



CTI Symposium

Automotive Transmissions, HEV and EV Drives

5 – 8 December 2016, Berlin, Germany

Keynote Speakers



Dr Ulrich Eichhorn



Larry Nitz



Jake Hirsch



Prof. Dr Dr h.c.
Harald Ludanek



Dr Renate Vachenauer



Jörg Grotendorst



Toshihiro Hirai



Dr Peter Mertens



Dr Enrico Pisino



Gerd Bofinger



Prof. Dr Fritz Indra



Prof. Dr Ferit Küçükay

Dr Ulrich Eichhorn

Chief Technology Officer, Volkswagen Group

Larry Nitz

Executive Director Global Transmissions and Electrification,
General Motors

Jake Hirsch

President, Magna Powertrain

Prof. Dr Dr h.c. Harald Ludanek

Member of the Board of Volkswagen Commercial Vehicle,
Volkswagen Nutzfahrzeuge

Dr Renate Vachenauer

Vice President Transmissions, Drive Train, BMW Group

Jörg Grotendorst

Head of E-Mobility, ZF Friedrichshafen AG

Toshihiro Hirai

Alliance Global Director, Corporate Vice President,
Powertrain Engineering Division, Nissan Motor Co., Ltd.

Dr Peter Mertens

Senior Vice President, Research & Development, Volvo Cars

Dr Enrico Pisino

Head of Research and Innovation, Fiat Chrysler Automobiles;
EUCAR Council Member

Gerd Bofinger

Director Transmission Development, Dr. Ing. h.c. F. Porsche AG

Prof. Dr Fritz Indra

Honorary Professor and Advisor

Chairman of the CTI Symposium

Prof. Dr Ferit Küçükay

Director of the Institute of Automotive Engineering,
Technische Universität Braunschweig

What to expect:

1,300 Delegates

135 Exhibitors @ the Transmission Expo

40 % International Participants

Panel discussion

Newcomers and experts will discuss about
“**Mobility and drive train of the future**”



Simultaneous Translation German ↔ English
English Conference Documentation!

#cti_sym

www.transmission-symposium.com/en

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Director of the Institute of Automotive Engineering, Technische Universität Braunschweig

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Vice President Fundamentals and Technologies, ZF Friedrichshafen AG

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**Gerd Bofinger**

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Technical Director Transmission, Fiat Chrysler Automobiles - FCA Italy S.p.A.

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Head of Transmission Development, Volkswagen AG

**Michael Schöffmann**

Head of Transmission Development, Audi AG

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Vice President Transmission, Drive Train, BMW Group

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Senior Vice President Transmission and Hybrid Systems, IAV GmbH

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Manager Engine & Powertrain Systems, Research & Advanced Engineering, Ford Motor Company

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General Manager, Head of Powertrain, Hyundai Motor Europe Technical Center GmbH

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Executive Deputy Director of National Engineering Research Center for Passenger Car Automatic Transmissions, School of Transportation Science & Engineering, Beihang University

**Prof. Dr Tong Zhang**

Director National Fuel Cell Vehicle and Powertrain System Engineering Center, Clean Energy Automotive Engineering Center, Tongji University

HONORARY MEMBERS:

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Automotive Consulting

**Dr Wolfgang Reik**

Automotive Consulting

**Georg Weiberg**

Automotive Consulting

15th CTI Symposium focusing on efficiency, diversity and complexity

The **multi-technology solutions** in drive train and transmission development are **more varied and more complex** than ever. It is clear now that **hybrid drives** – once considered a bridging technology – will remain a part of the technology mix for the **foreseeable future**. Thus, most of the automotive manufacturers are quickly developing hybrid variants in addition to electric vehicles, from 48V mild hybrid to full and plug-in hybrid, in order to meet the particularly demanding CO₂ and emissions requirements of the cycle and RDE test. Therefore, Toyota's announcement is only a logical consequence: in the 2020s, a hybrid variant of all Toyota and Lexus models will be offered.

Current discussions, e.g. in Norway, on banning diesel cars from city centres and stopping sale of new conventional vehicles once again puts the focus of automotive development on electrified drive trains. That is because **BEVs, FCEVs and PHEVs are the only alternatives guaranteeing zero emissions** in urban centres.

By 2020, the **range of electric vehicles** will be doubled due to increased energy density of batteries and, at the same time, the prices for batteries will be halved. Further significant improvements in the range, e.g. by using ASS (All Solid State) batteries, **will make electric vehicles the first choice for many customers** from 2030 onwards. This in turn puts – again – **more pressure on** the comparatively expensive **hydrogen drive trains**.

Conventional drive trains, however, will remain in the focus of drive train and transmission development. In most cases, not only for heavy trucks, they are virtually the only alternative in terms of range, fuel infrastructure and costs. Furthermore, they usually have a **better global CO₂ balance with regard to the life cycle analysis**. They therefore have to be made more efficient and the emissions have to be reduced.

What is undisputed, however, **is the advantage in comfort and safety due to connectivity and automated driving**. The transition from nowadays assisted to semi and fully automated driving in the future is expedited despite the recent accidents. In terms of drive train and transmission, this means that the traction has to be available throughout the speed range in a continuous, comfortable, acoustically unobtrusive and, if required, spontaneous way.

At last year's Symposium in Berlin, the term **"Dedicated Hybrid Transmission (DHT)"** was introduced for a new category of hybrid transmissions: their function requires the integration of one or more electric motors into the transmission. DHTs were discussed in the panel and were well accepted.

This year, new DHTs are also introduced as "purebred" hybrid drives. Furthermore, we will discuss new **transmission, hybrid and electric drive concepts**, but also many **component-related topics and problems**, which help to optimise the complete drive system:

- Trends in the development of **electrified drive trains**: high-speed EM for EV, modular concepts for compact as well as heavy-duty (P)HEV
- **MT, AMT, DCT, AT, CVT**: new concepts and improved components; what do future MTs need in order to persist?
- What are the drive topologies **48V systems** will conquer the (mass) market with?

- Will **e-axes** replace mechanical all-wheel drive systems?
- What is the impact of **automated driving** on the development of future transmissions and how do **functional safety and cyber security** affect the drive train?
- What challenges arise when transmissions are introduced to the market in **China**?
- **Starting devices, vibration damping, NVH**: potentials and limits
- **Components**: what is new in terms of efficiency and electrification? How can friction be reduced further?
- How do **lubrication and greasing** affect the **drive efficiency**?
- What is new with **battery development** in terms of costs and energy density?
- **Tools, simulation**: from synthesis of future drives to virtual calibration
- Can **drive train integration** help to control the increasing complexity of transmission development?
- **Commercial vehicle drives and transmissions**: AT or AMT?
- **Production**: lightweight design, manufacturing technologies and the influence of electrification
- How do **legislation and RDE tests** affect the development of drive systems?

The **8th CTI Young Drive Experts Award** for outstanding theses in the field of transmission and drive train development is again of special importance this year to emphasise how important the young engineers are.

The extensive conference programme takes account of the above-mentioned variety of topics: **over 100 presentations** in the plenary and **16 parallel sessions**. Drive train and transmission specialists and newcomers will discuss about **"Mobility and drive trains of the future"** in the **revised panel discussion**. In addition, the **Transmission Expo** will take place again, our "technology market for innovations at your fingertips" with **135 exhibitors** this year.

Together with the **Introductory Day for Newcomers**, the main programme and the annual **CTI Test Drive** to experience new developments and advancements after the main conference days, the 15th CTI Symposium in Berlin is again an excellent forum for international transmission and drive experts to exchange opinions. It also provides a valuable status update and a glimpse into the future.

I am looking forward to your participation and to many useful discussions and ideas.

Best regards



Prof. Dr. Ferit Küçükay

Director of the Institute of Automotive Engineering
Technische Universität Braunschweig



CTI
YOUNG DRIVE EXPERTS
AWARD

BSC, MSC GRADUATES AND PHD STUDENTS
of Automotive, Mechanical, E/E, Mechatronics and Mobility Engineering

Written your BSc, MSc or PhD thesis on transmission, powertrain
and/or environmental friendliness?

TAKE YOUR CHANCE AND APPLY!





CTI Symposium
6 + 7 DECEMBER 2016

FREE ADMISSION



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PECHA KUCHA
PRESENT YOUR PAPER
LIVE ON STAGE!

5 December 2016

Introductory Day:
Basics and Practice of Automotive Transmissions,
Hybrid and Electric Drives

- 9.00 Registration and hand out of the document
- 9.45 Welcome address
- 11.30 Lunch
- 12.30 Parallel sessions:
Conventional Drive Trains
Hybrid and Electric Drives
- 6.00 End of Introductory Day

5.00 – 9.00
Pre-Check-In for the Symposium

6.30 – 9.00
Welcome reception

Start networking during the informal kick-off meeting and get to know the new venue layout of the Symposium. The CTI invites you to a reception with drinks and finger food. We look forward to welcoming you!

Where? At the Festival Center/Foyer 1

6 December 2016

Symposium, Day One

- 7.45 Reception and hand out of the conference documentation
Opening of the Transmission Expo
- 8.30 **Welcome address**
- 8.50 **Plenary speeches**
- 10.30 **Panel discussion**
- 12.15 **Parallel sessions**
- Dedicated Hybrid Transmission (DHT)
- Concepts: AT, CVT
- Launch Elements, Vibration Damping
- Concepts: 48V
- Concepts: AWD
- Autonomous Driving | Market | Localisation
- Transmission and Drives for Commercial Vehicles
- Functional Safety, Cyber Security

- 1.15 Lunch
- 2.45 **Continuation of the parallel sessions**
- 5.00 **Plenary speeches**
- 6.00 End of the first main day
- 7.30 Start of the evening event at the Estrel Hotel

7 December 2016

Symposium, Day Two

- 8.15 Reception and opening of the Transmission Expo
- 8.30 **Welcome address**
- 8.40 **Plenary speeches**
- 9.55 **8th CTI Young Drive Experts Award**
- 11.00 **Parallel sessions**
- Concepts: HEV
- Concepts: MT, DCT
- EV Drives | Actuation
- Components
- Efficiency | Oils, Lubrication
- Tools, Simulation, Calibration
- Batteries
- Production

- 12.30 Lunch
- 2.00 **Continuation of the parallel sessions**
- 4.15 **Plenary speeches**
- 5.10 **Summary of the symposium and final discussion with the attendees**
- 5.30 End of the Symposium

12.00 – 5.00
Check-In CTI Test Drive

8 December 2016

CTI Test Drive
ADAC Centre of Driving Safety
Berlin/Brandenburg

- 8.30 Departure by bus shuttle
- 9.30 Arrival at the ADAC Centre of Driving Safety
Welcome address
Tour around the proving ground and instruction
- 4.00 End of the test drive and return to the Estrel Hotel Berlin
- ca. 5.30 Arrival at the hotel



Please be flexible with your return journey!
Limited number of participants!



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Basics and Practice of Automotive Transmissions, Hybrid and Electric Drives

9.00 Reception and hand out of the conference documentations

9.45 **Welcome address**

Prof. Dr Ferit Küçükay, Director of the Institute of Automotive Engineering, Technische Universität Braunschweig, Germany

10.00

Automotive drive concepts

- Drive characteristics and driving resistances, basics of longitudinal dynamics
- Background and function of starting devices, transmissions, hybrid and electric drives
- Design and function of
 - conventional drive concepts
 - serial, parallel and power-split hybrid drives
 - electric drives
- Market and development trends

Prof. Dr Ferit Küçükay

11.30 Lunch – afterwards sectioning into parallel sessions

Session Conventional Drive Trains

12.30

Constructive executions I

- Starting devices – clutch, dual-mass flywheel, torque converter
- Transmission concepts (1):
 - Manual transmission (MT) – two and multiple-shaft transmission for front-wheel and standard drive
 - Automated manual transmission (AMT) – “add on” and integrated solutions
 - Dual-clutch transmission (DCT) – DCT in serial application, introduced prototypes

Florian Schober, Research Associate, Institute of Automotive Engineering, Technische Universität Braunschweig, Germany

1.45 Coffee break

2.15

Constructive executions II

- Transmission concepts (2):
 - Automatic transmission (AT) – different gear set arrangements, examples of application
 - Continuously variable transmission (CVT) – layout, chains and belts, driveability
 - Dedicated hybrid transmissions (DHT) – layout, modes, examples
- All-wheel drives

Carl-Philipp Seekamp, Research Associate, Institute of Automotive Engineering, Technische Universität Braunschweig, Germany

3.30 Coffee break

4.00

Drive train management

- Drive train management and operating strategy
 - Control and regulation – shifting characteristics, applications
 - Interfaces – to engine, body, chassis

Dr Gunther Alvermann, Senior Research Associate, Institute of Automotive Engineering, Technische Universität Braunschweig, Germany

5.15 Short break

5.30

Summary of the parallel session: Basics of hybrid and electric drives

6.00 End of the Introductory Day

Objective

Newcomers and career changers will get an overview of the basics of conventional, hybrid and alternative drives during the Introductory Day. Based on road resistance as well as electric motor and combustion engine maps, the role of starting devices, transmissions and other drive train elements will be defined. Furthermore, the power flow of different drive concepts (conventional; parallel, serial and power-split hybrid; electric) will be explained and the corresponding development objectives presented.

Different transmission concepts, namely manual transmissions, automated manual transmissions, dual-clutch transmissions, automatic transmissions and continuously variable transmissions, will for example be illustrated in the session “Conventional Drive Train”. The topic of drive train management completes this session. The parallel seminar series “Hybrid and Electric Drives” will deal with the basic requirements and characteristics of electric motors, power electronics and vehicle batteries.

Following the presentations, the topics of the respectively parallel sessions will be presented as summary.

Session Hybrid and Electric Drives

12.30

Lithium-ion batteries

- Overview on lithium-ion batteries: design and operating principle
- Cathode and anode materials
- Electrical behaviour and ageing
- System technology (charging protocols, state diagnostics, system integration)
- Cost and safety aspects
- Modelling of lithium-ion batteries

Prof. Dr Julia Kowal, Chair of Electrical Energy Storage Technology, Technische Universität Berlin, Germany

1.45 Coffee break

2.15

Electric motors as vehicle drives – design, features, characteristics

- Physical basics
- Design and characteristics of the most important types of electric motors
- Operation of synchronous and induction motors of the frequency converter
- Important technical characteristics

Prof. Dr Bernd Ponick, Director of the Institute, Electrical Machines and Drive Systems Department, Institute for Drive Systems and Power Electronics, Leibniz Universität Hannover, Germany

3.30 Coffee break

4.00

Power electronics for hybrid and electric vehicles

- Power electronic components and circuits
- Assembly concepts and thermal management
- Control of power electronic converters
- Special considerations for vehicular applications

Prof. Dr Axel Mertens, Director of the Institute, Power Electronics and Drive Control Department, Institute for Drive Systems and Power Electronics, Leibniz Universität Hannover, Germany

5.15 Short break

5.30

Summary of the parallel session: Basics of conventional drive trains

6.00 End of the Introductory Day

Dr Ulrich Eichhorn, Chief Technology Officer, Volkswagen Group, Germany

Dr Ulrich Eichhorn studied and obtained his doctorate in Engineering at the Institute of Automotive Engineering, Technische Universität Darmstadt. He started his professional career with Ford in 1993, working in Germany, UK and USA. In seven years with this company he held a series of positions with responsibility for vehicle and chassis engineering, including having global responsibility for vehicle dynamics. In 2000, he joined Volkswagen in Wolfsburg as Executive Director Research, with responsibility for all brands within the Volkswagen Group. One of the key achievements during his tenure was the successful development of the 'One-Litre'-vehicle. From 2003 until 2011, he acted as Member of the Board at Bentley Motors. In this position he had overlooked for all aspects of engineering, the development of all models as well as the execution and production. In January 2012, Dr Eichhorn became Managing Director of the Association of the German Automotive Industry (VDA). His responsibilities included all aspects of technology and the environment, including automotive industry's Quality Management Center, standardisation with DIN and ISO and the German National Platform Electromobility. In March 2016 he returned to Volkswagen as Chief Technology Officer.

Dr Renate Vachenauer, Vice President Transmissions, Drive Train, BMW Group, Germany

Dr Renate Vachenaue started her career in 1999 as Project Manager Advanced Development Chassis Electronics at BMW AG. In 2002 she became Group Manager Series Development Chassis. From 2009 until 2013, Dr Vachenaue has held the position Department Manager Driver Assistance Systems, Chassis. In 2013, she took over the Department Management Power Electronics for Electrical Power Trains. Last year, Dr Vachenaue was appointed Vice President Transmissions, Drive Train. In this position, she is responsible for advanced and series development of all transmissions (manual transmissions, dual-clutch transmissions, automatic transmissions and electric transmissions) and drive train components.

Jörg Grotendorst, Head of E-Mobility, ZF Friedrichshafen AG, Germany

Jörg Grotendorst studied Electrical Engineering and joined DaimlerChrysler AG as Development Engineer in Electronic Braking Control Systems, Development Passenger Cars in 1996. Three years later, he moved to Ford Motor Company to become Design Team Leader Vehicle Network. In 2000, he was appointed Manager in the field of Development and Automotive Systems and later Head of Strategy & Technology for the Powertrain Division at Continental AG. In 2012, he then joined Siemens AG as CEO Business Unit "eCar Powertrain-Systems", Digital Factory Division Vice Chairman of BSAES-Beijing Siemens Automotive E-Drive Systems in Changzhou/China. Since January 2016, Mr Grotendorst has been Head of E-Mobility at ZF Friedrichshafen AG.

Toshihiro Hirai, Alliance Global Director, Corporate Vice President, Powertrain Engineering Division, Nissan Motor Co., Ltd., Japan

Toshihiro Hirai joined Nissan Motor Company in 1984. In 1999, he was appointed Manager, Advanced Engineering Department. In 2005, he became Deputy General Manager, Powertrain Project Planning Department and in 2008 General Manager, Powertrain Technology Development Department. In the following year, he took over the position as Powertrain Program Director and was e.g. responsible for Infiniti and Nissan C Class vehicles. Since 2014, Mr Hirai has been Alliance Global Director, Corporate Vice President Powertrain Engineering Division. In this position, he manages the Powertrain Engineering Department including all gasoline, diesel, hybrid and drive train activities for Nissan/Renault and their alliances.

Gerd Bofinger, Director Transmission Development, Dr. Ing. h.c. F. Porsche AG, Germany

Gerd Bofinger studied Mechanical Engineering at University of Applied Sciences Esslingen and started his career in Transmission Testing at Porsche AG in 1979. In 1986, he was appointed Manager Manual Transmission Testing and became Team Leader Carrera Transmission. In 2004, Mr. Bofinger was appointed Director Transmission Development at Porsche AG and has been responsible for the development of all drive train components ever since.

Prof. Dr Fritz Indra, Honorary Professor and Advisor, Austria

Prof. Dr Fritz Indra studied Mechanical Engineering at Technical University Wien and obtained a PhD afterwards. During his career, Prof. Indra was responsible for the development of engines and cars for BMW Alpina, Audi, Opel and General Motors. Since 1985, he teaches the subject Racing Engines and Racing Cars as an honorary professor at the Technische Universität Wien. Furthermore, he also works as a consultant in the automotive industry since 2005. Prof. Fritz Indra has published numerous books and publications, especially on engine topics, alternative vehicles and propulsion systems.

7.45 Reception and hand out of the conference documentations, opening of the Transmission Expo

8.30 **Welcome address by CTI and the chairman of the Symposium**

Prof. Dr Ferit Küçükay, Director of the Institute of Automotive Engineering, Technische Universität Braunschweig, Germany

8.50 **Volkswagen on the path to electrification – diversity in the drive train**

- The arrival of electric mobility in the automotive industry
- The future importance of conventional and electric drives (passenger cars and commercial vehicles)
- The role of the gearbox on the way to electrification

Dr Ulrich Eichhorn, Chief Technology Officer, Volkswagen Group, Germany

9.10 **Complexity of transmission development – trends, challenges, solutions**

- Trends and challenges of transmission development and integration
- Mastering complexity through variants, architectures, functional interaction
- Impact of e-mobility, automated driving and big data

Dr Renate Vachenaer, Vice President Transmission, Drive Train, BMW Group, Germany

9.30 **Drives are changing and change drives us**

- E-mobility
- The electric drive
- User behaviour

Jörg Grotendorst, Head of E-Mobility, ZF Friedrichshafen AG, Germany

9.50 **What is the future key function and value of transmissions?**

- Powertrain system has been evolved based on rationality
- The requirements of powertrains are changing
- According to that, rational solutions are also changing

Toshihiro Hirai, Alliance Global Director, Corporate Vice President, Powertrain Engineering Division, Nissan Motor Co., Ltd., Japan

10.10 Q&A

10.20 Short break

10.30 **Panel discussion**

Newcomers and experts will discuss about: **“Mobility and drivetrain of the future”**

Moderator: Ulrich Walter, Moderator

Panelists: Ruben König, Research Assistant, Institute for Mechatronical Systems in Mechanical Engineering, Technische Universität Darmstadt, Germany

Stefan Trommer, Team Leader, Technology Acceptance and Benefit Assessment, German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt (DLR)), Germany

Dr Kerstin Schmidt, Academic Counselor, Institute for Automobile Management and Industrial Production, Technische Universität Braunschweig, Germany

Prof. Dr Peter Gutzmer, Member of the Board, Schaeffler AG, Germany

Dr Renate Vachenaer, Vice President Transmissions, Drive Train, BMW Group, Germany

Jörg Grotendorst, Head of E-Mobility, ZF Friedrichshafen AG, Germany

11.30 Coffee break and visit to the Transmission Expo | Change to parallel sessions

12.15 to 4.15 Parallel sessions (p. 10 to 13)

4.15 Coffee break and visit to the Transmission Expo | Change to plenum

5.00 **Current and future challenges for sports car drive trains**

The second generation Porsche Doppelkupplungsgetriebe (PDK) for conventional and hybrid drives – what comes next?

Gerd Bofinger, Director Transmission Development, Dr. Ing. h.c. F. Porsche AG, Germany

5.20 **Is Formula 1 with hybrid technology the wrong way?**

Race engine and electrical energies in interaction

Prof. Dr Fritz Indra, Honorary Professor and Advisor, Austria

5.40 Q&A

6.00 End of the first main day

7.30 Start of the Evening event



Dedicated Hybrid Transmission (DHT)

12.15

Toyota hybrid system in its 4th generation

- Technological evolution
- Technical highlights of the latest system
- Nearly 20 years of full hybrid experience in the global market

Raf Schuermans, Technical Senior Manager – Drivetrain Research & Planning, Toyota Motor Europe, Belgium

12.45

Dedicated CVT-hybrid – low emission, high performance

- Dedicated plug-in hybrid based on a CVT
- Transmission concept for front-transverse applications
- Detailed overall powertrain modeling
- Evaluation of fuel efficiency and vehicle performance

Dr Christian Lauinger, Senior Manager Advanced Development CVT, LuK GmbH & Co. KG, Germany

1.15 Lunch and visit to the Transmission Expo

2.45

Power shiftable spur gear-DHT with innovative multiple benefits

- Getting up to 30 modes out of 7 gearings
- Cost oriented DHT concept
- DHT with minimum complexity

Ivan Andrasec, Predevelopment, Passenger Car Transmission, AVL List GmbH, Austria

3.15

Dedicated hybrid transmission based on Magsplit technology

- Magsplit as a key part of a dedicated hybrid transmission
- Design and analysis of the hybrid drive train
- Integrating the drive train into the demonstrator vehicle
- Performance and mode change test results

Dr Stuart Calverley, Chief Engineer, Hybrid Drives, Magnomatics Limited, UK

3.45

Novel shift control without clutch slip in hybrid transmissions

- Shifts without slip for hybrid transmissions
- Effects of advanced control strategies to TM structure selections
- Shifts without thermal losses

Muammer Yolga, Department Manager System, Software and Simulation, AVL List GmbH, Austria

4.15

Coffee break and visit to the Transmission Expo, change to plenum

Concepts: AT, CVT

12.15

A next generation RWD transmission concept with integrated electrification by General Motors

- Future engine and transmission matching
- Dual and triple clutch RWD transmission concepts
- Opportunity for integrated electrification and benefits

Dr Darrell Robinette, Assistant Professor, Mechanical Engineering, Michigan Technological University, former Electrification Architecture Engineer, General Motors Powertrain, USA

12.45

All-new Ford 10-speed RWD planetary transmission design and development

- A discussion of efficient power-flow and related technologies

Jim Centlivre, Automatic Transmission & Driveline Engineering Manager, Ford Motor Company, USA

1.15 Lunch and visit to the Transmission Expo

2.45

Full-toroidal variator technology and productionisation progress with application to passenger cars

- Variator family value-engineering progress with Univance
- Test results of pre-production variators
- Application to new efficient car CVT layouts
- Development of DriveDisconnect™ (variator decoupling)

Chris Gaskell, Senior Engineer – New Concepts, Torotrak Group, UK

3.15

A new pushbelt to enhance CVT technology

- Advances in efficiency, power density and robustness
- Efficiency optimised element geometry
- Power density and wear optimised element flank
- First CVT application with ratio coverage 8.7

Francis van der Sluis, Senior Engineer, Bosch Transmission Technology, The Netherlands

3.45

Energy losses estimator for a push-belt CVT

- Push-belt CVT losses and efficiency
- Simulation of the CVT efficiency
- CVT losses estimation by simulation

Dr Valerian Croitorescu, Executive Director of Scientific Research and Continuous Training Center for Sustainable Automotive Technologies, University Politehnica of Bucharest, Romania

4.15

Coffee break and visit to the Transmission Expo, change to plenum

Launch Elements, Vibration Damping

12.15

Simulation-based concept selection for vibration dampers

- Methodical design in early stages of development
- Combination of functional and packaging requirements
- Modelling and integration into the optimisation process
- Validation, potentials and limits of application

Philipp Mall, Doctoral Candidate Startup Devices and Shift Control, Dr. Ing. h.c. F. Porsche AG, Germany

12.45

Three cylinders and cylinder deactivation: which dampening challenges exist?

- New dampening challenges with engine downsizing
- A technical roadmap depending on application requirements
- Two innovative technical solutions developed by Valeo

Marc Theobalt, Research & Development Director, Valeo, France

1.15 Lunch and visit to the Transmission Expo

2.15

Multi-mode clutch module – application and performance

- Innovative usages of mechanical clutches in transmissions
- Increased clutch system flexibility and performance
- Efficiency improvements with mechanical clutches

Calahan Campton, Advanced Product Engineer, Transmission Systems, BorgWarner, USA

2.45

The new “Variable Spring Absorber” – an innovative torsional damping system for future powertrains

- New, innovative, active torsional vibrational absorber
- Supports down speeding, downsizing and cylinder deactivation
- Excellent isolation performance
- Driveline simulations verified with component tests

Florian Schneider, Advanced Product Engineering DTCS, BorgWarner Drivetrain Engineering GmbH, Germany

3.15

Conventional versus electric vehicle launch – systems comparison

- Efficiency of electrical or conventional launching
- Challenges of controlling launch events of hybrids
- Comfort aspects of hybrid electric vehicle launch

Dr Burghard Pollak, Managing Director, pi3 GmbH, Germany

3.45

Launching device: the next torque transfer revolution

- From clutch to piloted clutch: DCT, e-clutch, hybrid – wet vs dry
- From lock-up to launching clutch: the future of torque converters
- From clutch to... no clutch: DHT challenges

Pascal Hervet, Transmission Systems R&D Director, Valeo, France

4.15

Coffee break and visit to the Transmission Expo, change to plenum

Concepts: 48V

12.15

12+12V and 12+48V hybridisation: a modular approach and transmission impacts

- 12V board net evolution to 12+12V and 12+48V
- Hybridisation functions and electric boosting assistance
- Transmission impacts

Dr Olivier Coppin, R&D Innovation Director, Powertrain Systems, Valeo, France

12.45

Modular P2-P3 DHT for 48V and HV applications

- Overview of DHT concepts
- Modularity, efficiency and cost-effectiveness
- The benefits of P2-P3 architecture
- Software control and energy minimisation strategies

Dr Jacopo Rossi, Project Engineer, Advanced Design and Innovation, Oerlikon Graziano SpA, Italy

1.15 Lunch and visit to the Transmission Expo

2.15

Highly integrated motor design for lay-shaft transmissions

- Bespoke motor design benefits within the transmission
- Electric lay shaft – synchronisation challenges
- The concept motor – transmission layout and its benefits
- Vehicle benefits of the electric lay shaft transmission

Miriam Lorenzo, Principal Engineer, Control and Electronics, Drive System Design Ltd., UK

2.45

Driveability and 48V hybrids – opportunities beyond CO₂-reduction

- Px 48V topology comparison
- New functions and drivability improvements
- Driving strategy and energy management are key

Friedrich Graf, Director Advanced Development Engineering, Powertrain Technology & Innovation, Continental, Germany

3.15

Effects of 48V systems on the front-end accessory drive (FEAD) dynamics and design

- High loads in realistic driving cycles
- Crankshaft isolation as a must for most 48V applications
- Outlook: 48V applications in the future

Dr Andreas Stuffer, Manager Product Management Engine Damper, LuK GmbH & Co. KG, Germany

3.45

Low cost modular powertrain platform for HEV and EV optimised by innovative development methods

- Cost-optimal mass electrification
- HEV (48V) and EV powertrain platform
- Minimal concept with maximum of efficiency and flexibility
- Systematical platform design by innovative methods

Christoph Danzer, Expert of Team Powertrain Concepts/Synthesis, Powertrain Development Configuration, IAV GmbH, Germany

4.15

Coffee break and visit to the Transmission Expo, change to plenum

Concepts: AWD

12.15

GKN TWINSTER: one AWD-system fulfils different vehicle platform requirements

- Vehicle requirements for AWD-systems
- AWD-system integration for specific vehicle DNA
- Vehicle performance enhancement by AWD-system control

Michael Höck, Manager AWD-Systems,
GKN Driveline International GmbH, Germany

12.45

The integration of coupling and rear axle drive module – iRDM – a new benchmark for fuel efficient AWD systems

- Design
- Vehicle dynamics
- In vehicle fuel efficiency

Tim Olsson, Project Manager, Innovation and New Concepts,
BorgWarner PowerDrive Systems, Sweden

1.15 Lunch and visit to the Transmission Expo

2.45

ECOMAX – the new generation of disconnect-capable transfer cases

- Disconnect-capable transfer case
- High efficient lightweight transfer case
- Transfer case with dry clutch technology

Daniel Prix, Manager Innovators, MPT Portfolio Innovation,
Magna Powertrain, Austria

3.15

Overall energy flow and loss contribution analysis of a FF 4WD system

- Energy flow and loss analysis in the FF 4WD
- Break down the part by energy loss
- Improve design of FF 4WD system

Dr Ilhun Ryu, Senior Research Engineer, Driveline Engineering Team,
Hyundai WIA Corp., South Korea

3.45

eTWINSTER – the first new-generation electric axle system

- Layout and concept eTWINSTER
- eTWINSTER functionality
- Advantages and impact to the vehicle

Jan Haupt, Supervisor Advanced Driveline Concepts,
GKN Driveline International GmbH, Germany

4.15

Coffee break and visit to the Transmission Expo, change to plenum

Autonomous Driving | Market | Localisation

12.15

How autonomous driving affects transmission design

- Stages of automated driving and effects on transmission design
- How swarm effects in traffic can accelerate technology changes
- New opportunities for package, NVH and efficiency

Dr Carsten Bündler, Senior Manager Product Engineering,
GETRAG Getriebe- und Zahnradfabrik Hermann Hagenmeyer GmbH
& Cie KG, Magna Powertrain, Germany

12.45

Limits of economical optimisation of manual transmissions

- Market trends and regional differences in MT development
- Technical optimisation potentials for MTs
- Cost-benefit comparison of transmission types

Dr Karsten Wasiluk, Consultant, Automotive Engineering,
Schlegel und Partner, Germany

1.15 Lunch and visit to the Transmission Expo

2.45

Transmission launch in China – challenge management

- Experiences in establishing a transmission joint venture in China
- Localising in-house development and production processes
- Choosing local sub suppliers and ensuring product quality

Sascha Mierbach, Platform Director DCT150/200,
GETRAG Ford Transmission GmbH, Magna Powertrain, Germany

3.15

A global answer to regional requirements: the CVT

- Customer's requirements are different, market by market
- Suitable powertrain adaptation to each market
- Jatco's strategy answers to every regional requirements

Benoît Boulet, Technical Research Project Leader,
Jatco France S.A.S, France

3.45

Effective activities to make success of transmission manufacturing localisation

- Jatco's latest status of manufacturing localisation
- New CVT launched at new assembly line in China
- Effective activities to ensure good quality for the new line
- Further strategy for successful global localisation

Yukio Matsushita, General Manager, R&D, Jatco France S.A.S, France

4.15

Coffee break and visit to the Transmission Expo, change to plenum

Transmission and Drives for Commercial Vehicles

12.15

Proven flywheel ERS fuel economy improvement in heavy duty vehicle applications

- Technical details and performance characteristics
- Validation in on- and off-highway heavy duty machines
- Testing of ERS fuel economy benefits in a bus application

Richard Dunne, Business Development Manager, Torotrak Group, UK

12.45

48V system in commercial vehicles

- Systemic approach and electrified components for an on-road truck
- Control strategies for sub systems
- Energetic evaluation of overall vehicle

Reinhold Bals, Project Manager, IAV GmbH, Germany

1.15 Lunch and visit to the Transmission Expo

2.45

Automatic vs automated manual transmissions – comparing the physics

- Efficiency through architecture, components and controls
- Benefits of power shifts on fuel efficiency
- Torque converter vs launch clutch energy

Dane Rodgers, Manager, TC10 Transmission, Product Engineering, Allison Transmission, Inc., USA

3.15

Series-parallel hybrid drive system and 2-speed transmission using electromagnetic dog clutches

- Attributes of JJE electromagnetic dog clutches (EMDC)
- Series-parallel hybrid application of EMDC
- 2-speed transmission application of EMDC

Ping Yu, Chairman, CEO and Chief Powertrain Engineer, Jing-Jin Electric Technologies, Beijing, China

4.15

Coffee break and visit to the Transmission Expo, change to plenum

Functional Safety, Cyber Security

12.15

The cyber security challenge from an OBD perspective

- Vehicle data access vs vehicle data security
- Defining access methods
- Hacking efforts
- Methods to thwart these efforts

Bob Gruszczynski, OBD Communication Expert, Volkswagen Group of America, Inc., USA

12.45

Cyber security in innovative brake systems as an enabling technology for modern propulsion systems

- On the importance of cyber security in modern vehicles
- Current scenario and possible threats
- Cyber security strategy for brake systems

Dr Rodrigo D. do Carmo, Software Project Manager, Cyber Security Expert and **Michael Gerhard Schneider**, Head of Cyber Security in Software Business Unit Vehicle Dynamics, Continental Teves AG & Co. oHG, Germany

1.15 Lunch and visit to the Transmission Expo

2.45

Model-based safety case development for a transmission system

- Approaches of safety development according to ISO26262
- Description of the model-based approach
- Example of a SysML model for a transmission

Andreas Kager, Functional Safety Technical Specialist, AVL List GmbH, Austria

3.15

Presentation title tba

Hans-Wilhelm Dünn, Secretary General, Cyber-Sicherheitsrat Deutschland e.V., Germany

4.15

Coffee break and visit to the Transmission Expo, change to plenum

CTI Networking Night

6 December 2016

Drink, dine and be entertained – all participants, speakers, exhibitors and sponsors are invited to the annual CTI Networking Night: an evening full of highlights, culinary surprises, in a top-class location with an exciting social programme. Discuss the topics of the day in a relaxed atmosphere and make new contacts at the CTI Networking Night – a great opportunity to get together again!



Perfect to intensify your contacts to fellow specialists

Relaxed atmosphere





CTI Symposium USA

Automotive Transmissions, HEV and EV Drives

15 – 18 May 2017, Novi, MI



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Papers**



Dr Enrico Pisino, Head of Research and Innovation, Fiat Chrysler Automobiles; EUCAR Council Member

Dr Enrico Pisino started his career as Research Analyst for Driving Comfort at Centro Ricerca FIAT in 1991. In the following years, he was responsible for different projects, e.g. in the fields of Methodology, Innovative Products, Vehicle Concepts and Architectures. In 2005, Dr Pisino was appointed Director Manufacturing and Materials, in 2006 Head of the Vehicle Architecture Division and Head of the Interiors Division for FIAT Group cars in 2008. This was followed by his appointment as Head of Innovation at Chrysler Group in 2011. Since 2014, Dr Pisino has been Head of Research & Innovation at Fiat Chrysler Automobiles (FCA). In the same year, he was appointed Chairman of the FCA Innovation Coordination Committee. Since last year, he has also been Design Systems Director EMEA. In addition, Dr Pisino is a EUCAR Council Member and Chairman of the Sustainable Propulsion Strategic Research & Innovation Division.

Prof. Dr Dr h.c. Harald Ludanek, Member of the Board of Volkswagen Commercial Vehicle, Volkswagen Nutzfahrzeuge, Germany

Prof. Dr Dr. h.c. Harald Ludanek holds a PhD in Mechanical Engineering and has been with Volkswagen since 1992. He began his professional career at Volkswagen researching into special gear units and transmission technology, e.g. dual-clutch transmissions and powershift transmissions. Since 1997, he had been Executive Assistant Technical Development for three years before he became Head of Group Development Coordination. From 2002 to 2007, Prof. Dr Dr h.c. Ludanek managed the Technical Development at Škoda-Auto in Mlada Boleslav. He subsequently assumed responsibility for total vehicle development and prototype construction at Volkswagen in Wolfsburg before he started working at Scania CV, AB in Södertälje/Sweden in 2012, where he headed Research and Development. In April 2016, Prof. Dr Dr h.c. Ludanek was appointed Member of the Board, Technical Development, Volkswagen Commercial Vehicles and is responsible for the development of the product range and future technologies.

Jake Hirsch, President, Magna Powertrain, USA

Jake Hirsch studied business administration at Reutlingen University. In addition, he completed a Global Leadership programme of the Thunderbird School in International Management and a Strategic Management seminar at Harvard University. During his extensive career, Mr Hirsch was President and CEO of Teksid Aluminium; Chairman, President and CEO of Textron Fastening Systems; Vice President and Managing Director of TRW Occupant Restraints as well as Executive Vice President and COO of Magna Europe AG, where he was also a member of the Supervisory Board. In 2007, Jake Hirsch returned to Magna and was appointed President of Magna Powertrain in the following year. As President, Mr Hirsch is responsible for Magna's global powertrain and electronics business. In 2011, Mr Hirsch was appointed Kommerzialrat by the Chancellor of the Republic of Austria.

Dr Peter Mertens, Senior Vice President, Research & Development, Volvo Cars, Sweden

Dr Peter Mertens graduated as Diplom-Ingenieur in Production Engineering and completed a Masters degree in Industrial Engineering and Operations Research at the Virginia Polytechnic Institute (USA) in 1985. He later went on to complete his doctorate in Production Engineering and Industrial Engineering at the University of Kaiserslautern. During that time he also worked as Head of Technology Transfer Institute at the same university. From 1990 to 1996, Dr Mertens has held different positions at DaimlerChrysler AG, Stuttgart, Germany (1990-1993 Head of Aftersales Engineering, 1993-1996 Project Leader Mercedes A-Class). In 1996, he became Managing Director at Tegarom Telematics GmbH before he decided to join Adam Opel AG as Vehicle Line Executive six years later. In 2004, he was appointed Vehicle Line Executive, Executive Director at General Motors Europe and later Global Vehicle Line Executive, Executive Director of General Motors worldwide. At Jaguar Cars/Tata Motors India, Dr Mertens worked as Head of Corporate Quality and was a member of the Management Board of Jaguar/Land Rover from 2010 to 2011. Since 2011, he has been Senior Vice President, Research & Development of Volvo Cars and is responsible for Research & Product Development.

Larry Nitz, Executive Director Global Transmissions and Electrification, General Motors, USA

Larry Nitz studied Electrical Engineering at Kettering University and received his Masters degree at Stanford University. In 1976, he started his career at General Motors (GM) and worked on gasoline engines, manual and automatic transmissions, powertrain and vehicle controls, and hybrid and electric systems. Today, Mr Nitz leads GM's Global Transmission and Electrification team, with engineering operations in North and South America, Europe, and Asia. His team is responsible for all of GM's automatic and manual transmissions and powertrain electrification products.

8.15 **Opening of the Transmission Expo**8.30 **Welcome address**

Prof. Dr Ferit Küçükay, Director of the Institute of Automotive Engineering, Technische Universität Braunschweig

8.40 **EUCAR's research priorities for sustainable propulsion**

EUCAR's perspective on future collaborative research and innovation priorities as concerns sustainable propulsion systems which must be increasingly clean, energy-efficient and cost-effective while responding to evolving customer demands.

Dr Enrico Pisino, Head of Research and Innovation, Fiat Chrysler Automobiles; EUCAR Council Member

9.00 **Future powertrain concept in light commercial vehicle for the outer- and inner-city delivery service**

- Future limitation in emission and customer demands
- Hybrid and electric driven vehicles in comparison
- Demands for sustainable inner-city distribution und delivery services
- Integrated approach, considering traffic control systems

Prof. Dr Dr h.c. Harald Ludanek, Member of the Board of Volkswagen Commercial Vehicle, Volkswagen Nutzfahrzeuge, Germany

9.20 **etelligentDRIVE by Magna Powertrain – supporting the powertrain of the future**

CO₂ improvements plus vehicle performance agility

Jake Hirsch, President, Magna Powertrain, USA

9.40 Q&A

9.55  **8th CTI Young Drive Experts Award****Presentation of the winners**

The authors who submitted the best Bachelor, Master or PhD theses in the field of transmission and drive technology selected by the expert committee will be introduced. The awarded theses will also be presented live on site.

Further information about the CTI Young Drive Experts Award:

www.cti-award.com



10.15 Coffee break and visit to the Transmission Expo | Change to parallel sessions

11.00 to 3.30 Parallel sessions (p. 18 to 21)

3.30 Coffee break and visit to the Transmission Expo | Change to plenum

4.15 **Volvo's strategy for electrification and positioning for the future**

- Volvo's approach on developing electrified vehicles
- Key technologies in Volvo's electrified cars and test fleet
- No contradiction between performance and efficiency

Dr Peter Mertens, Senior Vice President, Research & Development, Volvo Cars, Sweden

4.35 **Transformation of mobility**

- Putting customers at the center of a changing transportation eco-system
- The connected, autonomous and electric future
- Unconventional wisdom of diverse drive systems

Larry Nitz, Executive Director Global Transmissions and Electrification, General Motors, USA

4.55 Q&A

5.10 **Summary of the key messages and final discussion with the attendees**

Prof. Dr Ferit Küçükay

5.30 End of the Symposium



Concepts: HEV

11.00

P3 hybrid options with manual transmissions

- Manual transmission market position and threats
- Modular technology upgrade concept for manual transmissions
- Functional benefits of technology upgrades
- Compatibility with vehicle installation requirements and packages

Dr Frank Casimir, Director, Product Segment Manual Transmissions, GETRAG Ford Transmissions GmbH, Magna Powertrain, Germany

11.30

New FF 6-speed dry DCT for compact HEV

- System introduction: new 6-speed dry DCT for HEV
- Hardware development in aspects of efficiency and NVH
- Control strategy development targets and their features

Ju Hyun Nam, Senior Research Engineer, Research & Development Division, Hyundai Motor Company, South Korea

12.00

GKN 2-speed seamless-shift Technology for HEV and BEV

- Concept of 2-speed transmission with seamless shift
- Demonstrator vehicle with new ePowertrain
- Model based design and automatic code generation
- iECO- intelligent energy algorithm for best system efficiency

Theodor Gassmann, Vice President Advanced Engineering, GKN Driveline, Germany

12.30 Lunch and visit to the Transmission Expo

2.00

Schaeffler China plug-in P2 hybrid DCT concept car

- Powertrain integration and hybrid control strategy development
- Intelligent drive strategy
- Energy efficiency and dynamical performance
- System evaluation and validation

Bertrand Pennec, Director, Development Simulation, LuK GmbH & Co. KG, Germany

2.30

A modular approach for high-performance xEV drive systems

- Concept selection for inverter and electric machine
- Performance and packaging data
- Introduction in transmission concept and park system

Prof. Dr Eckhard Kirchner, Head of the Institute for Product Development and Machine Elements, Technische Universität Darmstadt, and **Dr Yves Burkhardt**, Head of Motor Engineering & Simulation, Siemens Automotive ePowertrain Systems GmbH

3.00

Identification of optimal plug-in hybrid powertrain configurations

- Holistic design method for plug-in hybrid powertrains
- Early identification of optimal configurations
- Potential analysis of new component technologies
- Analysis of fleet scenarios with plug-in hybrid powertrains

Thibaut Reuschlé, PhD Student, Robert Bosch GmbH, Germany

Concepts: MT, DCT

11.00

The AMG SPEEDSHIFT DCT for the new generation of the AMG compact class

- 4x4 drive train for AMG applications
- Gear set with high torque capacity
- Compact differential lock for the front axle
- Application from comfort to race mode

Dr Kuno Fronius, Manager Design Engineering and Project Manager Front-Transverse Automatic Transmissions, Daimler AG, Germany

11.30

9-speed dual clutch transmission for hybrid super sports car

- Compact and light weight package to adapt short overhang
- High vehicle performance and fuel efficiency through 9-speed DCT
- Effective cooling system

Ryuhei Kataoka, Assistant Chief Engineer, Honda R&D Co., Ltd, Japan

12.00

The new generation 6-speed FWD and AWD manual transmission for General Motors

- Development of the new generation 6-speed manual transmission
- Benchmark for efficiency, size, mass and cost
- Introduction 2017

Axel Geiberger, Global Assistant Chief Engineer Manual Transmissions, Adam Opel AG, Germany

12.30 Lunch and visit to the Transmission Expo

2.00

The new 5-/6-speed manual transmission for GM China

- State-of-the-art MT developed by PATA (SAIC-GM JV in China)
- High efficiency for reduced fuel consumption
- Competitive cost through local supply base in China
- Start of production in summer 2016

Ulrich Kretzschmar, Global Chief Engineer and Global Program Manager Manual Transmissions, Adam Opel AG, Germany

2.30

A new dual clutch automatic for mid torque applications

- Innovative 7-speed dual clutch transmission
- Single layshaft by using automatic transmission components
- Class leading thermal stability by axial clutch topology

Alex Serrarens, Manager Business Development, Punch Powertrain, The Netherlands

3.00

What manual transmissions of the future need

- Hybridisation of a manual transmission
- Clutch automatisisation; e-clutch
- Measures for installation space gaining

Dr Roland Welter, Vice President Product Line Total Clutch System, LuK GmbH & Co. KG, Germany

EV Drives | Actuation

11.00

The propulsion system of the new Opel Ampera-E

- Opel's first all-electric series car
- On market early in 2017
- Class-leading range and drive performance

Dr Peter Ramming, Chief Engineer & Program Manager, Adam Opel AG, Germany

11.30

Trends and challenges in the development of electrified powertrains

- The future of the electrified powertrain
- Future electric powertrain technologies
- The present and future of electrified powertrains
- Present and future electric drive systems

Dr Malte Jaensch, Head of Electric Drivetrain, Powertrain, Porsche Engineering Group GmbH, Germany

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12.00

High speed rotating transmission

- Basic requirements for high speed rotating transmissions
- Critical technical areas
- Approach for solutions

Jürgen Tochtermann, Lead Engineer Transmission Design, AVL Commercial Driveline & Tractor Engineering, Austria

12.30 Lunch and visit to the Transmission Expo

2.00

Lightweight e-motors for in-wheel and other mobile drives

- New motor design for ultra-low weight
- Top margins for power-to-weight and torque-to-weight ratio
- 2nd generation: overview and features
- New motor design delivers highest power and torque density

Prof. Dr Roland Kasper, Full Professor Mechatronics, Otto-von-Guericke-Universität Magdeburg, Germany

2.30

New generation of compact hydraulic control units for transmission controls

- Hydraulic control module with standardised pilot valves
- Benchmark with state of the art clutch control
- The Bosch solenoid design box for transmission control

Dr Christof Ott, Team Leader Simulation Solenoid Development, Robert Bosch GmbH, Germany

3.00

The "Smart Actuator Platform" as a modular system for energy-efficient and dynamic actuators and pumps

- Modular system for transmission actuators and pumps
- Transmission oil pumps
- Position actuators

Andreas Schulze, Head of Base Development Sensors & Actuators, Continental, Germany

Components

11.00

Efficient synchroniser for comfort and performance increase of manual and dual clutch transmissions

- Synchroniser for the future
- Reduction of complexity
- Eliminating the limitations of self-locking

Ulf Christoffer, Head of Product Development Europe, Research and Development, Oerlikon Friction Systems, Germany

11.30

Integrated electrical auxiliary oil pump for automatic transmissions

- Pressure control without pressure sensor by means of a replacement model
- Exact torque determination in a PMSM electric motor
- Simulation-based pump optimisation, focus, torque characteristics
- Pressure control accuracy in series production

Jens Löffler, Team Manager System Development, Central R&D, ebm-papst St.Georgen GmbH & Co.KG, Germany

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12.00

Wear-resistant parts for friction vs aluminum applications

- Polymeric choices for friction applications
- Aluminium counter surfaces
- Materials selection by pressure-velocity-matrix

Lucie Noé, Application Engineer, DuPont Performance Materials, DuPont De Nemours, Switzerland

12.30 Lunch and visit to the Transmission Expo

2.00

World's 1st production selectable one way clutch for AT

- Design basis for the technology
- How and where is the device used in the automatic transmission
- Advantages of selectable one way clutch for customers A and B

Carl Beiser, Technical Business Manager, Clutch Systems, Means Industries, Inc., USA

2.30

Dog clutch with zero circular backlash

- Design of new dog clutch with zero circular backlash
- Results of tests on flywheel test stand
- Comparison between behaviour of synchroniser and new dog clutch
- Potential of dog clutch for dimension minimisation

Dr Gabriela Achtenova, Associate Professor, Automotive, Czech Technical University in Prague, Czech Republic

3.00

Optimisation of transmission electrical oil pumps using model-based system engineering techniques

- Electrical oil pump modular design platform
- Simulation-based optimisation method for EOP design
- Co-simulation framework for parameter sensitivity analysis
- Approach for assessment integration level based on KPIs

Oscar Sarmiento, Manager Advanced Systems Modeling & Control, Transmission - Systems and Innovation, Continental, Germany

Efficiency | Oils, Lubrication

11.00

Reduction of energy losses in transmission systems

- Reduced friction losses in bearings and clutch packs
- Power-on demand actuators with low energy consumption
- E-clutch, DCT, P2 KO clutch, gear shift and e-axes

Dr Hartmut Faust, Senior Vice President R&D Transmission Systems, LuK GmbH & Co. KG, Germany

11.30

Efficiency improvements in automatic transmissions using “latching” clutch systems

- Energy saving potentials of actuators in drive trains
- Latching clutches or brakes
- Test and simulation results of latching systems

Alexander Moser, Advanced Product Engineering, BorgWarner Drivetrain Engineering GmbH, Germany

12.00

Reducing friction through innovative surface textures

- CO₂-saving potentials of Levitas seal rings in transmissions
- Description of friction reduction technology
- Newly developed Levitas seal ring

Hikaru Tadano, Project Manager Strategic Product Development, Technology & Innovation, Freudenberg Sealing Technologies, Germany

12.30 Lunch and visit to the Transmission Expo

2.00

The link between improved driveline efficiency and lower lubricant temperatures

- Lubricant effect on transmission efficiency and oil temperature
- Impact of synthetic lubricants on efficiency
- Real world fuel consumption benefits from lubricants

Dr Ian Taylor, Technology Manager, Innovation Scouting, Lubricants Department, Shell Global Solutions (UK), UK

2.30

The next generation of wet DCT lubricants – new challenges for the fluid designer

- Increasing OEM requirements
- Tailor made product solutions
- Extended evaluation programmes

Armin Schenk, Global Driveline OEM Liaison Manager, Castrol Driveline Technology Centre, Germany

3.00

Advanced measuring system for 3D oil flow utilising stereo camera system

- Motivation of the new method development
- Outline of 3D oil flow measuring system utilising stereo camera
- Example of 3D flow visualisation in torque converter

Satoshi Watanabe, Assistant Manager, Hardware System Development Department, Jatco Ltd., Japan

Tools, Simulation, Calibration

11.00

Towards a paradigm shift in transmission design

- Online and real-time lifetime monitoring system
- Lifetime-oriented operating strategy: eLIFE
- Smart big data in transmission engineering: ecoLIFE3

Prof. Dr Stephan Rinderknecht, Director of the Institute for Mechatronical Systems, Technische Universität Darmstadt, Germany

11.30

Synthesis and evaluation of an electrified vehicle concept

- Requirements and characteristics
- Synthesis of a drive system
- Simulation and evaluation

Hendrik Piechottka, Doctoral Candidate, Audi AG, Germany

12.00

The future for the connected drivetrain systems

- Transmission usage profiles monitoring system
- Transmission components assessment and failures prediction
- Transmission cost reductions, downsizing and optimisation
- Autonomous vehicles, RT data for transmission control systems

David Kelly, Director, Drive System Design Ltd., UK

12.30 Lunch and visit to the Transmission Expo

1.30

E-drive end of line testing in production – putting the excitement into drive testing

- Modular EOL testing concepts for most advanced electric drives
- Electrical testing requirements integrated into drive test benches
- Modular drive EOL testing combined with e-drive test

Ralph Heckmann, Vice President Technical Sales Automotive, teamtechnik Maschinen und Anlagen GmbH, Germany

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2.00

Generation of simulation tools to tackle specific transmission issues

- Downsizing and downsizing
- Coupling of 0D/1D and 2D/3D tools
- Vibrations instabilities in clutches

Dr Herve Mahe, NVH Senior Expert, Valeo, France

2.30

Virtual calibration of conventional and hybrid drive train strategy

- Detailed and rating based comparability of calibrations
- Virtual calibration of drive strategy
- Virtual analysis, optimisation and evaluation
- Method enables the frontloading approach in calibration

Falko Pflüger, Senior Calibration Engineer Transmission, AVL List GmbH, Austria

3.00

Dynamic torque sensing for future powertrain control

- Pure torque sensing for engine and transmission management
- Real-time electronic transfer case management
- Active torque management of ICE and electric driven axles
- Torque assist to enhance automated gear shifting

Johannes Giessibl, Senior Magneto-elastic Project Manager, Automotive Division, Methode Electronics International GmbH, Germany

Batteries

11.00

Performance and cost potentials as well as production challenges of future battery generations

- Design and performance expectations of different battery technologies
- Chances for a battery production in Germany
- Cost development of present and future battery generations

Prof. Dr Arno Kwade, Head of the Institute Particle Technology, Technische Universität Braunschweig, Germany

11.30

Battery roadmap for electric mobility

- Battery until 2030+: status and development potentials
- Implications for electro-mobility concepts
- Trends, markets and development of demand

Dr Axel Thielmann, Deputy Head of the Competence Center – Emerging Technologies, Fraunhofer Institute for Systems and Innovation Research (ISI), Germany

12.00

Cathode material development for lithium ion batteries for xEV applications

- Development directions for lithium ion batteries
- Increasing the energy densities
- Improving durability

Dr Paul Spurk, Applied Technology Manager, Rechargeable Battery Materials, Umicore AG & Co. KG, Germany

12.30 Lunch and visit to the Transmission Expo

2.00

Solid state batteries – many chances and even more challenges

- Materials: selection follows requirements
- Concepts: form follows function
- Processing: application follows materials

Dr Frank Tietz, Team Leader Materials Development, Forschungszentrum Jülich GmbH, Institute of Energy and Climate Research, Germany

2.30

New battery systems for electric vehicles by General Motors (2nd generation BEV and EREV)

- Design consideration for BEV and E-REV batteries
- Progress of battery systems from Gen 1 to Gen 2
- Technical description of the new BEV battery system

Roland Matthé, GM Technical Fellow Global Battery Systems & Manager Electrification Architecture, Adam Opel AG, Germany

3.00

Sensors' potential to enhance the safety of battery cells

- Sensors provide status information on LIB-cells at will
- How to use this information (by the BMS or else) is the key
- Can improvements in safety, security, ... justify the effort

Dr Wilhelm Maurer, Director Funding Projects and Coordination, Infineon Technologies AG, Germany

Production

11.00

Electrification – challenges in transmission production

- Impact due to NVH requirements
- Development of new controlling methods at end-of-line-test benches
- Verification of electrification specific characteristics

Dr Wolfgang Geis-Drescher, Manager Process Engineering Transmission, Adam Opel AG, Germany

11.30

Cold forming – key technologies for precision powertrain components

- Clutch housing for different applications
- Design feature on clutch housing combined with forming process
- Varieties of forming processes combined with tooling concept
- Comparison, technical results, costs and economy

Horst Linzbach, Manager Sales & Engineering, Feintool System Parts Obertshausen GmbH, Germany

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12.00

Lightweight design in the transmission by use of high-performance polymers in gear shift and park lock actuators

- Technical requirements
- Choice of materials
- Development methodology
- Plastic-specific design features

Wilhelm Heubner and **Stefan Gebert**, both Director Development, Advance Development/Development Gear Actuation Systems, FTE automotive GmbH, Germany

12.30 Lunch and visit to the Transmission Expo

2.00

24% mass reduction from light-weighting process applied to an axle

- Application of the light-weighting process for an axle
- Efficiency results from rig and vehicle durability tests
- NVH advantages from integration of side-shaft joints

Jon Hodgson, Principal Engineer, Ricardo Innovations, Ricardo plc, UK

2.30

NVH-relevant aspects of e-drive unit manufacturing

- Holistic NVH simulation chain
- Statistical sensitivity analysis
- NVH-phenomena of electric drives

Dr Georg Lührs, Head of Advanced Development and Simulation, Volkswagen AG, Germany

3.00

Plasmanitriding in the transmission and drive train technology

- Profitable redesign of heat treatment and manufacturing process
- Reduction of expensive hard machining
- Improvement of eco-balance

David Unterberger, Head of Sales, RÜBIG GmbH & Co. KG, Austria

You can experience these – and many other – cars in practice*

- 8.30 Departure with the shuttle service from Estrel Hotel Berlin to ADAC Fahrsicherheitszentrum Berlin-Brandenburg GmbH, Am Kalkberg, 14822 Linthe
- 9.30 Arrival at the ADAC Centre of Driving Safety and welcome address
Tour around the proving ground and instruction
- 10.30 Start of the test drive
- 4.00 End of the test drive and departure to the Estrel Hotel Berlin
- 5.30 Arrival at the hotel



Please be flexible when planning your return journey. Please wear comfortable shoes and warm clothes. Limited number of participants. Register early!

**Check-In for the CTI Test Drive
Wednesday, 7 December 2016,
12.00 – 5.00 p.m**

We kindly ask all registered participants and persons accompanying test vehicles to check-in for the test drive at our special Check-In desk at the Estrel Hotel Berlin. Please bring your completed declaration of non-liability (provided by CTI in advance) and your driving license with you. Please let us know if you will be using our bus shuttle to Linthe or if you will be making your own travel arrangements. All important information concerning the test drive will be handed out at the Check-In.

You would like to provide a car for the CTI Test Drive? Please contact us and we will inform you about details.

Contact: maria.forko@car-training-institute.com
Web: www.transmission-symposium.com/testdrive



Nissan Juke with Jatco CVT8



2016 Cadillac CT6

©General Motors



2016 Chevrolet Camaro V8

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2016 Chevrolet Volt 2

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Opel Mokka X

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Opel Zafira

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Mitsubishi Outlander PHEV



smart BRABUS with twinamic 6-speed DCT



Volvo XC90 T8 Plug-in-Hybrid



Volvo V90 D5 AWD with 8-speed-AT

*Available vehicles subject to change

We are here for you!

We are pleased to answer all questions regarding the Symposium.

Projekt Management CTI Symposium



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Marketing/Press, Customer Service

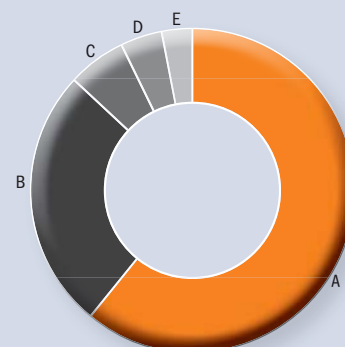


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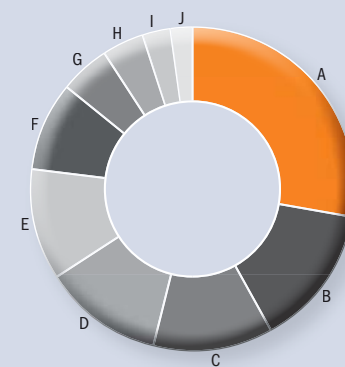
by country



A	Germany	61 %
B	Europe w/o Germany	26 %
C	Asia	6 %
D	North America	4 %
E	Others	3 %

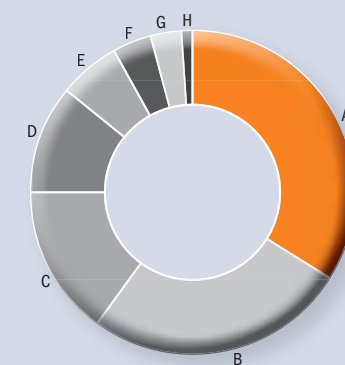
in total 23 countries

by sector



A	Automotive Supplier (w/o Transmission Manufacturers)	28 %
B	Automobile Manufacturers	14 %
C	Electric/Electronics	12 %
D	Transmission Manufacturers	12 %
E	Engineering/Development Service Providers	11 %
F	Metal Processing	9 %
G	Mineral Oil & Chemical Industry	5 %
H	Mechanical Engineering	4 %
I	Plastics Industry	3 %
J	Universities	2 %

by function



A	R&D/Transmission/Drive Development	34 %
B	Marketing/Sales	26 %
C	Engineering/Design	15 %
D	Management Board	11 %
E	Business Development	6 %
F	Projekt Management	4 %
G	Others	3 %
H	Press	1 %



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AVL List GmbH

www.avl.com/transmission

AVL is the world's largest independent company for the development of powertrains (combustion engines, transmissions, control software, electric motors and batteries). The development and integration is fully supported by simulation tools; instrumentation & test systems; as well as the methodology required for passenger cars, trucks and marine engines. AVL offers a complete service portfolio for OEMs and transmission suppliers which contains design, analysis, calibration, transmission control development, hybridization and manoeuvre-based testing.

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Technologies that provide better fuel economy, reduced emissions and great performance – **BorgWarner** makes them possible. As a leading automotive supplier, we develop innovative propulsion solutions. Our products can be found in efficient combustion, hybrid and electric vehicles as well as in commercial and on/off-highway applications. Through our ongoing commitment to innovation, BorgWarner delivers environmentally-friendly solutions that improve driving comfort, performance and reliability.

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Diehl Metall

www.diehl.com/metall

For more than 60 years, **Diehl Metall** has been a successful partner to the international automotive industry when it comes to synchronizer ring production. The long-established company, with its product expertise, sets innovative trends in transmission solutions. The unique diversity of products as well as the combination of long-standing experience and the latest know-how enable efficiency increases in existing technologies. With the brand Formed@Diehl, the company offers both conventionally forged brass synchronizer rings as well as production of steel synchronizer rings with high-performance coatings. These improve friction and wear behavior and cover the entire performance range. As the global market leader in this area, Diehl Metall is a specialist in optimizing existing transmissions as well as in developing customized solutions for new projects. Furthermore, production sites in Germany, Brazil, China and India ensure supply to the international markets. Our claim: Precision. Innovation. Quality.

Visit us at our booth at the Transmission Expo.



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Your contact

Michael Follmann
Sales Director

michael.follmann@car-training-institute.com



GETRAG

Magna Powertrain/GETRAG

www.magna.com

www.getrag.com

Magna Powertrain, an operating group of Magna International, is a premier supplier for the global automotive industry with full capabilities in powertrain design, development, testing and manufacturing. Complete system integration sets us apart from our competitors. To address increasing environmental pressures, many of Magna Powertrain's innovations focus on electronically controlled technologies, supporting the quest for improved efficiency and reduced emissions.

GETRAG is the world's largest independent supplier of transmission systems for passenger cars and light commercial vehicles with approximately 14,500 employees at more than 20 locations. Headquartered in Untergruppenbach/Germany, the company develops and manufactures transmission solutions for the automotive industry. The transmission portfolio comprises manual, automated manual and dual-clutch transmissions. GETRAG also offers a range of hybridization and electrification of transmissions. On January 1, 2016, GETRAG was acquired by Magna International and is now part of the Magna Powertrain organization.

Visit us at our booth at the Transmission Expo.



PETRONAS Lubricants International

www.pli-petronas.com

PETRONAS Lubricants International (PLI) is the global lubricants manufacturing and marketing arm of PETRONAS, the national oil corporation of Malaysia. Established in 2008, PETRONAS Lubricants International manufactures and markets a full range of high-quality automotive and industrial lubricants products in over 80 markets globally. Headquartered in Kuala Lumpur, PLI has over 30 marketing offices in 23 countries, managed through regional offices in Kuala Lumpur (Malaysia), Turin (Italy), Belo Horizonte (Brazil), Chicago (USA) and Durban (South Africa).

The Global Technology Center located in Turin, Italy, develops tailor made Transmission Lubricants for several OEMs at global level, both for First Fill and for the Aftermarket same as high performance transmission oils for various motorsport applications (such as Formula 1 and DTM). PLI's portfolio offers a wide range of Manual Transmission Fluids (MTF), Automatic Transmission Fluids (ATF incl. DCTF) and Axle/Differential Fluids for global applications in the automotive sector (Passenger Car and Commercial Vehicles).

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Largest International Exhibition on Automotive Transmissions, HEV and EV Components



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www.aam.com/europe

As a leading Tier One global automotive supplier, **AAM** delivers driveline and drivetrain systems and components around the world. Our intense focus on engineering and manufacturing allows us to build value for our customers through quality, technology leadership, and operational excellence. AAM is present in more than 30 locations in 13 countries worldwide.



Afton Chemical Ltd

www.aftonchemical.com

Afton Chemical is the market leader for additives used in Automatic and Dual-clutch Transmission Fluids, and is approved by Ford, Daimler, GM, VW & ZF for factory fill. As the additive provider of the lowest-viscosity transmission oil worldwide, Afton offers “on-demand” solutions for customers to match their hardware needs, and performance that is maintained throughout the lifetime of their transmission.



AIDA Germany GmbH

www.aida-europe.com

AIDA – leader in the metalforming industry – has been concentrating on the innovation, development, manufacture, and sales and service of metal stamping equipment. AIDA is a global brand in the press industry with production and development facilities in Japan, Asia, the United States, and Europe. With a global network of sales and service locations in 42 cities across 20 countries.



Associated Spring

www.asbg.com

A pioneer, leader & innovator in the engineered spring & precision metal component manufacturing industry. With a wealth of engineering capability & manufacturing expertise, the Associated Spring Team solves customers’ complex product and process design challenges, to help them achieve superior performance & competitive advantages in the market place.



Associated Spring Raymond

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ATESTEO GmbH

www.atesteo.com

ATESTEO GmbH – Drivetrain Testing specialist for the automotive and automotive supply industry. With 120 drivetrain test benches and 450 experts, we are represented at 5 locations in Germany and China. Car manufacturers and automotive suppliers rely on our independent testing results, which we can ensure due to the sophisticated and customisable features of our test benches, the flexibility and the high level of expertise of our experienced employees. With 30 years of market experience, we are well prepared for your tasks. Take advantage of our promise: Excellence in Drivetrain Testing.



Athena S.p.A.

www.athena.industries

Born in Northern Italy in 1973, **Athena** is today an International Group with 10 plants worldwide. Considered the best partner for solutions which guarantee maximum reliability and quality for Tier 1, Automotive and Powertrain Industries; Athena engineers and provides high quality gaskets, sealing systems, metal parts and rubber parts.



ENGINEERED COMPONENTS

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www.bginc.com

Barnes Engineered Components (EC) is a world class manufacturer, supplier and distributor to key markets including: Automotive, Medical, Aerospace, HVAC/Refrigeration, High Tech/Telecom, HDT, Construction/Mining, Energy & General Industrial. EC spans 20+ global manufacturing and non-manufacturing strategic locations, with approximately 1,500 employees dedicated to collaborating with customers, adding value through innovation and state-of-the-art technologies.



Werkzeug- und Maschinenbau

Paul Beier GmbH | Werkzeug- und Maschinenbau & Co. KG

www.beier-kassel.de

Paul Beier is one of the leading companies in the field of tool manufacturing and mechanical engineering. Our customers are top German and international industrial enterprises. They rely on our precision and professionalism. And value the flexibility and proximity offered by a medium-sized enterprise such as ours.



driven by passion

Bomatec Automotive AG

www.bomatec.ch

Bomatec is involved for 20 years with magnet-, sensor- and drive technology. Bomatec is a competent, solution-oriented and quality-conscious supplier to automotive, general equipment and machine industry with our own R&D, production and testing laboratory. Magnets: Permanent magnets, magnet-assemblies, customer-designed solutions. Engineering for magnetic circuits, sensors and e-motors. F/E calculations and simulations, preparation of prototypes. Test laboratory for magnets and sensors. Sensors: Resolver, encoders, MEMS-Gyro.



Invented for life

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www.bosch-mobility-solutions.com

Automotive Technology is the largest **Bosch Group** business sector. The Bosch Group is one of the leading automotive suppliers. Bosch provides technologies and solutions for the electronic and hydraulic control of all types of automated transmissions and offers key components for CVT.



Springs & Wireforming

Brand KG

www.brand-group.com

The **Brand Group** is the specialist for development and manufacturing cold formed technical springs and wire formed parts. In Europe we are the leading producer of damping springs for the powertrain. We offer innovative technology and efficient solutions for constantly increasing requirements. Our customers appreciate since decades our reliability and know-how regarding material, development, prototypes and as well our sophisticated manufacturing technology.



Bühler Motor



Bühler Motor GmbH

www.buehlermotor.de

Bühler 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 1700 employees at ten locations worldwide, we are committed to offering world-class products to help to improve the drivetrain efficiency and performance.


Christian Bauer GmbH + Co. KG
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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 we also support you with tailored and customised developments.


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How do you use prediction to prevent breakdowns? How do you capture user profiles without additional sensors? How do you lower material costs and design automotive components user-oriented? With the software from **compLIFE!** compLIFE is a start-up-project, which is founded by the EXIST-program of the Federal Ministry for Economic Affairs and Energy (BMWi).


Continental AG
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With sales of €39.2 billion in 2015, **Continental** is among the leading automotive suppliers worldwide. The Transmission business unit (BU) is one of five BUs of the division Powertrain, which integrates innovative and efficient system solutions for the drivetrain. BU Transmission develops and produces electronics and mechatronic systems for controlling the latest automatic transmissions such as stepped automatic transmissions, continuously variable transmissions (CVT), automatic gearshift systems, double-clutch transmissions, transfer boxes and all-wheel drive systems


Curtiss Wright/Metal Improvement
www.cwst.de

CWST – since 1945 known as Metal Improvement Company – with more than 70 global business units is the market leader in the process “Controlled Shot Peening”. The implementation of Engineered Coating Services and the development of our Laser Peening Process expanded our product portfolio to a complete high quality package (One-Stop-Job) for our customers in the global Surface Technology sector.


CY Myutec
www.cymyutec.com

CY Myutec is specialized in development and manufacturing of Synchronizer Rings for Manual and Dual Clutch Transmission. As a total solution provider, the company offers Synchronizer Ring pack design consulting including various tests and simulations. On the basis of self-developed carbon friction material technology, the company's product portfolio comprises steel stamping & forging and brass alloy Synchronizer Rings.


Daimler AG
www.daimler.com

Daimler AG is one of the world's most successful automotive companies. With its divisions Mercedes-Benz Cars, Daimler Trucks, Mercedes-Benz Vans, Daimler Buses and Daimler Financial Services, the Daimler Group is one of the biggest producers of premium cars and the world's biggest manufacturer of commercial vehicles with a global reach. Daimler Financial Services provides financing, leasing, fleet management, insurance and innovative mobility services.


DivgiWarner Pvt. Ltd.
www.divgi-warner.com

DivgiWarner is India's leading supplier of specialized Automotive Powertrain Solutions and Products. As a joint venture between Divgi Metalwares Pvt. Ltd. and BorgWarner Inc. (USA), it leverages its over 50 years of manufacturing experience in automotive transmission and 100+ years of BorgWarner's leadership in powertrain components to provide world-class Torque Transfer and Transmission Solutions to top OEMs in India and across the globe.



Drive System Design Ltd

www.drivesystemdesign.com

Drive System Design (DSD) is an innovative transmission design and development company. DSD specialises in transmission/driveline design, simulation, control engineering, test and development, delivering prototype demonstrators and solutions to production issues. Current technology focus is around robust low noise gear design for volume production, efficiency improvement process for existing and novel axles/transmissions, light-weighting and eDrive solutions for EV/Hybrid architectures.



DVS Technology GmbH

www.dvs-production.de

As the service provider in the strong community of the DVS group, **DVS Technology** offers contract manufacturing equipped with everything that is required for a sophisticated serie production. Our areas of expertise:

- turning, gear tooth forming, grinding
- gear honing, gear grinding
- machining before and after heat treatment
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The latest machine generations of the DVS group are used for the entire production technology.



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www.ebmpapst.com

The **ebm-papst Group** is the world's leading manufacturer of fans and motors. As a highly qualified engineering partner of the automotive industry, our precision machines have been helping to make the driving experience safer, more comfortable and less stressful. A growing number of renowned manufacturers and system suppliers, in both the passenger and commercial vehicle areas, are among our customers.

- bore honing



ECM Technologies

www.ecm-furnaces.com

ECM Technologies has been manufacturing vacuum industrial furnaces for over 50 years. With decades of field feedback, ECM has built itself a strong reputation in automotive, aeronautics, commercial heat treatment and other industries. Worldwide Leader in low pressure carburizing equipment for automotive market thanks to the flexibility and high productivity of the ICBP® Installations.



EFI Automotive

www.efiautomotive.com

As a recognized tier-one automotive supplier, **EFI Automotive** delivers electronic and electromagnetic systems to major carmakers worldwide. These systems improve performance in three major vehicle functions: engine, drivetrain and energy management. Thanks to its 80 years' experience, EFI Automotive offers its customers :

- Unique competencies and industrial know-how.
- A approach based on anticipation and innovation, designed to stay one step ahead of customer needs



EJOT GmbH & Co. KG

www.industrie.ejot.de

The **EJOT Group** is a medium-sized company which is dedicated to innovative fastening solutions. The Industrial Division produces thread-forming fasteners for plastics and metal. Cold forming parts are manufactured up to a 6-die/6-blow forming stage. Another group of products are novel fastening elements, especially designed to work with new materials and material combinations.



ElringKlinger AG

www.elringklinger.com

We develop and produce cylinder-head and specialty gaskets, lightweight plastic components and shielding systems for engine, transmission, exhaust tract, underbody and body applications. Specifically for transmission applications, our portfolio is complemented by partially coated sandwich plates for hydraulic control units, integrated mesh solutions, shift pistons and plastic oil pans, bearing rings, piston rings and guides made of PTFE. We have increased our share of the market for transmission control plates. **ElringKlinger** operates its own production sites for this technology within the world's key automotive markets: China, Europe and the US.

ENCOPIM

ENCOPIM S.L

www.encopim.com

ENCOPIM S.L. is a leading company in development, manufacturing, installation and commissioning of turnkey testing equipment as well as later servicing. In the automotive sector ENCOPIM supplies customers with driveline and powertrain test rigs. ENCOPIM has its own technology in control software and mechanics, which allows supplying innovative solutions with high added value.



Erdrich Umformtechnik GmbH

www.erdrich.de

Core Competencies:

- Development and production of complex deep drawing parts and assemblies.
- Experience in changing manufacturing processes.
- Intelligent solutions achieved by our development capability with state of the art equipment.

Products: Deep drawings, Stampings, Fine blanking parts and assemblies

Customers: Daimler, BMW, VW, Vibracoustic, Bosch-Group, ZF-Group, Schaeffler Group, Continental Automotive Group, BorgWarner, Getrag, FTE, Valeo



ERNST GROB AG

www.ernst-grob.com

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.

- Cold forming machines for sheet metal and solid components
- Slotting machines for sheet metal components
- Subcontracting
- Engineering

ERNST

Ernst Umformtechnik GmbH

www.ernst.de

Ernst Umformtechnik GmbH is a recognized, leading partner in the sheet metal forming industry. Core activities are the production of high precision stampings, deep drawn parts and assemblies as well as the development and production of prototypes. Complementary processes such as laser welding, machining and surface- / heat treatment complete the program. Product portfolio: components for synchronization-, clutch- and transmission systems, waste gas, automotive safety, automotive electronics and HVAC.



FAVI

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FAVI is the provider of your technical solutions in pressure die-casting. Main activity is the development and production of shift forks in brass or aluminium for gear boxes, from single parts to a complete internal shifting system. Moreover, FAVI is leader in production of die-cast copper rotors for e-mobility and hybrid motors.



Federal-Mogul Powertrain Sealing & Gaskets

www.federalmogul.com

Federal-Mogul Holdings Corporation is a leading global supplier of products and services to the world's manufacturers and servicers of vehicles and equipment in the automotive, light, medium and heavy-duty commercial, marine, rail, aerospace, power generation and industrial markets. The company's products and services enable improved fuel economy, reduced emissions and enhanced vehicle safety. Federal-Mogul's Powertrain Division designs and manufactures original equipment powertrain components and systems protection products for automotive, heavy-duty, industrial and transport applications.



Feintool International Holding AG

www.feintool.com

Feintool is a world leader in the development of fineblanking systems and in the production of pre-finished, high-precision fineblanked and formed components for demanding industries, particularly the automotive industry. Feintool's processes support its current trends toward lighter vehicles, improved transmissions and module types. With locations in Europe, Japan, China and the US, Feintool is represented in the most important automotive markets.



FEV GmbH

www.fev.com

FEV is an independent powertrain systems research, design and development company. From concept to production, FEV offers comprehensive transmission design and development solutions for a variety of applications ranging from electric or hydraulic hybrids to conventional systems. We provide extensive functional/durability testing and benchmarking for all transmissions types.



Fischer & Kaufmann GmbH & Co. KG

www.fiuka.de

FIUKA ranks among the renowned suppliers of the automotive industry. Main focus is the development and manufacture of metal parts in 100% cold forming technology for airbag, chassis, exhaust system, engine and transmission. Using mechanical and servo-presses (150 – 1,600 tons) and with the utmost precision, we manufacture components from steel, stainless steel, aluminium and special materials. Engine and transmission parts are finished on automated production lines.
Sites: D-57413 Finnentrop and PL-55 300 Środa Śląska



Freudenberg Sealing Technologies GmbH&Co. KG

www.fst.com

Freudenberg Sealing Technologies Automotive, a market leader in the auto industry's technology, quality and service segments, provides a wide range of products to all the major automobile and commercial vehicle manufacturers worldwide. The portfolio includes a large assortment of seals – ranging from O-rings to bidirectional, low-friction cassette seals.



FTE automotive GmbH

www.fte.de

The **FTE automotive Group** is your competent partner in the sector of development and production of drive train and brake system applications for the automotive industry. The company is located in all important continents and one of the leading OE-suppliers for passenger cars and commercial vehicles worldwide.



FunctionBay Inc.

www.functionbay.co.kr

FunctionBay is the world's fastest-growing CAE software company developing 'RecurDyn' which is an engineering simulation software based on Multi-body-dynamics (MBD) with the most high-leveled cutting-edge technologies. FunctionBay has been providing many industry customers with various engineering solutions throughout its own software of RecurDyn as well as a cooperative CFD code of Partcleworks developed by Prometech Software to help them resolve their engineering challenges in fields of automotive, ship-building, railway, robot, heavy industry, military equipment, and many other areas related to mechanical and electronic fields of engineering.



GIF - ENTWICKLUNGSGESELLSCHAFT MBH

GIF-Entwicklungsgesellschaft mbH

www.gif-e.de

GIF-Entwicklungsgesellschaft mbH ("GIF-E") strives to introduce innovative developments into the market and into series production for protected patents of vehicle powertrain. Current developments include the Axial Piston Engine, the Cone-Ring-Transmission and a new Dry Torsion Damper. These innovative technologies achieve significant improvements in efficiency and therefore help to reduce fuel consumption and pollution.



GKN Driveline | GKN Driveline International GmbH

www.gkn.com/driveline

GKN Driveline is the world's leading driveline technology engineer, an expert in conventional, hybrid and electrified power delivery, employing around 25,000 people at 46 locations in 23 countries. GKN Driveline is a true integration partner with unmatched driveline expertise delivering brand aligned driving experiences.



GKN SINTER METALS

GKN Sinter Metals Engineering GmbH

www.gknsintermetals.com

GKN Sinter Metals is the world's largest development & production partner of high precision sintered metal products for automotive drivetrain application. GKN engineers and produces solutions for NVH reduced high performance gears, light-weight hydraulic and actuation pump components. The company's metal additive manufacturing capability for prototypes enables to shorten development cycle times.



Great Taiwan Gear

www.taiwangear.com

Great Taiwan Gear is a leading manufacturer of high-accuracy gears and transmission assemblies. Our production capabilities allow us to offer our customers the quality, cost effectiveness and reliability they demand. We have considerable experience in the production of gears, shafts and complete assemblies for DCT, CVT, EV and Hybrid projects - from prototypes to mass production. Our willingness and ability to manufacture and develop new products in cooperation with our customers in a short space of time is the basis for our growth.



A business of BARNES GROUP INC

Heinz Hänggi Stanztechnik

www.hanggi.ch

A world class partner for ultra-precision microstamping and fine-blanked applications. **Hänggi** offers unique solutions from engineering prototypes to serial production including complete assemblies. They specialize in producing complex metal stampings or by converting machined components into stamped parts gaining significant efficiencies and superior value. Hänggi has unmatched engineering expertise and manufacturing disciplines to provide complex stampings, optimal lifecycle costs & superior quality and service.



Henkel AG & Co. KGaA

www.henkel.com

Henkel is a leading solution provider for adhesives, sealants and functional coatings worldwide. We offer a comprehensive portfolio of tailor-made solutions for our customers. In the Transport and Metal business, we provide the automotive, aircraft, and metal processing industries with superior system solutions and specialized technical services.



the heart of your performance

hGears

www.hgears.com

Born from merge of two historical brands, Herzog and miniGears, **hGears** is one of the world's leading manufacturers of precision turned parts, drive components, gear kits as well as complex system solutions. These components can be manufactured either with Powder Metal or Cut Metal technology. Based in Germany, Italy and China with more than 1000 employees, hGears works with customers to develop and engineer precision gears and components for automotive, motorcycle, power tools, outdoor products, ebike and other industrial applications.



HMP Umformtechnik GmbH

www.hmp.com

HMP's activities are concentrated on lightweight tubular automotive components. We support our customers during the product design phase, are developing manufacturing processes and are producing tools and prototypes. In the next step we can either build production equipment that is specially configured to meet customer's requirements or we can produce and deliver components according to automotive standards.



HOERBIGER Antriebstechnik GmbH

www.hoerbiger.com

HOERBIGER is the leading independent provider of synchronizer systems worldwide. The Strategic Business Unit Drive Technology offers full "package" support from complete development down to serial supplies of components and complete synchronizer systems: The ClassicLINE offers flexible solutions for all applications, the new ClassicLINE DCT-Type was specifically developed for dual clutch transmissions, and the CompactLINE is ideally suited for compact transmissions.



hofer powertrain GmbH

www.hofer.de

Established in the 1980's, **hofer** is a global automotive engineering consultancy with expertise in the field of powertrain and energy efficiency. Development, industrialisation and production of components for passenger cars, trucks, mobile industrial and construction machines, motorcycles and special vehicles form hofer's core competences. The hofer group is placed strategically: its competence centers in Germany and abroad are in close proximity to customers and thus guarantee efficiency, promptness and short reaction time.



Hugo Benzing GmbH & Co.KG

www.hugobenzing.com

As one of world's leading producer of retaining elements **Hugo Benzing** is a Tier-1 supplier for almost every reputable automotive manufacturer. On more than 20.000 square meters we employ about 620 people. Over 22.000 different items are included within our product range of retainers, wire forms, precision stampings and complex designed assemblies. Benzing components are used in numerous applications for example in parking lock systems for torque converters and dual clutch transmissions.



IAV

www.iav.com

About IAV: Employing over 6,500 members of staff worldwide, IAV is one of the world's leading providers of engineering services to the automotive industry. The company has been developing innovative concepts and technologies for future vehicles for more than 30 years. Core competencies include production-ready solutions in all fields of electronics, powertrain and vehicle development. Clients include all of the world's premier automobile manufacturers and suppliers.



IBS Filtran GmbH

www.ibs-filtran.com

IBS Filtran GmbH/Filtran LLC leading manufacturer of filter system solutions for automatic transmissions. With our development centers and manufacturing plants in Germany, USA, China and Mexico, as well as cooperation partners in Japan and Korea, we are able to satisfy our global customers' requirements due to innovative system solutions.

Brinkmann

www.ing-db.de

Ing-D.B. GmbH is your partner for the development and distribution of automation technology. One focus are the setting processing equipment for sealing plugs, blind rivet nuts, rivet screws and blind rivets. From simple manual workstations, over the use of process monitoring, to a high level of automation with automatic feeding systems and workpiece handling all customer requests can be satisfied.



Institute of Automotive Engineering
Member of Automotive Research Center Niedersachsen
Technische Universität Braunschweig

www.iae.tu-bs.de

- Shift and launch comfort (objectification, documentation, automated application)
- Requirement engineering and representative load spectra (testing, simulation, requirements based on customer operation and test routes)
- Gearshift and selector lever actuation (objectification, optimization)
- Drivetrain efficiency (measurement, simulation and optimisation of drivetrain components)
- Energy and thermal management
- Electric and hybrid drives (analysis of drivetrain topologies, simulation, customer benefit, control strategy)



JATCO Ltd

<http://www.jatco.co.jp/ENGLISH/index.html>

JATCO is a dedicated manufacturer of automatic transmission for automobiles including the step automatic transmission (AT) and the continuously variable transmission (CVT). With a mission to provide value to our customers, to automotive culture and to society, we constantly strive to provide high quality transmission units that meet the needs of society to our customers in a speedier manner. Today, JATCO offers an extensive line that includes step AT, advanced and environmentally friendly CVT and a transmission exclusively for hybrid vehicles. We are also the only manufacturer of CVT in the world to feature a line up that spans from mini vehicles through to full-size sedans.



Jing-Jin Electric

www.jjecn.com

Jing-Jin Electric (JJE) is China's leading supplier of traction electric motors for EV, HEV and PHEV. JJE provides highly competitive drive motor products featuring high power intensity, high torque intensity and high reliability. It also extends its technology and products to electric drive assembly and its core parts and components, supplying to customers more complete solutions of these products including motors, motor controllers, precise transmissions, and advanced control software.



Johnson Electric Germany GmbH & Co KG

www.johnsonelectric.com

The **Johnson Electric Group** is the world's leading provider of innovative motion subsystems and components for transmission and driveline applications. We improve fuel economy and driving experience by deploying advanced motion technologies and precision manufacturing processes for global automotive markets. Johnson Electric Group is headquartered in Hong Kong and has over 38,000 employees in 24 countries.



JOPP Group

www.jopp.com

The **JOPP Group's** product range comprises gearshift systems and knobs, mechanical components (machining), powder metal parts, plastic components and electronics. There are 10 production sites worldwide. Own developments include internal and external shifters as well as oil- and water-bearing engine and transmission components. With its various own patents in the shifter sector, JOPP has been a competent partner in the automotive industry for many years.



JTEKT Corporation

<http://www.jtekt.co.jp/e/index.html>

JTEKT Corporation was established in 2006 through the merger of Koyo Seiko Co., Ltd., a world-class bearing manufacturer, and Toyoda Machine Works, Ltd., a machine tool manufacturer excelling in world-leading technologies. Combining the most advanced technologies and the manufacturing passion of the two companies, JTEKT is now a trusted systems supplier of automotive components, bearings and machine tools, providing customers with world-class products and technologies that result in ongoing contributions to society.



KACO GmbH + Co. KG

www.kaco.de

KACO develops and produces seals for moving parts of machines and vehicles. The company is strongly development-oriented. Its customers today include almost all OEMs and many tier-one suppliers. High level in automatic production systems, advanced development equipment in-house. Manufacturing plants are in Germany, other European countries, USA and China.



Keihin Seimitsu Kogyo Co.,Ltd

www.ksk-inc.co.jp

KSK offers the next stage of production creation. KSK can provide various light-weight and environmentally friendly products by "high strength, high density aluminum die-casting" and "high quality aluminum die-cast" technology and new developed plastic binding and one clutch one motor technology. As a systems supplier in Japan, KSK manufactures products in an integrated manner from design to die-casting through to processing and assembly.



Kissling Elektrotechnik GmbH

www.kissling.de

KISSLING is a leading provider of high power relays and switches for automotive, heavy duty and special vehicles, aircraft, military. KISSLING develops and manufactures high quality and reliable standard or customized components as well as system solutions.



KISSsoft AG

www.KISSsoft.AG

KISSsoft is a modular calculation system for the design, optimization and analysis of machine elements. The scope of the software ranges from a single machine element up to the automatic sizing of complete gearboxes. Besides calculation software, we provide the power transmission community with engineering services, know-how and training. In the last 25 years, over 2800 companies decided to use KISSsoft/KISSsys to their advantage. KISSsoft AG is located in Switzerland with resellers worldwide.



H. Kleinknecht GmbH & Co. KG

www.testing-technology.com

H. Kleinknecht GmbH & Co. KG holds the entire expertise in testing technology for gearboxes. The company covers the complete scope such as test stands for manual, automatic, double-clutch, electric-transmission, and hybrid gearboxes, components, and corresponding assembly lines. Due to the self-developed test stand automation system ATS-Advanced the company holds proven know-how in software engineering.



KOKI TECHNIK Transmission Systems GmbH

www.kokitransmission.com

KOKI TECHNIK: Both development partner and production company. KOKI initiates and gives support to development processes of transmission systems and produces the components. KOKI's current product range contains shift towers, shift forks and parking lock systems that enable the switching operation as well as the shift feel both of a manual and double clutch transmission. www.kokitransmission.com



Kolektor group, d.o.o.

www.kolektor.com

Kolektor is a development and production partner for various Motor Components and Subsystems and due to innovative technology offers key solutions for Motors, Brakes, Gear boxes and Electronics. Through production locations on the European, Asian and the U.S. market, Kolektor utilizes its full technological and developmental potentials to ensure customer satisfaction.

**Konzelmann GmbH**www.konzelmann.com

Are you looking to increase efficiency without adding extra costs in your tribological system? Look no further.

At **Konzelmann GmbH**, using global market experience and results from our test laboratory, we design each solution's polymer blend and geometry in order to optimize your application, with price and performance in mind. Our solutions include bushings, axial/radial bearings, thrust washers, seal rings, gears, guiding components, and more.

**Kyowa Synchro Technology Europe SAS**<http://www.kyowagokin.co.jp/e/>

Kyowa Synchro Technology Europe is responsible to European market as a member of Kyowa Metal Group, a global synchronizer ring manufacturer. Not only to supply conventional rings, Kyowa also has high expertise to develop innovative systems which can provide proper solutions for VA/VE requirement in the synchronization mechanism.

**LEE Hydraulische Miniaturkomponenten GmbH**www.lee.de

For more than 65 years, "The LEE Company" has been a leading supplier of high-precision, miniature hydraulic components mainly for the aerospace industry but also used in the Offshore industry, in the racing world and other high end industries. In the late 80s the portfolio has been extended by an industrial valve program. Formally used in the automotive and truck industry but also used in the medical and pharmaceutical market.

**Linamar**www.linamar.com

Linamar is a diversified global manufacturing company of highly engineered powertrain products. Linamar has extensive product expertise in transmission modules, driveline components and complete AWD systems, including Hybrid e-Axle solutions. Linamar's manufacturing capabilities include Machining & Assembly, Forging, Light Metal Casting and Metal Forming.

**LTTO** http://dial.uclouvain.be/pr/boreal/object/boreal%3A168982/datastream/PDF_01/view

LTTO helps researchers of the UCL - University of Louvain in Belgium - to transfer their technologies to companies: The LTTO licences their discoveries or sets up spinoffs.

This year, the LTTO presents a CVT which is a true innovation - see all details via

**Marzocchi Pompe SPA**www.marzochipompe.com

Marzocchi Pompe SPA is specialized in design and manufacturing of external gear pumps and motors for high performance: not only micro hydraulics (as low as 0,18 cc/rev) but an extended range of products to cover all the standard needs of the market in terms of displacement, flanges, shafts and porting. Marzocchi has established in Zola Predosa a new product location with a dedicated assembly and testing area for all automotive projects in addition to standard products in continuous development (low noise and energy saving).

**MAZARO nv**www.mazaro.eu

As a Belgian engineering company, **MAZARO** designs innovative, ultra-high-efficiency transmissions based on an improved CVT principle. They function without slipping components, suffer no internal drilling motion and are the first CVTs that can handle high torques. Suitable for all ground transport driving on any kind of fuel, electricity and hybrids.



Melecs EWS GmbH

www.melecs.com

Melecs Elektronikwerk Siegendorf (EWS), with sales revenue of 162 million euros, is the largest electronics manufacturing service provider (EMS) with Austrian roots and has more than 25 years of experience. All value creation stages from development, validation and industrialization to production and logistics are provided from a single source. Melecs EWS relies on innovative solutions tailored specifically to its customers, such as in the areas of all-wheel drive ECUs (Electronic Control Units) and LED lighting in vehicles.



Metaldyne GmbH

www.metaldyne.de, www.mpgdriven.com

Our leading position in the automotive industry is demonstrated by our capabilities in metal components, products and modules for chassis and powertrain, engine and transmissions applications. Our high quality products lead us to our common goal: optimization of resources, reduction of cycle times and therefore, cost reduction and improvement of vehicle quality and performance.



MIASA

www.miasa.com

MIASA develops, validates and manufactures lightweight solutions for almost all automotive brands since 1968. We are based in America, Europe and Asia assuring our highest quality standards to our customers worldwide. We are completely vertical integrated from casting to final assembly producing transmission parts and assemblies.



Miba Group

www.miba.com

Global presence, years of experience and ongoing technological progress distinguish the **Miba Group** as market and technology leader. Sintered components, friction materials and coatings make vehicles more efficient, more reliable and more environmentally friendly.



Michigan Spring and Stamping

www.msands.com

Michigan Spring and Stamping manufactures a complete range of technical springs, flat springs, precision stampings, wire forms, clutch return springs, and detent assemblies for transmission applications. Cradle to grave philosophy including wire and flat spring design, FEA, prototyping, and component testing and verification services. Significant investment in automated processes and 100% inspection.



Moving Magnet Technologies

www.movingmagnet.com

MMT is an innovative company specialized in the field of electromagnetism. This unique know-how applies in the development of direct drive actuators, non-contact position sensors and electric motors. These mechatronics systems integrating patented technology are then industrialized for mass production in collaboration with the customer under a License agreement. MMT offers a full range of engineering services including magnetic simulation, prototyping and tests, drive electronic and magnetization equipments.



MS-Schramberg GmbH & Co. KG

www.ms-schramberg.de

MS-SCHRAMBERG – EVERYTHING FROM A SINGLE SOURCE FOR MAXIMUM RELIABILITY

MS-Schramberg has been synonymous with problem-solving expertise and quality for 50 years. The company is one of Europe's leading manufacturers of permanent magnets and assemblies. More than 550 employees are developing and producing more than 5,000 customer-specific articles, used successfully worldwide by companies from a wide range of sectors.

Mubea

Mubea Tellerfedern GmbH
Muhr und Bender KG

www.mubea.com
www.mubea.com

Mubea Tellerfedern GmbH produces highly-stressed transmission springs and separating springs for modern automatic transmissions, CVT- and dual clutch transmissions. The transmission weight and drag torque losses can be reduced significantly by using Mubea disc springs instead of coil springs. Further products in the transmission sector are light weight transmission shafts. The weight of these shafts can be reduced by up to 30 %.

Nidec

Nidec Corporation

www.nidec.com

Nidec, the world's No.1 comprehensive motor manufacturer was established in 1973. Aiming to become the world's best, Nidec has since developed its business based upon the motto "everything that spins and moves." Regarding the automotive sector, Nidec provides powerful and energy efficient, high quality, electric motors, to steadily increase its market shares.

oerlikon

Oerlikon Metaplas GmbH

www.oerlikon.com/balzers

Oerlikon Balzers is one of the world's leading suppliers of surface solutions that significantly improve the performance and durability of precision components as well as tools for the metal and plastics processing industries:

- Plasma heat treatment, primarily for wear and corrosion protection
- PVD coating
- PACVD coating minimizing friction
- Duplex treatment (nitriding and PVD/PACVD from a single source)

Oerlikon Balzers maintains 108 Coating facilities in 35 countries worldwide.

oerlikon

Oerlikon Friction Systems (Germany) GmbH

www.oerlikon.com

Oerlikon Friction Systems specializes in manufacturing synchronizers for manual and dual-clutch transmissions, as well as developing customer-focused synchronizer components and modules. Oerlikon Friction Systems is the leader in Carbon friction technology. With a combination of in-house produced stamped steel synchronizers and highly efficient friction materials, Friction Systems offers the ideal solution for maximum gear shifting comfort during the lifetime of the vehicle.

Locations: Germany, USA (2x), Brazil, Italy, China, India (2x), UK, Japan & Thailand

oerlikon graziano

Oerlikon Graziano SpA

www.oerlikon.com/graziano

Oerlikon Graziano is world's no.1 in design, development and supply of transaxles for high performance cars, highly specialised in transmission systems for 4WD (PTU, RDM and transfer case assemblies), electric and hybrid transmissions for passenger cars and commercial vehicles, key player in applying innovative technology, as DCTs, AMTs and their hybrid derivatives to premium supercars. Leading transmission controls technology is provided by Vocis, majority owned by Oerlikon Graziano.



PMG Füssen GmbH

www.pmginter.com

The **PMG group** is a leading manufacturer of powder metallurgical modules and components for the automotive industry, especially in the field of transmissions and shock absorbers, and of soft magnetic powder composites (SMC) for electrical applications in various industries. With seven production facilities on three continents and more than 50 years of experience in R&D and production, the PMG group covers the world's automotive markets as a leading supplier.



Profiroll Technologies GmbH

www.profiroll.de

Profiroll Technologies is specialized in the development and manufacturing of thread rolling machines, spline rolling machines and cold ring rolling machines. The appropriate process techniques and rolling dies are completing the service.



Punch Powertrain NV

www.punchpowertrain.com

Punch Powertrain N.V. is an independent Tier1 developer and manufacturer of continuously variable transmissions (CVT), dual clutch transmissions (DCT), electrical and hybrid powertrains for passenger cars. In developing the new generation CVT, DCT and hybrid powertrains optimal performance, minimal fuel consumption, low emissions and driving pleasure are key topics.



Reich GmbH

www.reich-gmbh.com

Integrity, Sustainability and Quality – As a leading manufacturer of turned parts, ball bearings, components for injection systems and other vehicle parts, the name **REICH** stands for quality. Our company was founded 1919 as a family business and even today Reich GmbH is still 100 % family owned, we are located in Germany and USA.



Ricardo Deutschland GmbH

www.ricardo.com

Ricardo has a leading, fully integrated design, development and low volume production capability for driveline and transmission systems. Our engineers have been responsible for an extremely wide range of products on a global basis, from cost-optimized manual transmissions to advanced dual clutch transmissions. We also have over 50 years of experience in the provision of testing programmes enabling us to help our customers deliver the latest technologies focused on optimized efficiency, improved driving enjoyment and reduced lifecycle costs.



Romax Technology

www.romaxtech.com

Romax Technology provides software and services for gearbox, bearings and driveline systems to EV, automotive, aerospace, off road, rail, marine, bearings and wind energy sectors worldwide. We offer an all-in-one solution for electrified and conventional driveline systems. 14 of the world's top 15 auto manufacturers use Romax solutions to help them get better quality products to market faster and at lower cost.



ROTOR CLIP s.r.o.

www.rotorclip.com

Rotor Clip is the leader in the manufacture of tapered, constant section and spiral retaining rings meeting DIN, Inch, ANSI Metric and JIS standards, as well as TRUWAVE wave springs, ROTOR CLAMP hose clamps and custom designs. We support the market with first class Engineering Know-How, expert advice, reliability of delivery and high quality products. Rotor Clip is certified to ISO 9001, TS 16949, ISO 14001 and AS9100.



RÜBIG GmbH & Co KG

www.rubig.com

RÜBIG GmbH & Co KG encompasses the strategic divisions Die Forge, Heat Treatment, Aluminum and Engineering. The optimized synergies established the group as innovative leader in any metal working industry worldwide. Above all, the Know-How that is reflected in the plants has been gained in the in-house job shop for years.


Saint-Gobain Performance Plastics L+S GmbH
www.seals.saint-gobain.com

Saint-Gobain Performance Plastics L+S GmbH is your global partner for applying high-performance and high temperature polymer materials to solve engineering challenges in advanced transmissions. Since 1985 we specialize in design, testing and manufacturing expertise in seal rings, thrust washers and radial plain bearings. In line with the trends in automotive and transmissions developments, our innovative solutions are designed to increase efficiency by reducing leakage, drag losses and component wear. In addition these engineered components can be used where their compact installation, low mass and easy assembly allow their high performance to be combined with economic efficiency.


Samkee Automotive Co., Ltd.
www.samkee.com

- Aluminum die-casting specialist since 1978, covering entire range of die-cast components for engine, transmission and structural applications
- 50 die-casting machines from 350 to 2,500 tons
- Provides one-stop solutions to customer by operating along the entire value chain of die-casting industry
- ISO/TS 16949, ISO 14001 and OHSAS 18001 certified


Schaeffler Technologies AG & Co. KG
www.schaeffler.com

The **Schaeffler Group** is a leading global integrated automotive and industrial supplier. The company stands for the highest quality, outstanding technology and strong innovative ability. The Schaeffler Group makes a decisive contribution to "mobility for tomorrow" with high-precision components and systems in engine, transmission, chassis applications and e-mobility as well as rolling and plain bearing solutions for a large number of industrial applications.


Scherdel
www.scherdel.com

SCHERDEL, with its 29 locations worldwide, 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. Our products can be found in power train applications, break systems and the car interior.


SEEGER-ORBIS
www.seeger-orbis.de

A world leading innovator and manufacturer of retaining and snap rings. **Seeger-Orbis** offer a large variety of industry standard products, specializing in specific items for customers' unique design applications. Utilizing state-of-the-art manufacturing processes and a wealth of experience, the Seeger team is able to design and manufacture retention solutions to fit individual requirements.


SELZER Fertigungstechnik GmbH & Co. KG
www.selzer-automotive.de

SELZER is one of the first addresses within the automotive industry. We design and manufacture systems and components in the areas transmissions, engines and brakes. In particular SELZER have a large know how for internal shift controls and shift fork systems. From the plants in Germany and Brazil SELZER supplies the customers world-wide.


SETFORGE
www.farinia.com

SETFORGE is recognized as one of the leading suppliers of high-quality forged parts made out of all forgeable materials using all kinds of forging technologies like hot-forging, upset forging, warm and cold forging. In particular for the transmission business field SETFORGE offers solutions like hollow shafts, parts produced by using different technologies as well as drive components which are the results of a close partnership together with our customers.



SGL TECHNOLOGIES GmbH

www.sglgroup.com

SGL Group – The Carbon Company is one of the worldwide leading manufacturers of carbon-based products. We have an in-depth materials, production, applications and engineering expertise, a comprehensive graphite and carbon fiber-based product portfolio, and an integrated value chain from carbon fibers to composites.



Shell Deutschland Oil GmbH

www.shell.de

Shell Lubricants are a global leader in the development of fluid solutions for the automotive industry. We work with OEMs and component manufacturers to deliver ATF, MTF and fluids for CVT, IVT, differentials and double-clutch systems for on- and off-road applications, continually improving friction durability, component life and fuel efficiency.



SHW Automotive GmbH

www.shw.de

SHW Automotive is one of the leading European manufacturer for transmissions- and lubricating oil pumps as well as sintered parts for transmissions and engines. SHW presents the latest developments of regulated concepts for oil pumps. The division sinter production will give you an overview of new material as well as of the form parts for camphaser systems.

SHW is also represented at the booth of the 'Powder Metal Gearbox Initiative'.



Simerics GmbH

www.simerics.de

Simerics offers two state-of-the-art CAE tools: SimericsMP and PumpLinX. These can solve a broad range of flow and thermal applications across industries. Areas of strength include cavitation, aeration, multiphase, transient flows, conjugate heat transfer in complex geometries.



AB SKF

www.skf.com

SKF is a leading global supplier of bearings, seals, mechatronics, lubrication systems, and services which include technical support, maintenance and reliability services, engineering consulting and training. SKF is represented in more than 130 countries and has around 17,000 distributor locations worldwide. ©SKF is a registered trademark of the SKF Group.



Smart Manufacturing Technology

www.smartmt.com

Smart Manufacturing Technology 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.



Sodecia FSG

www.sodecia.com
www.fsg-automotive.de

As part of the Sodecia Group, **Sodecia FSG** is a well-known solution provider and manufacturer of precision fine blanking parts and powertrain products with manufacturing facilities in Europe and Asia Pacific. Our precision transmission products range from manual gearboxes up to dual clutch systems and our powertrain specialized products range from shift forks to park break systems.



Solvay

www.solvay.com

With its unique portfolio of specialty polymers, **Solvay** is a world leader in high performance plastics, collaborating with customers to offer high quality, innovative transmission solutions while enjoying numerous advantages such as lightweighting, excellent friction and wear properties, broad chemical resistance as well as the ability to withstand extreme temperatures.



Sonceboz

www.sonceboz.com

SONCEBOZ develops, produces and sells electric motion solutions dedicated to AMT, DCT, CVT applications for the major global equipment manufacturers and OEM's in the automotive industry. Innovative mechatronic concepts and creative ideas are put into practice in partnership with the customer aiming to bring technological added value to the transmission or driveline architecture.



Stackpole Powertrain International GmbH

www.stackpole.com

Stackpole International is part of the Johnson Electric Group and is a premier global manufacturer of innovative engine and transmission pumps, electric pump modules and powder metal components to the global automotive marketplace. With products specified into the powertrain platforms of major nameplates worldwide, Stackpole is widely recognized as a technology-driven automotive supplier and global leader.



STIWA Group

www.stiwa.com

The **STIWA Group** with headquarters in Attnang-Puchheim, Austria is a leading company in the field of product and high-performance automation. The core competences of the group include product and software development for manufacturing automation, energy-efficient building technology, laboratory automation and supplier component production of premium metal and plastic subassemblies.



Swoboda KG

www.swoboda.de

Swoboda develops and produces in Germany, Czech Republic, the States, China, Romania and in Mexico and is a worldwide leader in the technologically complex area of molding elements (high-precision metal-plastic composite parts). Swoboda develops and manufactures components and assemblies for the automotive industry that form the interface between mechanical parts and electronics.



TE Connectivity Germany GmbH

www.te.com

TE Connectivity is a \$ 12 billion global technology leader. Our connectivity and sensor solutions are essential in today's increasingly connected world. We collaborate with engineers to transform their concepts into creations - redefining what's possible using intelligent, efficient and high-performing TE products and solutions proven in harsh environments.



teamtechnik Maschinen und Anlagen GmbH

www.teamtechnik.com

teamtechnik is an internationally leading company for innovative production technologies. Over 900 highly qualified employees have been developing and building intelligent and reliable automation solutions for assembly and functional testing. In transmission testing and testing of E-Drive components, the company supplies development test benches, interlinked serial test systems and complete EOL test facilities.


teckentrup GmbH + Co KG
www.teckentrup.de

Since 1938 the midsize family owned **teckentrup** has developed continuously towards a production specialist for stampings, coining, forming and deep drawing components with sophisticated requirements and for patent protected bolt locking products. Many years of experience in process and application engineering for substituting fine blanking, machining, powder metal and cold heading create cost optimized solutions for our customers.


TLX Technologies, LLC
www.tlxtech.com

TLX Technologies answers automotive system demands with superior electromagnetic solutions. Custom solenoids for automotive applications are vital in meeting system demands for better performance, safety, and greater fuel-efficiency. TLX partners with OEMs, Tier 1 and Tier 2 suppliers to reach these standards by delivering efficient, cost-effective custom solenoids and valves.


Torotrak Group
www.torotrak.com

Torotrak Group offers a range of innovative fuel saving and performance improving technologies for various vehicle applications. The Group's three core technologies include: Torotrak traction drive, a gearless variable transmission system; V-Charge variable ratio supercharging, offering efficient power boost for downsized engines, and Flybrid Energy Recovery Systems, a leading mechanical hybrid technology which is highly power dense, affordable and durable.


TREMEC Corp.
www.tremec.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 includes manual RWD transmissions, dual clutch transmissions, gears, shafts, clutches, shift controllers, synchronizers, and mechatronic systems with integrated clutch systems and control software.


UNICK Corporation
www.unick.co.kr

Established in 1971, **UNICK** today produces components for the automotive industry with more than 700 employees in its homeland Korea as well as in China. UNICK supplies hydraulic solenoid valves for automatic transmissions & oil pump to the main Korean OEMs. In addition UNICK also produces EGR-valves & EGR-Bypass valves. UNICK holds certification in accordance to TS16949, QS9000, ISO9001, ISO14001, OHSAS18001, CMMI level 3.


VACUUMSCHMELZE GmbH&Co.KG
www.Vacuumschmelze.com

VACUUMSCHMELZE (VAC) with 4,100 employees worldwide, thereof 1,450 employees in Hanau, designs, produces and markets advanced materials, particularly with magnetic, but also other physical properties as well as related products. In over 50 countries VAC Group today achieves annual sales of over 400 million euros and, with over 800 patents to the world's most innovative companies in the development of advanced industrial materials.

For more information, see www.vacuumschmelze.com

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Valeo Powertrain Systems

www.Valeo.com

Valeo is an automotive supplier, partner to all automakers worldwide. As a technology company, Valeo proposes innovative products and systems that contribute to the reduction of CO2 emissions and to the development of intuitive driving. Valeo is listed on the Paris Stock Exchange and is a member of the CAC 40 index.

For more information about the Valeo Group and its activities, please visit our website www.valeo.com



Victrex

www.victrex.com/automotive

Victrex, the innovative world leader in high-performance PAEK polymer solutions, supports engineers in developing cost-effective, durable transmission components enhancing fuel efficiency and driving comfort. That is why for more than three decades, the industry has specified VICTREX™ PEEK-based solutions for demanding transmission applications. In electric drives, APTIV™ films enable cost-efficient and reliable insulation solutions with higher energy density.



Walter Henrich GmbH

www.walter-henrich-gmbh.de

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



WEBO Werkzeugbau Oberschwaben GmbH

www.webo.de.com

We are 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 we offer our customers complete tool and process solutions for competitive production.



Winkelmann MSR Technology GmbH & Co.

winkelmann-flowforming.de

Winkelmann MSR Technology is a well-known supplier in the manufacture of rotationally symmetrical components using spinning and flowforming techniques. The advantage of manufacturing these components by means of forming technology compared to other techniques lies, inter alia, in the high degree of material utilization, the great final strength resulting from strain hardening, and in the weight reduction involved.



Winkelmann Powertrain Components GmbH & Co.

www.winkelmann-automotive.de

The company "**Winkelmann Powertrain Components**" produce among other things drive elements and driveline components by different non-cutting forming, for example Grob-forming, profiling, deep drawing and other innovative manufacturing processes. The company is subsidiary company of the "Winkelmann Group", are established suppliers of the automobile industry, construction equipments industry and agriculture industry, and belong to the world market leaders in these markets.



YASA Motors Ltd.

www.yasamotors.com

YASA's compact and lightweight electric motors enable vehicle hybridization and electrification when there is limited powertrain space. YASA is an OEM supplier and designs and manufactures axial-flux e-motors and generators at its volume manufacturing facility in the UK.


Yantai Shougang Magnetic Materials Inc (YSM)
www.ysm-magnet.com

YSM is a Sino-Japanese sintered NdFeB magnet manufacturer (2014 largest factory in China). We secure the supply risk of Heavy Rare Earth Element via :

- Heavy Rare Earth FREE material,

Supply advantage via one of our shareholder China North Rare Earth (owner of 83 % of China rare earth reserve)


ZF Friedrichshafen AG
www.zf.com

ZF is a global leader in driveline and chassis technology as well as active and passive safety technology. The company has a global workforce of around 138,300 at about 230 locations in some 40 countries and reported sales of €29.2 billion in 2015. ZF is one of the largest automotive suppliers worldwide.


Zoerkler Gears GmbH & Co KG
www.zoerkler.at

Zoerkler - the spirit of precision

From exactly made gears to high quality bevel gears and spur gears offers Zoerkler precisely manufactured gearboxes and drive systems worldwide. Beginning the development with production of prototypes and ending with testing of mounted series production transmissions stands Zoerkler for highest precision, quality and safety.


PUNCH Powerglide Strasbourg SAS
www.punchpowerglide.com

PUNCH Powerglide brings in more than 50 years expertise in the design, development and production of automatic transmissions.

The current product line includes 6-speed automatic transmissions (optional feature Stop&Start and in the future a P2 hybrid version) which are sold to customers around the world. Its R&D Centre ensures the application development, but also develops new transmission solutions ranging from DHT to a 10-speed automatic.



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Automotive Transmissions, HEV and EV Drives

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