Europe invites the world
International Conference on Gears 2023
FZG, Garching/Munich, Germany

Key topics:
- Sustainable gears with reduced carbon footprint and increased efficiency
- Optimization of gear design and geometry
- New test methods for endurance, efficiency and NVH behavior
- Numerical methods and multiscale simulation tools to improve gear performance
- Smart gears for condition monitoring systems and additional functions
- Life cycle assessment of geared drive systems

Associated organisations:

American Gear Manufacturers, USA
ARTEMA, France
ASSIOT, Italy
ASME
BAPT
British Gear Association
Chinese Mechanical Engineering Society
Canadian Society for Mechanical Engineering
CSVTS, Czechia
Drive Technology Research Association, Germany

Visit parallel conferences free of charge

Gear Production 2023
www.vdi-wissensforum.de/02TA411023

High Performance Plastic Gears 2023
www.vdiconference.com/02TA409023

An event organized by VDI Wissensforum
www.vdi-gears.eu
1st Conference day
Wednesday, September 13th, 2023

Plenary lectures

09:30 Common welcome and opening of the
- International Conference on Gears 2023
- International Conference on High Performance Plastic Gears 2023
- International Conference on Gear Production 2023
Prof. Dr.-Ing. Karsten Stahl, Full Professor, Institute of Machine Elements, Director, Gear Research Center (FZG), TUM School of Engineering and Design, Technical University of Munich, Garching, Germany

09:55 Welcome address by
Prof. Dr. sc. tech. Gerhard Kramer, Senior Vice President Research and Innovation, TUM School of Engineering and Design, Technical University of Munich, Garching, Germany
Prof. Dr.-Ing. Birgit Vogel-Heuser, Vice Dean Research and Innovation TUM School of Engineering and Design, Chair of Automation and Information Systems, Technical University of Munich, Garching, Germany

10:05 Welcome address by
Dr.-Ing. Burkhard Pinnekamp, Head of Central Technology, RENK GmbH, Augsburg; President, Research Association for Drive Technology (FVA), Frankfurt, Germany

10:15 Keynote session: Re-X: Recycle | Reuse | Reduce
From why to how: It is time for sustainability to move from the executive agenda into the real world
Dominik Leisinger, EMBA, Partner & Europe Lead Product Excellence (PERlab), A.T. Kearney (International) AG, Zurich, Switzerland

The need for global standards to define CO₂ footprint in product specifications
Erik Claesson, M. Sc., Director, Automotive Segment & Group Business Intelligence, Ovako AB, Hofors, Sweden

Refurbishing tracked vehicle transmissions
Dr.-Ing. Burkhard Pinnekamp, Head of Central Technology, Sebastian Schießler, M. Eng., Head of Repair, Vehicle Mobility Solutions, RENK GmbH, Augsburg, Germany

Increasing air travel and the challenges to reduce emissions
Dr.-Ing. David Krüger, Design Engineer, R&T Project Manager, Transmissions, Rolls-Royce Deutschland Ltd & Co. KG, Blankenfelde-Mahlow, Germany

Efficiency-improvement with low-loss-gears by two different applications
Prof. i.R. Dr.-Ing. Dr. h.c. Bernd-Robert Höhn, TUM emeritus of excellence, Michael Geitner, M. Sc., Research Associate, Institute of Machine Elements, Gear Research Center (FZG), TUM School of Engineering and Design, Technical University of Munich, Garching, Germany

12:00 Time for working lunch – meet & greet in the exhibition area, poster presentation area and GearArena

Parallel sessions

International Conference on Gears

Lecture Room A
13:30 Tooth root load & carrying capacity

Lecture Room B
15:00 Coffee break – meet & greet at the exhibition area, poster presentation area and GearArena

16:00 Damage detection

17:30 Evening reception at the university

Lecture Room C
13:30 NVH: Impacts

15:00 Coffee break – meet & greet at the exhibition area, poster presentation area and GearArena

16:00 Damage detection

17:30 Evening reception at the university

Lecture Room D
13:30 Lubrication

15:00 Coffee break – meet & greet at the exhibition area, poster presentation area and GearArena

16:00 Damage detection

17:30 Evening reception at the university

Lecture Room E
13:30 Sustainability

15:00 Coffee break – meet & greet at the exhibition area, poster presentation area and GearArena

16:00 Damage detection

17:30 Evening reception at the university

Parallel conferences – free of charge –
International Conference on Plastic Gears
www.vdi-wissensforum.de/02TA409023

International Conference on Gear Production
www.vdi-wissensforum.de/02TA411023

With digital polls during the speeches
### 2nd Conference day
Thursday, September 14th, 2023

<table>
<thead>
<tr>
<th>Time</th>
<th>Lecture Room A</th>
<th>Lecture Room B</th>
<th>Lecture Room C</th>
<th>Lecture Room D</th>
<th>Lecture Room E</th>
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<tr>
<td>08:30</td>
<td>Load capacity</td>
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<tr>
<td>10:00</td>
<td>Coffee break – meet &amp; greet at the exhibition area, poster presentation area and GearArena</td>
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<tr>
<td>11:00</td>
<td>Planetary gears: NVH</td>
<td>CFD: Applications</td>
<td>Bevel and hypoid gears</td>
<td>NVH</td>
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<td>12:30</td>
<td>Time for Working lunch – meet &amp; greet in the exhibition area, poster presentation area and GearArena</td>
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<tr>
<td>14:00</td>
<td>Design, application, standardization</td>
<td>Planetary gears: Design</td>
<td>Strength: Bevel, hypoid &amp; worm gears</td>
<td>Manufacturing and operating properties</td>
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<tr>
<td>15:30</td>
<td>Coffee break – meet &amp; greet at the exhibition area, poster presentation area and GearArena</td>
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<tr>
<td>16:30</td>
<td>Tooth flank load capacity</td>
<td>NVH: Analysis</td>
<td>Design geometry</td>
<td>Gear geometry and calculation</td>
<td>Gear metrology</td>
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<tr>
<td>18:00</td>
<td>End of the lectures - Switch to the plenary session -</td>
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<td>18:05</td>
<td>Dinner Speech: Dr.-Ing. Bernhard Bouché, Director of Research and Development Mechanics, Getriebebau NORD GmbH &amp; Co. KG, Bargteheide, Germany</td>
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<td>18:45</td>
<td>Organized bus transfer to the evening reception</td>
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<td>19:30</td>
<td>Evening reception at the “Löwenbräukeller” in Munich</td>
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### 3rd Conference day
Friday, September 15th, 2023

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<tr>
<th>Time</th>
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<th>Lecture Room E</th>
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<tbody>
<tr>
<td>08:30</td>
<td>Planetary gears: Load distribution</td>
<td>Smart gears</td>
<td>Efficiency and friction</td>
<td>Performance and validation of plastic gears</td>
<td>Sustainability and surface integrity</td>
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<tr>
<td>10:00</td>
<td>Coffee break – meet &amp; greet at the exhibition area, poster presentation area and GearLab</td>
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<tr>
<td>11:00</td>
<td>Load capacity</td>
<td>NVH</td>
<td>Digitalization of the product development process</td>
<td>Tribology and thermal behavior</td>
<td>Manufacturing processes</td>
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<td>12:30</td>
<td>Closing remarks</td>
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<td>12:45</td>
<td>Awarding of the best presentation for young engineers by Prof. Dr.-Ing. Karsten Stahl, Gear Research Center (FZG), TUM School of Engineering and Design, Technical University of Munich, Garching, Germany</td>
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<tr>
<td>14:15</td>
<td>End of the conferences</td>
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**Gears 2023**

Europe invites the world!
1st Conference day
Wednesday, September 13th, 2023

08:15 Registration

09:30 Common welcome and opening of the conference

- International Conference on Gears, High Performance Plastic Gears, Gear Production
  Prof. Dr.-Ing. Karsten Stahl, Full Professor, Institute of Machine Elements, Director, Gear Research Center (FZG), TUM School of Engineering and Design, Technical University of Munich, Garching, Germany

09:55 Welcome address by

- Prof. Dr. sc. tech. Gerhard Kramer, Senior Vice President Research and Innovation, TUM School of Engineering and Design, Technical University of Munich, Garching, Germany
  - Prof. Dr.-Ing. Birgit Vogel-Heuser, Vice Dean Research and Innovation TUM School of Engineering and Design, Chair of Automation and Information Systems, Technical University of Munich, Garching, Germany

10:05 Welcome address by Dr.-Ing. Burkhard Pinnekamp, Head of Central Technology, RENK GmbH, Augsburg; President, Research Association for Drive Technology (FVA), Frankfurt, Germany

10:15 - 12:00 Keynote session: Re-X: Recycle | Reuse | Reduce

Moderation: Prof. Dr.-Ing. Karsten Stahl, (FZG), TUM School of Engineering and Design, Technical University of Munich, Garching, Germany

- From why to how: It is time for sustainability to move from the executive agenda into the real world
  - Determine emission baselines for product portfolio
  - Prioritize levers to decrease emissions
  - Achieve change through product design and business model adaptation
  Dominik Leisinger, EMBA, Partner & Europe Lead Product Excellence (PERLab), A.T. Kearney (International) AG, Zurich, Switzerland

- The need for global standards to define CO2 footprint in product specifications
  - High performance and low emissions is no conflict for engineering steels
  - Maximum CO2 and recycled content as properties in the steel product specifications
  - Global initiatives vs. sustainability demands on the product
  Erik Claesson, M. Sc., Director, Automotive Segment & Group Business Intelligence, Ovako AB, Hofors, Sweden

- Refurbishing tracked vehicle transmissions
  - Extended lifetime
  - Upgrade and RE-use
  - Increase share of re-used parts
  Dr.-Ing. Burkhard Pinnekamp, Head of Central Technology, Sebastian Schießler, M. Eng., Head of Repair, Vehicle Mobility Solutions, RENK GmbH, Augsburg, Germany

- Increasing air travel and the challenges to reduce emissions
  - Future demand in air travel
  - Emissions of air travel
  - New engine architecture to reduce emission for medium and long range flights
  Dr.-Ing. David Krüger, Design Engineer, R&T Project Manager, Transmissions, Rolls-Royce Deutschland Ltd & Co. KG, Blankenfelde-Mahlow, Germany

- Efficiency-improvement with low-loss-gears by two different applications
  - Low-loss-gears for a Wolfrom-transmission, reduced gear-mesh losses
  - Wolfrom-transmission without carrier, no losses in the radial bearings for the planets
  - Low-loss-gears for a normal planetary transmission (minus-type), efficiency-improvement in a special application
  Prof. i.R. Dr.-Ing. Dr. h.c. Bernd-Robert Höhn, TUM emeritus of excellence, Michael Geitner, M. Sc., Research Associate, Institute of Machine Elements, Gear Research Center (FZG), TUM School of Engineering and Design, Technical University of Munich, Garching, Germany

12:00 Time for a working lunch – meet & greet in the exhibition area, poster presentation area and GearArena
13:30 Optimization of statistical and geometrical evaluation in the determination of tooth root endurance strength
- Influence of asymmetrical clamping of a gear in pulsator tests
- Evaluation of the real geometry of test gears
Ahmad Alnahlaui, M. Sc., Research Assistant, Prof. Dr. Ing. Peter Tenberge, Full Professor, Chair of Industrial and Automotive Drivetrains (IFA), Faculty of Mechanical Engineering, Ruhr-University Bochum, Germany

14:00 The consequences of different methodologies for the elaboration of pulsator test results with respect to the load spectrum assessment of Gears
- Statistical analysis of STBF (Single Tooth Bending Fatigue Test) data
- Effect of the curve shape within the framework of load spectrum assessment
Luca Bonaiti, M. Sc., PhD candidate in Mechanical Engineering, Prof. Ing. Carlo Gorla, Associate Professor, Department of Mechanical Engineering, Politecnico di Milano, Italy; Prof. Dr.-Ing. Karsten Stahl, Full Professor, Institute of Machine Elements, Director, Gear Research Center (FZG), TUM School of Engineering and Design, Technical University of Munich, Garching, Germany

14:30 Tooth bending strain rate analysis in a counter shaft drivetrain and implications on fatigue strengths
- Dynamic tooth bending strain analysis
- Material fatigue strength behaviour under variable strain rate
Dr. Isaac Hong, Research Assistant Professor, Dr. David Talbot, Assistant Professor, Gear and Power Transmission Research Laboratory, Department of Mechanical and Aerospace Engineering, The Ohio State University, Columbus, USA

15:00 Coffee break – meet & greet in the exhibition area, poster presentation area and GearArena

15:30 - 15:50 Poster presentation in the poster exhibition area
Program

Lecture Room A

**Damage detection**

Moderation: Dr.-Ing. Todor Radev, Volkswagen AG, Germany/
Prof. Dr.-Ing. Philippe Velex, INSA – Institut National des Sciences Appliquées de Lyon, France

- 16:00 Investigation of the electrical behavior of a spur gear pair by means of impedance measurements
  - Measuring system for determining the electrical properties
  - First results and behaviors of the impedance of a spur gear
  Simon Graf, M. Eng., M. Eng., Research Assistant, Dipl.-Ing. Michel Werner, Research Assistant, Prof. Dr.-Ing. Manuel Gehler; Junior Professor for Mechanical Drive Technology, Chair of Machine Elements, Gears and Tribology (MEGT), Department of Mechanical and Process Engineering, Rheinland-Pfalzische Technische Universität Kaiserslautern-Landau (RPTU), Kaiserslautern, Germany

- 16:30 Measuring instantaneous angular speed using a gear wheel as a material measure to detect pitting damage during an endurance test
  - Influence of the transfer path
  - Comparing different measurement systems
  Yanik Koch, M. Sc., Research Assistant, Prof. Dr.-Ing. Eckard Kirchner, Director, Institute of Product Development and Machine Elements, Technische Universität Darmstadt; Julian Hirschmann, B. Eng., product engineer vibration analysis, SEW-Eurodrive GmbH, Bruchsal, Germany

- 17:00 Pitting detection for prognostics and health management in gearbox applications
  - Experimental study with predamaged gears
  - AI based damage detection
  Lisa Binanzer, M. Sc., Research Assistant, Drive Technology, et. al, Institute of Machine components (IMA), Universität Stuttgart, Germany

- 17:30 End of the first conference day

Lecture Room B

**Asymmetric gear geometry**

Moderation: Prof. Dr.-Ing. Christian Brecher, RWTH Aachen University, Germany/Dr.-Ing. Reiner Vonderschmidt, Georgii Kobold GmbH & Co. KG, Germany

Design optimization of multi-stage gear trains with asymmetric teeth under a broad range of torques by incorporating multibody simulations

- Asymmetric gear complex gear train design optimization with a wide range of torques
- Multibody simulation for accurate gear contact analysis for NVH performance evaluation
Daehyun Park, PhD, Senior Research Engineer, Ali Rezayat, PhD, Advanced Research Engineer, Motion Product Development, Siemens Industry Software NV, Leuven, Belgium; Yeohyeon Gwon, M. Sc., Senior Researcher, EV geartrain NVH, Hyundai Motor Company, Gyeonggi-Do, Korea

Comparing the contact characteristics of involute gear/eccentric cycloidal gear calculated by various loaded tooth contact analysis models

- Compare results of involute gear from different models
- Propose a new contact analysis approach for EC gears
Ling Chiao Chang, M. Sc., Research Associate, Dr.-Ing. Shyi-Jeng Tsai, Associate Professor, Department of Mechanical Engineering, National Central University, Taoyuan City, Taiwan; Prof. Dr.-Ing. Karsten Stahl, Full Professor, Institute of Machine Elements, Director, Gear Research Center (FZG), TUM School of Engineering and Design, Technical University of Munich, Garching, Germany

Contact simulation of tooth flanks using isogeometric analysis

- Implementation of an isogeometric contact penalty formulation
- Two-dimensional simulation of contact between mating spur gear teeth
Dipl. Ing. Christos Karampatakakis, PhD Candidate, Laboratory of Machine Elements and Machine Design, Aristotle University of Thessaloniki; Prof. Christopher Provattidis, Full Professor, School of Mechanical Engineering, National Technical University of Athens, Greece; Dr. Angelos Mantzaflaris, Research Faculty, Inria Sophia Antipolis, Université Côte d’Azur, Sophia Antipolis, France

Lecture Room C

**Efficiency and friction**

Moderation: Prof. Dr. Eng. Jože Duhovnik, University of Ljubljana, Slovenia/Prof. Dr.-Ing. Georg Jacobs, RWTH Aachen University, Germany

Gear friction coefficient estimation using directional parameter under ATF lubricated condition

- Gear frictional properties and the directivities of tooth surfaces
- Gear friction estimation under ATF lubricated condition
Junichi Hongu, Senior Lecturer, Department of Mechanical and Aerospace Engineering, Graduate School of Engineering, Tottori University, Tottori, Japan

Frictional behavior in injection lubricated and loss of lubrication conditions: Twin-disc test experiments and simulations

- Friction and lubrication gap during high velocity and high-pressure conditions
- Influence of topography and loading conditions on time of failure during loss of lubrication
Dr.mont. Ulrike Cikah-Bayr, Projectmanager, Key Scientist – Material Simulation, Thomas Wopeika, PhD, Senior Scientist for Nanoscale Wear Analysis, Christoph Wintersteiger, PhD, Junior Scientist, ACZT research GmbH, Wiener Neustadt, Austria

Influence of surface and material technologies on loss of lubrication performance of gears

- Friction reduction and scoring prevention of gears facing loss of lubrication
- Influence of superfinishing and coatings on loss of lubrication behavior
Bernd Morhard, M. Sc., Research Associate, Dr.-Ing. Thomas Lohner, Head of Group EHL-Tribological-Contact and Efficiency, Prof. Dr.-Ing. Karsten Stahl, Full Professor, Institute of Machine Elements, Director, Gear Research Center (FZG), TUM School of Engineering and Design, Technical University of Munich, Garching, Germany

Get-together

Evening reception at the university

Enhance your personal network and use the relaxed and informal atmosphere for deeper-going conversations with other participants and speakers.
2nd Conference day
Thursday, September 14th, 2023

Lecture Room A

**Load capacity**

**Moderation:** Dr.-Ing. Carsten Gitt, Mercedes-Benz AG, Germany
**Research Associate:** Moritz Zalfen, M. Sc., Research Institute for Applied Sciences, Japan

- Crack growth based tooth root life prediction model
  - Crack growth based tooth root life prediction model for very high cycle fatigue
  - Analysis of influencing factors on tooth root lifetime
  
Johannes Lövenich, M. Sc., Research Associate, Moritz Zalfen, M. Sc., Group Leader Gear Power Density, Dr.-Ing. Jens Brimmers, M. Sc., Chief Engineer Gear Department, Chair of Machine Tools, Laboratory for Machine Tools and Production Engineering (WZL), Faculty for Mechanical Engineering, RWTH Aachen University, Germany

- Experimental investigation of the increased tooth root load capacity of beveloid gears with optimized flank topography
  - Test bench to test the tooth root load carrying capacity of beveloid gears
  - Tooth root load carrying capacity for beveloids with intersecting axes

Marius Willecke, M. Sc., Research Assistant, Prof. Dr.-Ing. Christian Brecher, Full Professor, Chair of Machine Tools, Dr.-Ing. Jens Brimmers, M. Sc., Chief Engineer Gear Department, Chair of Machine Tools, Laboratory for Machine Tools and Production Engineering (WZL), Faculty for Mechanical Engineering, RWTH Aachen University, Germany

- Statistical analysis of the influence of inherent manufacturing errors in the mesh load factor in planetary gears
  - Application of the Monte Carlo method in the analysis of the planetary gear transmissions performance
  - Combination of the effects of different manufacturing errors

Javier Sanchez-Espiga, PhD, Assistant Professor, Prof. Dr. Fernando Viadero, Full Professor, Prof. Dr. Alonso Fernandez-del-Rincon, Full Professor, Structural and Mechanical Engineering, University of Cantabria, Santander, Spain

Lecture Room B

**Planetary gears: Simulation and lubrication**

**Moderation:** Prof. Dr.-Ing. Berthold Schlecht, Technische Universität Dresden, Germany
**Research Associate:** Michael Geitner, M. Sc., Research Associate, Sebastian Preintner, M. Sc., Research Associate, Dr.-Ing. Thomas Tobie, Head of Department, Load-Capacity Cylindrical Gears, Institute of Machine Elements, Gear Research Center (FZG), TUM School of Engineering and Design, Technical University of Munich, Garching, Germany

- Simulation study on the tribological characteristics in the meshing contact in the context of the load carrying capacity calculation of internal gears with unbalanced sliding conditions
  - Internal gears with unbalanced sliding conditions

Michael Geitner, M. Sc., Research Associate, Sebastian Preintner, M. Sc., Research Associate, Dr.-Ing. Thomas Tobie, Head of Department, Load-Capacity Cylindrical Gears, Institute of Machine Elements, Gear Research Center (FZG), TUM School of Engineering and Design, Technical University of Munich, Garching, Germany

- Thermal model for a planetary gear set using an isothermal approach
  - Power losses on a planetary gear train
  - Numerical study of oil temperature in a transient regime

Wassim Ramdane, M. Sc., R&D Engineer/PhD Student, Cyril Chevrel–Fraux, PhD, Doctor/Engineer, Machine drives, REDEX Group, Férrières-en-Gâtinais; Christophe Changenet, PhD, Researcher and Lecturer, Academic Research Department, ECAM La Salle, Lyon, France

- Wetting and airflow analysis of planetary gearboxes using oil flow simulations
  - Optical validation of simulation data
  - Analysis of pumping effects of the gearing

Dr.-Ing. Claus Kunik, Development Engineer, Dr.-Ing. Jens Kunert, Head of Department, Technology Department Heat Management & Department of Gearing Technology, SEW-EURODRIVE GmbH & Co. KG, Bruchsal, Germany

Lecture Room C

**Efficiency: Gearbox**

**Moderation:** Prof. Dr.-Ing. Oliver Koch, Rheinland-Pfalzische Technische Universität Kaiserslautern-Landau (RPTU), Germany
**Research Associate:** Dr.-Ing. Bernd Pfeifer, Magna PT B.V. & Co. KG, Germany

- On the reduction of windage power losses in gears by the modification of tooth geometry
  - Experimental investigation of 3D-printed pinions
  - Numerical CFD analysis related to modified tooth geometry

Dr.-Ing. Michal Ruzek, Associate Professor, LaMCoS, INSA – Institut National des Sciences Appliquées de Lyon, Villeurbanne Cedex, France; Rémy Brun, B. Sc., master level student, Dr. Yann Marcheses, Associate Professor, ECAM La Salle, Lyon, France

- Efficient concepts for high ratio angular gearboxes
  - Comparison of the ratio-dependent efficiency of different angular gearings
  - Introduction of highly efficient W.9 angular gearboxes

Dr.-Ing. Björn Sievers, Development Engineer, Dipl.-Ing. (FH). Michael Herberger, Development Engineer, Dipl.-Ing. Felix Rudolph, Development Engineer, SEW-EURODRIVE GmbH & Co. KG, Bruchsal, Germany

- Holistic sustainability-assessment of gearboxes
  - Sustainability evaluation of gearboxes over life cycle
  - Assessment of ecological, economic and social aspects

Prof. Dr.-Ing. Markus Klein, Professor for machine elements and sustainable product development, Department of mechanical, automotive and aeronautical engineering, University for Applied Sciences Munich, Germany

- Coffee break – meet & greet in the exhibition area, poster presentation area and GearArena

- Poster presentations in the poster exhibition area
### Lecture Room A

**Planetary gears: NVH**  
Moderation: Prof. Ing. Carlo Gorla, Politecnico di Milano, Italy/Dr.-Ing. Benedikt Neubauer, Schaeffler Technologies AG & Co. KG, Germany

- **11:00** Vibration reduction of planetary gear drive using mesh phasing: modelling and experimental validation
  - Conceptual assessment on gears helps improving NVH performance: Gear mesh phasing, suppressing vibrations, operational deflection shapes
  - Electric drive unit NVH performance optimization: High speed application, multibody simulation and correlation, evaluation of different planetary designs
  

- **11:30** Influence of axis misalignments in stepped planetary gear stages on the excitation behavior – Test rig development and simulative analysis
  - Test rig for investigation of axis misalignments
  - Multi body simulation of misaligned stepped planetary gears
  
  Christian Westphal, M. Sc., Group Leader Gearbox NVH, Research Assistant, Prof. Dr.-Ing. Christian Brecher, Full Professor, Chair of Machine Tools, Dr.-Ing. Jens Brimmers M. Sc., Chief Engineer Gear Department, Chair of Machine Tools, Laboratory for Machine Tools and Production Engineering (WZL), Faculty for Mechanical Engineering, RWTH Aachen University, Germany

- **12:00** Excitation behavior of double helical planetary gear units – Influence of the apex point
  - Validation of simulation method by developing and using a back-to-back planetary test rig
  - Evaluation of influence of apex point tolerances on excitation behavior by applying the validated simulation method
  
  Uwe Weinberger, M. Sc., Gear Research Center (FZG), TUM School of Engineering and Design, Technical University of Munich, Garching, Germany

### Lecture Room B

**CFD: Applications**  
Moderation: Dipl.-Ing. Norbert Haefke, Research Association for Drive Technology (FVA), Germany/Prof. Daisuke Iba, Kyoto Institute of Technology, Japan

- **11:00** Challenges and possibilities of virtual development of transmission systems
  - Optimization of oil flow in early design stages
  - Prediction of torque losses due to oil splashing
  
  Michael Reichl, M. Sc., Senior Simulation Engineer, Philipp Lenz, M. Sc, Simulation Engineer, AVL Deutschland GmbH, Munich, Germany

- **12:00** Latest advancements in the lubrication simulations of geared systems: a technology ready for industrial applications
  - Lubrication simulations of gearboxes
  - Latest modelling approaches with high computational efficiency
  
  Prof. Dr.-Ing. Franco Concilli, PhD, Professor of Machine Design, Head of the Materials Characterization Lab, Faculty of Engineering, Free University of Bozen, Italy

- **13:00** Lubrication improvement at the HS-IS spline shaft interface of a wind turbine gearbox using the smooth particle hydrodynamic method
  - Improved understanding of local oil flows using advanced computational methods
  - Local design optimization allows to utilize superior designs by removing local shortcomings
  

### Lecture Room C

**Bevel and hypoid gears**  
Moderation: Prof. Dr.-Ing. Aleksandar Mitenović, University of Niš, Serbia/Dipl.-Ing. Zsolt Roth, J. M. Voith SE & Co. KG | VTA, Germany

- **11:00** The relevance of pinion deflection and twisting for loaded tooth contact analysis of high reduction hypoid gears
  - FEA simulations of contact of high reduction hypoid gears
  - Influence of twist and bending on the contact pattern of HRHs

  Dipl.-Ing. Wolf Wagner, Research Associate, Dr.-Ing. Stefan Schumann, Chief Engineer, Prof. Dr.-Ing. Berthold Schlecht, Full Professor and Head of Institute of Machine Elements and Machine Design, Faculty of Mechanical Science and Engineering, Technische Universität Dresden, Germany

- **12:00** The effect of pinion axial positioning on noise and transmission error of face hobbed and face milled bevel gears
  - Results of an experimental campaign performed on bevel gears
  - Particular considerations are made with respect to the effect of misalignments

  Luca Bonaiti, M. Sc., PhD candidate in Mechanical Engineering, Prof. Dr.-Ing. Paolo Chiariotti, Department of Mechanical Engineering, Prof. Ing. Carlo Gorla, Associate Professor, Department of Mechanical Engineering, Politecnico di Milano, Italy

- **13:00** Exploration of trade-offs between NVH and efficiency in bevel gear design
  - Efficiency and NVH optimization
  - Pareto front exploration

  Eugeniu Grabovic, PhD, Assistant Professor, Prof. Ing. Alessio Artoni PhD, Associate Professor, Prof. Ing. Marco Gabiccini PhD, Associate Professor, Department Civil and Industrial Engineering, Università di Pisa, Italy

### Program

- **12:30** Time for a working lunch – meet & greet in the exhibition area, poster presentation area and GearArena

- **13:00** Poster presentations in the poster exhibition area

- **13:20**
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<tr>
<td>14:00</td>
<td>Review of different calculation approaches for the mean coefficient of friction in ISO 6336</td>
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<td>• Analysis of approaches due to origin and validated ranges</td>
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<td>• Exemplary comparative calculations for various applications</td>
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<td><strong>Niklas Blech, M. Sc., Research Associate, Dr.-Ing. Thomas Tobie, Head of Department, Load-Capacity Cylindrical Gears, Prof. Dr.-Ing. Karsten Stahl, Full Professor, Institute of Machine Elements, Director, Gear Research Center (FZG), TUM School of Engineering and Design, Technical University of Munich, Garching, Germany</strong></td>
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<tr>
<td>14:30</td>
<td>Forward performance-driven design of gear parameters</td>
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<td>• Multi-objective optimization design of gear parameters</td>
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<td>• Universal design method of symmetric and asymmetric gears</td>
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<td><strong>Shuxin Chen, Master Student, Prof. Changzhao Liu, PhD, Associate Professor, Prof. Datong Qin, PhD, Professor, State Key Laboratory of Mechanical Transmissions, Chongqing University, China</strong></td>
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<tr>
<td>15:00</td>
<td>Analysis of quasi-static mesh characteristics of gear transmission considering system deformation</td>
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<td>• LTCA method considering system deformation</td>
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<td>• Coupling characteristics of multi-gearbox system</td>
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<td><strong>Dr. Jingyi Gong, Prof. Dr. Geng Liu, Full Professor, School of Mechanical Engineering, Northwestern Polytechnical University; Director; Shaanxi Engineering Laboratory for Transmissions and Controls, Xi’an, China; Bing Yuan, PhD, Associate Professor, Xi’an Technological University, China</strong></td>
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<tr>
<td>15:30</td>
<td>Coffee break — meet &amp; greet in the exhibition area, poster presentation area and GearArena</td>
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<tr>
<td>16:00</td>
<td>Poster presentations in the poster exhibition area</td>
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<tr>
<td>14:30</td>
<td>Design and analysis of compound stepped planetary gear drives for better transmission performances</td>
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<td>• Design rules for compound stepped planetary gear sets</td>
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<td>• Effects of meshing-phase on transmission performances by LTCA</td>
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<td><strong>Ling Chiao Chang, M. Sc., PhD Candidate, Dr.-Ing. Shyi-Jeng Tsai, Associate Professor, Qi-Yuu Zhuang M. Sc., PhD Candidate, Department of Mechanical Engineering, National Central University Taiwan, Taoyuan City, Taiwan</strong></td>
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<tr>
<td>15:00</td>
<td>Evaluation of the effect of the rim thickness on the root stress cycle of helical planet gears with integrated rollers</td>
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<td>• Stress analyses of planet-sun and planet-ring models</td>
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<td>• Finite element modelling considering the rollers rigidity</td>
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<td><strong>Dr. Ignacio Gonzalez-Perez, Full Professor, Department of Mechanical Engineering, Materials and Manufacturing, Universidad Politecnica de Cartagena, Spain; Alfonso Fuentes-Aznar, Professor, Rochester Institute of Technology, Rochester NY, USA; Jose Calvo-Irisarri, Engineer, Gamesa Energy Transmission S.A., Zamudio, Spain</strong></td>
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<tr>
<td>15:30</td>
<td>Experimental investigation of moving contact pattern in planetary gearboxes</td>
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<td>• Impact of shaft misalignments on the contact pattern, depending on the carrier rotational position</td>
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<td>• Tooth root strain and coordinate measurements</td>
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<td><strong>Marius Fürst, M. Sc., Research Associate, Institute of Machine Elements, Gear Research Center (FZG), TUM School of Engineering and Design, Technical University of Munich, Garching, Germany</strong></td>
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<td>16:00</td>
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<td><strong>Transferrability of the scuffing load capacity of gear oils determined on spur gears to hypoid gears</strong></td>
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<td>• Comparison of test methods</td>
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<td>• Transferrability of test results from spur to hypoid gears</td>
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<td><strong>Alexander Drechsel, M. Sc., Team Leader Bevel Gears and Lean Management, Dr.-Ing. Josef Pellkofer, Head of Department of Worm gears and Bevel gears, Fatigue life analysis, Prof. Dr.-Ing. Karsten Stahl, Full Professor, Institute of Machine Elements, Director, Gear Research Center (FZG), TUM School of Engineering and Design, Technical University of Munich, Garching, Germany</strong></td>
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<td><strong>Fatigue testing of large sized bevel gears</strong></td>
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<td>• Novel testing setup capable of fatigue tests with high power and large gears</td>
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<td>• Proven capability to produce TFF failures in testing environment</td>
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<td><strong>Erikka Virtanen, M. Sc., (Tech), Doctoral researcher/PhD Student, Mikko Kanerva, Associate Professor, Faculty of Engineering and Natural Sciences, unit of Material Sciences, research group of Tribology and Machine Elements, Faculty of Engineering and Natural Sciences, Tampere University; Gabor Szanti, M. Sc. (Tech), Engineering and Development Manager, ATA Gears Oy, Tampere, Finland</strong></td>
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<td><strong>Calculation method for wear of steel-bronze rolling-sliding contacts relating to worm gears</strong></td>
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<td>• Wear behavior of steel-bronze rolling-sliding contacts</td>
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<td>• Wear calculation of steel-bronze pairings</td>
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<td><strong>Dipl.-Ing. (FH) Philipp Schnetzler, M. Sc., Research Associate, Dr.-Ing. Josef Pellkofer, Head of Department of Worm gears and Bevel gears, Fatigue life analysis, Prof. Dr.-Ing. Karsten Stahl, Full Professor, Institute of Machine Elements, Director, Gear Research Center (FZG), TUM School of Engineering and Design, Technical University of Munich, Garching, Germany</strong></td>
</tr>
</tbody>
</table>
### Program

**Lecture Room A**

**Tooth flank load capacity**

Moderation: Dr.-Ing. Bernhard Bouché, Getriebebau NORD GmbH & Co. KG, Germany / Prof. Bingkui Chen, Chongqing University, China

- 16:30 Scuffing load carrying capacity of high-speed gears with an isotropic superfinished surface
  - Scuffing load carrying capacity of high-speed gears
  - Improved method to calculate scuffing
  - Jaacob Vorgerd, M. Sc., Research Assistant, Prof. Dr.-Ing. Peter Tenberge, Full Professor, Chair of Industrial and Automotive Drivetrains (IFA), Faculty of Mechanical Engineering, Ruhr-University Bochum, Germany

- 17:00 On the testing of flank fracture calculations based on 3D-gears
  - Calculation of flank fracture damage with different approaches
  - Application of the calculation approaches on three dimensional gears
  - Dipl.-Ing. Thi Tra My Truong, Research Associate, Prof. Dr.-Ing. Stefan Schumann, Chief Engineer, Prof. Dr.-Ing. Berthold Schlecht, Full Professor and Head of Institute of Machine Elements and Machine Design, Faculty of Mechanical Science and Engineering, Technische Universität Dresden, Germany

- 17:30 White Etching Cracks (WECs) on gears of E-Axle applications
  - Premature tooth flank fatigue due to WECs
  - Testing of oils concerning WEC-potential
  - Dipl.-Ing. (FH) Thomas Schmidt, Senior Specialist, Gears, Dr.-Ing. Benedikt Neubauer, Director Gears e-mobility, Schaeffler Technologies AG & Co. KG, Herzogenaurach; Dipl.-Ing. Daniel Merk, Senior Expert Bearing Technology, Validation Industrial, Schaeffler Technologies AG & Co. KG, Schweinfurt, Germany

- 18:00 End of the lectures
  - Switch to the plenary session

**Lecture Room B**

**NVH: Analysis**

Moderation: Dr.-Ing. Alex Kapelevich, AKGears, LLC, USA / Dr.-Ing. Andreas Klein, Flender GmbH – Winergy Voerde, Germany

- 18:05 Dinner speech

**Investigation of sound and vibration behavior of cylindrical gears**

- Determination of equivalent radiated power
  - Andreas Beinstingel, M. Sc., Chair of Vibroacoustics of Vehicles and Machines, Technical University of Munich (TUM), Garching & Computational Engineering, Renk GmbH, Augsburg; Dr.-Ing. Michael Heider, Head of Calculation Department, Renk GmbH; Prof. Dr.-Ing. Steffen Marburg, Chair of Vibroacoustics of Vehicles and Machines, TUM, Garching, Germany

- Validation of an industrial gearbox model for predicting vibro-acoustic behavior
  - The MBS model considers the measured gear flanks and profiles
  - Prateek Chavan, M. Sc., Development Engineer, Simulation Gear Units, Dipl.-Ing. Markus Lutz, Head of Department, SEW-EURODRIVE GmbH & Co. KG, Bruchsal, Germany

- 18:45 Organized bus transfer to the evening reception

**Lecture Room C**

**Design geometry**

Moderation: Dr.-Ing. Johannes König, ZF Friedrichshafen AG, Germany / Dr.-Ing. Kai Lubenow, Eickhoff Antriebstechnik GmbH, Germany

- 18:45 Dinner speech

**Local load capacity analysis for the design of a balanced flank modification for cylindrical gears according to bevel gear procedures**

- Influence using Weber-Banaschek, BEM and FEA for the calculation of load distribution and load capacity for cylindrical gears
- Influence of the interaction of cylindrical gears and the overall system on the load distribution
  - Dipl.-Ing. Frederik Mieth, Software development engineer, Modeling and Simulation, Dipl.-Ing. Dennis Tazir, Software development engineer, FVA GmbH, Frankfurt am Main, Germany

- Analysis of new tooth profile design based on the biomimetics principles
  - The idea for profile design inspired by nature is presented
- Procedure based on FEA and TCD is explained and implemented
  - Dr. Ivana Atanasovska, Research Professor, Mathematical Institute of the Serbian Academy of Sciences and Arts (Mathematical Institute SANU), Department of Mechanics; Dr. Dejan Momcilovic, Assistant Research Professor, Institute for material testing IMS, Belgrade, Serbia

- Study on the tip interference in low gear ratio internal spur gears with profile modification
  - A discussion on the influence of the depth of relief on the tip interference in internal gears
  - A new methodology to combine modifications of center distance, teeth height, rack shift coefficients and tip relief depths to maximize the contact ratio
  - Prof. Dr.-Ing. José I. Pedrero, Full Professor, Dr.-Ing. Miguel Pleguezuelos, Associate Professor, Dr.-Ing. Miryam B. Sánchez, Associate Professor, Department of Mechanics Faculty of Engineering, Universidad Nacional de Educación a Distancia (UNED), Madrid, Spain

- 19:30 Evening reception at the “Löwenbräukeller” in Munich
08:30 Parametric system simulation of load sharing in planet stages
- FE simulation of contact behavior in planetary stages to analyse load sharing
- Influence of stiffness of structural components and of misalignments on load sharing
Dipl.-Ing. Jean-André Meis, Head of Technology and Materials, Technology & Innovation, Flender GmbH, Bocholt, Germany

09:00 Mesh load factor in multiple planetary stage gearboxes
- System understanding of a gearbox with 3 planetary stages
- Interaction of planetary stages and those impact on mesh load factor
Abdul Baseer, M. Eng., Simulation Engineer, Dr.-Ing. Björn Bauer, Head of Gearbox Development, Cong Wang, M. Eng., General Manager, DHHI Germany GmbH, Bochum, Germany

09:30 Assessing gear mesh misalignment in a helical gear set by transmission error measurements
- Indirect gear flank load distribution assessment
- Gear transmission error versus flank load distribution
Nico De Bie, M. Sc., Gear Technology Engineer; Wim Smet, B. Sc., Gear Expert Engineer, Product Technology, Business Unit Wind Power Technology, Tom Van Der Kamp, B. Sc., Test Engineer, NWH & Loads, ZF Wind Power, Lommel, Belgium

10:00 Coffee break – meet & greet in the exhibition area, poster presentation area and GearArena
## Program

### Lecture Room A

<table>
<thead>
<tr>
<th>Time</th>
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<th>Speakers</th>
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<tbody>
<tr>
<td>11:00</td>
<td>Review of the definition of the loads for spur and helical gears in standards and handbooks</td>
<td>Luc Amar, PhD, Research Engineer, Power Transmissions (TDP), CETIM (Technical Center for Mechanical Engineering Industries), Senlis Cedex, France; Dr.-Ing. Ulrich Kissling, President, KISSsoft AG, Bubikon, Switzerland</td>
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<tr>
<td>11:30</td>
<td>Hybrid models for the simulation of displacements and stresses in light-weight gears</td>
<td>Dr.-Ing. Bérengère Guilbert, Associate Professor, Prof. David Dureisseix, Full Professor, Prof. Dr.-Ing. Philippe Velux, Full Professor, LaMCoS, INSA – Institut National des Sciences Appliquées de Lyon, Villeurbanne Cédex, France</td>
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<tr>
<td>12:00</td>
<td>Development of damage-based accelerated life test code for gearbox using genetic algorithm</td>
<td>Jung-Ho Park, PhD Student, Biosystems engineering, Seoul National University, Seoul, Republic of Korea</td>
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### Lecture Room B

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<tbody>
<tr>
<td>11:00</td>
<td>Electromechanical coupling modeling and torsional vibration analysis of helicopter electric propulsion system</td>
<td>Hanjie Jia, PhD, Lecturer, Datong Qin, PhD, Professor, Guanghong Hu, Master Student, Xiangyang Xu, PhD, Professor, Chongqing Jiaotong University, China</td>
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<tr>
<td>11:30</td>
<td>Numerical analysis of bevel gear transmission acoustic emission using a 3D gear contact force model within a multibody system dynamic simulation</td>
<td>Dr. Mathijs Vivet, Research Engineering Manager, Product Development – Simulation 3D Mechanical, Siemens Digital Industries Software, Leuven, Belgium</td>
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<tr>
<td>12:00</td>
<td>Experimental investigation of influence of spacing errors on gear rattling</td>
<td>Prof. Ahmet Kahrman, Professor and Director, Dr. Ata, Donmez, Postdoctoral Researcher, Gear and Power Transmission Research Laboratory, Department of Mechanical and Aerospace Engineering, The Ohio State University, Columbus, Ohio, USA</td>
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### Lecture Room C

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<tr>
<td>11:00</td>
<td>Digitalization of the product development process</td>
<td>Dr.-Ing. Johannes König, Manager Gear Fundamentals &amp; Digitalization, Dr.-Ing. Martin Obermayr, Manager CoE Digital Twin, Tobias Klein M. Sc., R&amp;D Engineer, ZF Friedrichshafen AG, Friedrichshafen, Germany</td>
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<tr>
<td>11:30</td>
<td>Opportunities arising from digital twins in gear development</td>
<td>Dipl.-Ing. Constantin van Oss, Research Associate, Dr.-Ing. Stefan Schumann, Chief Engineer, Prof. Dr.-Ing. Berthold Schlecht, Full Professor and Head of Institute of Machine Elements and Machine Design, Faculty of Mechanical Science and Engineering, Technische Universität Dresden, Germany</td>
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<td>12:00</td>
<td>Development of damage-based accelerated life test code for gearbox using genetic algorithm</td>
<td>Jung-Ho Park, PhD Student, Biosystems engineering, Seoul National University, Seoul, Republic of Korea</td>
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<tr>
<td>12:30</td>
<td>The impact of different reliability data on a cloud-based gearbox digital twin using telematic data</td>
<td>MA MEng CEng MIMechE, Barry James, Senior Technical Leader, Research and Innovation, Romax Technology, Ltd., Nottingham, United Kingdom; Dipl.-Ing. (FH) Detlev Runkel, Senior Solutions Strategist, Hexagon Applied Solutions Group, Garching, Germany</td>
</tr>
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### Closing remarks

- Awarding of the best presentation for junior engineers by Prof. Dr.-Ing. Karsten Stahl, Gear Research Center (FZG), TUM School of Engineering and Design, Technical University of Munich, Garching, Germany
- Awarding of the best paper by Dr.-Ing. Franz Völkel, Sr. Vice President R&D Bearings, Schaeffler Technologies AG & Co. KG, Herzogenaurach, Germany
- Lunchtime snack
- End of the conference
The Gear Research Center (FZG) of the Technical University of Munich has comprehensive facilities for examination and testing of machine elements, such as gears, bearings, synchronizations and couplings. Based on the research results developed here during the past decades, FZG is the leading international research institute for gears and transmissions today. Development and validation of methods and tools of reliable determination of fatigue life, efficiency, and vibration characteristics of gears and transmission elements are in focus of research activities at FZG. Implementation of the research is carried out in close cooperation with industry and standardization organizations, funded either through public research grants or industrial collective and contract research.

International Conference on Gears 2023
Technical University of Munich
TUM School of Engineering and Design
Institute of Machine Elements
Gear Research Center (FZG)
Boltzmannstr. 15
85748 Garching, Germany

How to find us
Find all travel information at a glance!

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Concerning the organisation
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Conference organisation
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Email: breuer@vdi.de
P1 Modelling and analysis of the effect of root modification on load sharing and stress values in spur gears
   Ali Imre Aydeniz, PhD, Mechanical Engineering, Istanbul Technical University (ITU), Istanbul, Turkey

P2 LUBGEAR – Experimental Campaign for Aviation Gears in Loss-of-Lubrication
   Dipl.-Ing. Lorenz Braumann, Research Engineer, Advanced Drivetrain Technologies GmbH, Vienna, Austria

P3 PVD deposition of Nb-MoS2 coatings on gear carburized steel
   Angelo Carvalho, M. Sc., Research Assistant, Competence Center in Manufacturing, Aeronautics Institute of Technology, São José dos Campos, Brazil

P4 Testing and modelling of a 2.5 MW wind turbine gearbox: Influence of lubricant formulation
   Carlos Fernandes, PhD, Assistant Professor, Inegi – Institute of Science and Innovation in Mechanical and Industrial Engineering, Porto, Portugal

P5 Improvement of the transmission efficiency in electric vehicles by using double staggered helical gears
   Dr. Ignacio Gonzalez-Perez, Full Professor, Department of Mechanical Engineering, Materials and Manufacturing, Universidad Politecnica de Cartagena, Spain

P6 Method for calculating the tooth root nominal stress in worm gear shafts
   Johannes Gründer, M. Sc., Research Assistant, Institute for Chemical-, Material- and Product Development, Nuremberg Institute of Technology, Germany

P7 Developing CAE solutions for robotics gears; Cycloidal and Strain Wave Gear Drives. Leveraging more mature robust technologies from the automotive industry
   Owen Harris, PhD, Research Department Manager, Research, Smart Manufacturing Technology, Nottingham, United Kingdom

P8 The effect of working surface deviation on transmission error in helical gear
   Dongu Im, Student/PhD candidate, Researcher, Department of Biosystems Engineering, Design of Off-Road Equipment and Soil-Machine Systems, College of Agriculture and Life Sciences, Seoul National University, Korea

P9 A study on the efficiency prediction of a gear bearing drive by means of mathematical modelling
   Bahadir Karba, PhD candidate, Transmission & Powertrain Design Engineer Lvl III, Research & Development, TR Transmisyon engineering Inc., Ankara, Turkey

P10 Backlash optimization via compatible gear couples on the assembly lines for planetary gearboxes
   Bahadir Karba, PhD candidate, Transmission & Powertrain Design Engineer Lvl III, Research & Development, TR Transmisyon engineering Inc., Ankara, Turkey

P11 Classifying plastic beveloid gear quality considering manufacturing errors
   Bahadir Karba, PhD candidate, Transmission & Powertrain Design Engineer Lvl III, Research & Development, TR Transmisyon engineering Inc., Ankara, Turkey

P12 Investigation of the electrical impedance of the gear mesh of a spur gear in an industrial gearbox
   Prof. Dr.-Ing. Eckard Kirchner, Director, Institute of Product Development and Machine Elements, Technische Universität Darmstadt, Germany

P13 Development of optimal design program for planetary gear set macro-geometry using multi-objective optimization algorithm
   Beom-Soo Kim, Lab. for Off-Road Equipment and Soil-Machine Systems Design, Department of Biosystems Engineering, Seoul National University, Seoul, Korea

P14 Test rig trials on transmissions for lubricant aging and analysis of the properties of used lubricants
   Timo König, M. Eng., Research Assistant, Institute for Drive Technology Aalen, Hochschule Aalen – Technik und Wirtschaft, Germany

P15 Parameter based definition of eccentric cycloid gearings
   Stefan Landler, M. Sc., Research Associate, Institute of Machine Elements, Gear Research Center (FZG), TUM School of Engineering and Design, Technical University of Munich, Garching, Germany

P16 Model based NVH design: E-bike application
   Dr.-Ing. Herve Mahe, NVH Master Expert, NVH discipline manager, New Mobility Center, Valeo Transmissions, Amines, France

P17 Effect of overlap ratio on gear dynamic behavior and noise level
   Joao Marafona, M. Eng., PhD Student, Tribology, Vibrations and Industrial Management Unit, INEGI – Institute of Science and Innovation in Mechanical and Industrial Engineering, Porto, Portugal

P18 Overview of gear mesh and bearing frequencies and their application in a heavy-duty industrial gearbox condition monitoring
   Sebastjan Matković, M. Eng., Developer & Researcher, KISSsoft AG, Bubikon, Switzerland

P19 Influence of misalignment of large cylindrical gears on contact pattern in operation
   Prof. Dr.-Ing. Aleksandar Miltenović, Professor, Department for mechanical design, development and engineering, Faculty of Mechanical Engineering, University of Niš, Serbia

P20 Gear geometry, size and material influences not captured in ISO 6336
   Wim Smet, B. Sc., Gear Technology,ZF Wind Power Antwerpen N.V., The Netherlands

P21 Numerical simulation of low-temperature lubrication in gear models using MPS method
   Chunhui Wei, PhD Student, School of Mechanical Engineering, Beijing Institute of Technology, China and INSA – Institut National des Sciences Appliquées de Lyon, Villeurbanne Cédex, France

P22 Three-dimensional dynamic contact behaviors of gear pairs with various tooth flank errors
   Dr. Bing Yuan, Professor; Xi’an Technological University, China

P23 Meshing limit line of offsetting ZC1 worm drive
   Prof. Dr. Yaping Zhao, College of Mechanical Engineering and Automation, Northeastern University China, Shenyang City, China

P24 A novel dynamic modeling method of high-speed rimmed gear transmission
   Jiayu Zheng, M. Sc., PhD student, State Key Laboratory of Mechanical Transmissions, Chongqing University, China

Poster Exhibition

Combined with 5-minute talks!
5th International Conference on Gear Production 2023
September 13 - 15, 2023, Garching/Munich, Germany

Key topics:
• Sustainable gear production
• Inline quality inspection for gear production
• Additive manufacturing of gears
• Performance of new gear materials in gear manufacturing
• Hard finishing of high performance gears
• Innovative processes for gear manufacturing

Presidency:
Prof. Dr.-Ing. Thomas Bergs, Full Professor, Laboratory for Machine Tools and Production Engineering (WZL), Chair of Manufacturing Technology, Faculty for Mechanical Engineering, RWTH Aachen University, Germany
Prof. Dr.-Ing. Christian Brecher, Full Professor, Chair of Machine Tools, Laboratory for Machine Tools and Production Engineering (WZL), Faculty for Mechanical Engineering, RWTH Aachen University, Germany
Prof. Dr.-Ing. Karsten Stahl, Full Professor, Institute of Machine Elements, Director, Gear Research Center (FZG), TUM School of Engineering and Design, Technical University of Munich, Garching, Germany

The conference will give you the answers to these questions:
• How do we manufacture high performance gears in the future?
• What are best practices for the additive manufacturing of gears?
• How do we increase sustainability in gear manufacturing?
• Which digital solutions drive gear production?
• What are the innovations in gear metrology?

Further details and the final program can be found here:
www.vdiconference.com/02TA411023

5th International Conference on High Performance Plastic Gears 2023
September 13 - 15, 2023, Garching/Munich, Germany

Key topics:
• Carbon footprint assessment of sustainable plastic materials
• Influence of manufacturing on gear quality and load capacity
• Recent calculation methods for load capacity and excitation behavior
• Recent test methods of plastic gears
• Optimizations of plastic gears

Presidency:
Prof. Dr.-Ing. Karsten Stahl, Full Professor, Institute of Machine Elements, Director, Gear Research Center (FZG), TUM School of Engineering and Design, Technical University of Munich, Garching, Germany
Prof. Dr.-Ing. Thomas Bergs, Full Professor, Laboratory for Machine Tools and Production Engineering (WZL), Chair of Manufacturing Technology, Faculty for Mechanical Engineering, RWTH Aachen University, Germany
Prof. Dr.-Ing. Christian Brecher, Full Professor, Chair of Machine Tools, Laboratory for Machine Tools and Production Engineering (WZL), Faculty for Mechanical Engineering, RWTH Aachen University, Germany

Conference Board:
Dr.-Ing. Marco Baccalaro, Chassis Systems Control, Gear Development and Test Conception/Realization, Robert Bosch GmbH, Heilbronn, Germany
Ingo Decke, M. Eng., Gear Development, Group Wide Components, Corporate Research & Development, ZF Friedrichshafen AG, Friedrichshafen, Germany
Dr.-Ing. Ulrich Kissling, President, KISSsoft AG, Bubikon, Switzerland
Dr.-Ing. Andreas Langheinrich, Development Drive Technology, Horst Scholz GmbH & Co. KG, Kronach, Germany

The conference will give you the answers to these questions:
• How can the carbon footprint of plastic gears be assessed and optimized?
• How can plastic gears be recycled?
• How can lubrication improve the performance of plastic gears?
• How can the NVH-behavior of plastic gears be evaluated and optimized?
• How does the manufacturing process impact gear performance and cost?

Further details and the final program can be found here:
www.vdiconference.com/02TA409023

Free of charge for participants of the “International Conference on Gears 2023”
Gears Interactive – New ideas, more added value for your business

**GearArena**

**Gather hands-on experience in the transmission world!**
Take a look at individual gear components, gain an insight into how the different components interact and compare design and workmanship! You will find an on-site contact person from the exhibitor to answer all your questions.

**FZG lab tours**

**Get the chance to visit innovative laboratory facilities!**
Seize the opportunity and visit the nearby test and laboratory facilities at the Gear Research Center (FZG). Several guided tours with different core topics offer opportunities of gaining deeper insights into a variety of innovative gear test rigs and laboratory equipment.
For registration meet at the FZG information desk during the conference.

**Speakers meetup**

**Do you still have unresolved questions?**
You can address your questions to the speakers right after the lecture during the coffee break. Take the chance to say hello to your favorite speaker and to connect with them. They will be available for at least 15 minutes after their session.

**Poster exhibition with impulse talks**

**The poster exhibition is combined with a 5-minute talk.**
The compact style of presentation called the ‘5-minute rapid’ presentation, will provide you with all information in a clear, succinct manner. Poster presentations are scheduled during the coffee breaks. Presentation times will be announced on-site.

**Two gear community nights**

**Your networking hotspot for the international gear community!**
Enjoy the evening reception at the ‘Löwenbräukeller’ as well as another social event at the university. The ‘Löwenbräukeller’ is a restaurant with a long tradition offering modern Bavarian cuisine.
Both – the get-together at the FZG and the brewery visit – offer you an excellent opportunity to network with your peers and catch up on trends.
Program Committee

Presidency

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

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Prof. Dr.-Ing. Dr. h.c. Bernd-Robert Höhn, TUM emeritus of excellence, Gear Research Center (FZG), TUM School of Engineering and Design, Technical University of Munich, Garching, Germany

Dr.-Ing. Burkhard Pinnekamp, Head of Central Technology, RENK GmbH, Augsburg; President, Research Association for Drive Technology (FVA), Frankfurt/Main, Germany

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<tr>
<th>Function</th>
<th>Experts: 46%</th>
<th>Project manager: 25%</th>
<th>Production engineer: 17%</th>
<th>Project management: 7%</th>
<th>Others: 5%</th>
<th>Sales: 9%</th>
<th>others: 7%</th>
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<td>Research and Development</td>
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<td>University/research institutions</td>
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<td>Construction and development</td>
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<th>VAT-ID</th>
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<th>Job Title</th>
<th>Department</th>
<th>Street</th>
<th>ZIP Code, City, Country</th>
<th>Phone</th>
<th>Email</th>
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