 5 R&D centers in Korea, U.S. and Germany.

Hyundai Wia Corp. | www.hyundai-wia.com

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IAV Automotive Engineering Inc. | www.iav.com

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IMA Automation North America | www.automation.ima.it
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Konzelmann GmbH | www.konzelmann.com

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Means Industries develops award-winning, transformational propulsion-system technologies like our Selectable One-Way Clutch through rigorous, innovative design and collaboration with global OEMs. Our manufacturing capabilities include complex propulsion systems and advanced Metal-Forming and Joining, while our emerging Dynamic Clutch technologies will serve as the new building blocks for efficient Propulsion Electrification.

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We offer the ideal solution for all applications in passenger and commercial vehicle transmissions with manual and dual-clutch gearboxes as well as for pioneering hybrid applications. Modern transmission synchronizers consist of precision-formed steel synchronizer rings with Carbon friction linings which meet the highest requirements for quick and smooth gear changes. In particular, the 2-layer EF 8000 and EF 5010 Carbon friction linings are market leaders in this industry.

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Reich LLC | www.reich-llc.com

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Schaeffler | www.schaeffler.com

Scherdel offers a full product range in the area of technical springs and metal forming with extensive knowledge in primary materials, spring calculation, production processes and testing methods. Our product portfolio comprises technical springs, stamping and bending parts, welded and assembled parts as well as in-house tool and machine construction.

Sigma Powertrain Inc is a tech company that designs and manufactures high tech all electric powertrains for the commercial duty truck market using proprietary technology authored and developed by Sigma Powertrain. Sigma emphasizes efficiency, power density, and robustness in designing and building modular mult-mode powertrains for class 1 to class 8 commercial duty trucks.

Scherdel | www.scherdel.com
SMT is an internationally trusted provider of cutting-edge drivetrain design, analysis and simulation software as well as technical consultancy services. SMT has in-depth experience in all industries that involve gear-shaft-bearing systems. Increasing development efficiency, reducing costs and driving innovation has been the core outcome from all of its global projects.

SMT | www.smartmt.com

Solvay manufactures semi-aromatic polyamides for solenoids, shift levers, clutch cylinders, housings, and shift forks; aromatic ultra polymers for seal rings, bearings, cages, bushings, and balls; fluoroelastomers for O-rings, bonded pistons, and oil seals; fluorinated fluids for lubrication, bearing grease, and additives; sulfone polymers for pump pistons; and customized films for bushings and bearings.

Solvay | www.solvay.com


teamtechnik Maschinen und Anlagen GmbH | www.teamtechnik.com

THORS eLearning Solutions headquartered in Ohio, USA, is a world leader in Digital Learning Solutions offering technical online courses to manufacturing companies; the course offerings include specializations in Materials, Manufacturing Processes, and Manufactured Products. The courses capture the ‘Experiential Knowledge’ from global experts and leading organizations and are presented in a well-structured, graphical, and interactive format. The knowledge gain after taking the course is completely measurable. THORS also offers an Objective Technical Knowledge Assessment Tool.

THORS has a full array of online courses that cater to the Gear and Transmission Industry. These courses cover the fundamental concepts of gearing, gear terminology, gear chart interpretation, gear manufacturing, and troubleshooting. Additional courses dedicated to upstream and downstream processes for manufacturing quality gears – Raw Materials

THORS eLearning Solutions | www.thors.com

Torque transfer solutions from TREMEC are found in products ranging from supercars and high-performance sports cars to severe duty, vocational and commercial vehicles worldwide. The portfolio of products includes manual transmissions, dual clutch transmissions, EV & HEV drivetrain solutions, gears, shafts, clutches, friction materials, synchronizers, mechatronic systems, transmission control units, and control software.

TREMEC | www.tremec.com

As a world leader in high-performance PAEK polymer solutions with 40+ years of experience, we partner with OEMs and Tiers to develop cost-effective, durable powertrain solutions that enhance efficiency, safety and driving comfort. With VICTREX™ PEEK polymer, APTIV™ film and VICTREX™ Gear Technologies, we provide innovative and cost-effective solutions for your future mobility needs.

VICTREX | www.victrex.com

The middle-class family business Walter Henrich GmbH has specialized in the development and production of precisely cold-formed tubular shafts. The Walter Henrich GmbH offers you the following advantages:
- support in the development of new products
- optimization regarding development time and costs through the own manufacturing of samples and prototypes
- use of efficient production technologies for chipless and chipping processing

Walter Henrich GmbH | www.walter-henrich-gmbh.de

WEBO is an innovative tooling company and technology leader in the tool and process technology for the forming production of components used in the automatic and hybrid transmission as well as in the powertrain. In addition to component and tool design services, mechanical part testing units and simulation WEBO offers their customers complete tool and process solutions for competitive production.

WEBO GmbH | www.webo.de.com
Established in 2010, **WUXI SHINDEN** aims to become a leader in the world’s rapid manufacturing industry. Focusing on 3D CNC Milling Prototype, 3D Transparent Parts, 3D Print Sand Casting Parts manufacturing for more than 10 years our customer groups are becoming more and more abundant. Nearly 100 top 500 enterprises in the world and top domestic enterprises choose us to promote SHINDEN more intelligent and international.

**WUXI SHINDEN INTELLIGENT TECHNOLOGY CO., LTD | www.shinden-model.com**

**ZF** is a global technology company and supplies systems for passenger cars, commercial vehicles and industrial technology, enabling the next generation of mobility. 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 | www.zf.com**

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Arjun Ramesh, Saint Gobain Performance Plastics

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