

Europe invites the world

International Conference on Gears 2023

FZG, Garching/Munich, Germany

#vdi_gears

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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

Gears interactive

GearArena
Speakers meetup
FZG lab tours
Poster exhibition
Two gear community nights

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



Gear Research Institute, USA



Scientific Society of Mechanical Engineers, Hungary



IFTOMM



Institution of Mechanical Engineers, United Kingdom



JSME



The Korean Society of Mechanical Engineers, Korea



Romanian Association of Mechanical Transmissions



Technical Chamber of Greece



WiGeP, 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

08:15 Registration

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

a representative, TUM School of Engineering and Design, 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

With digital polls during the speeches

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

Lecture Room B

Lecture Room C

13:30 Tooth root load & carrying capacity

NVH: Impacts

Lubrication

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

16:00 Damage detection

Asymmetric gear geometry

Efficiency and friction

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

Lecture Room D

Lecture Room E

Sustainability

Innovations in gear production

Tooth root strength

Software in gear production

2nd Conference day
Thursday, September 14th, 2023

	International Conference on Gears			International Conference on Plastic Gears	International Conference on Gear Production
	Lecture Room A	Lecture Room B	Lecture Room C	Lecture Room D	Lecture Room E
08:30	Load capacity	Planetary gears: Simulation and lubrication	Efficiency: Gearbox	Fibre reinforcement	Additive manufacturing
10:00	Coffee break – meet & greet at the exhibition area, poster presentation area and GearArena				
11:00	Planetary gears: NVH	CFD: Applications	Bevel and hypoid gears	NVH	Materials in gear production
12:30	Time for Working lunch – meet & greet in the exhibition area, poster presentation area and GearArena				
14:00	Design, application, standardization	Planetary gears: Design	Strength: Bevel, hypoid & worm gears	Manufacturing and operating properties	Modeling and tracing of gear manufacturing processes
15:30	Coffee break – meet & greet at the exhibition area, poster presentation area and GearArena				
16:30	Tooth flank load capacity	NVH: Analysis	Design geometry	Gear geometry and calculation	Gear metrology
18:00	End of the lectures - Switch to the plenary session -				
18:05	Dinner Speech: Dr.-Ing. Bernhard Bouché, Director of Research and Development Mechanics, Getriebbau NORD GmbH & Co. KG, Bargteheide, Germany				
18:45	Organized bus transfer to the evening reception				
19:30	Evening reception at the "Löwenbräukeller" in Munich				

3rd Conference day
Friday, September 15th, 2023

	Lecture Room A	Lecture Room B	Lecture Room C	Lecture Room D	Lecture Room E
08:30	Planetary gears: Load distribution	Smart gears	Efficiency and friction	Performance and validation of plastic gears	Sustainability and surface integrity
10:00	Coffee break – meet & greet at the exhibition area, poster presentation area and GearLab				
11:00	Load capacity	NVH	Digitalization of the product development process	Tribology and thermal behavior	Manufacturing processes
12:30	Closing remarks				
12:45	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 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				
14:15	End of the conferences				

Gears 2023

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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

With digital polls
during the speeches

Lecture Room A



Tooth root load & carrying capacity

Moderation: **Luc Amar, PhD**, CETIM, France/**Dr.-Ing. Rolf Doeberneiner**, AVL List GmbH, Austria

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

Lecture Room B



NVH: Impacts

Moderation: **Dr.-Ing. Bernhard Kohn**, AUDI AG, Germany/**Prof. Dr.-Ing. Jose I. Pedrero**, Universidad Nacional de Educación a Distancia (UNED), Spain

Acoustical behavior of periodic flank modifications under dynamic operating conditions

- Acoustic optimisation of gear flank geometry
- Influence of dynamic operating conditions on periodic flank modifications

Sebastian Sepp, M. Sc., Research Associate, Dr.-Ing. Michael Otto, Head of department Calculation and Verification of Transmission Systems, 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 influence of the wheel body design on airborne noise

- Describing how to quickly simulate a wheel body design
- A combination of static and dynamic calculations is used

Benjamin Abert, M. Sc., Head of Consulting and Service, FVA GmbH, Garching; Denis Werner, M. Eng., Calculation and Support Engineer, AVL Deutschland GmbH, Munich, Germany

Impact of manufacturing deviations on the NVH behavior of modern gear design concepts

- Deterioration of gear behavior due to manufacturing deviations
- Influence of gear quality on gear mesh characteristics

Dr.-Ing. Ulrich Kissling, President, KISSsoft AG, Bubikon, Switzerland

Lecture Room C



Lubrication

Moderation: **Prof. Dr.-Ing. Gerhard Poll**, Leibniz University Hannover, Germany/**Prof. Dr. Datong Qin**, Chongqing Jiaotong University, China

Lubricant free transmissions for food and beverage applications – a comparison

- Comparison of three different lubricant free transmission technologies
- Magnetic transmissions, porous sintered materials, plastic gears

Andrej Wallinger, M. Sc., Development Engineer, Research & Development, Dr.-Ing. Stefan Vonderschmidt, Managing Director, Dr.-Ing. Reiner Vonderschmidt, Shareholder, Georgii Kobold GmbH & Co. KG, Horb am Neckar, Germany

Analysis of load cycles and local wear of dry and solid-lubricated gears

- Analysis of the operational behaviour of dry and solid-lubricated gears
- Analysis of the local wear of the solid lubricant on the tooth flank

Sebastian Sklenak, M. Eng., Research Assistant, Gear Power Density, Prof. Dr.-Ing. Christian Brecher, Full Professor, 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

Considerations on lubrication of high-speed rotating gear (first report) – relationship between the lubricating oil behavior and airflow on the tooth surface

- Behavior of the injection oil flow onto the rotating gear tooth surface
- Behavior of airflow generated at the gear engagement

Kensuke Suzuki, Development Engineer, Kazuki Sakai, Experiment Sec. Product Development Dept., Kaori Sakai, Product Design Sec. Product Development Dept, UNIVANCE CORPORATION, Kosai-City, Japan

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, Jun. Prof. Dr.-Ing. Manuel Oehler; Junior Professor for Mechanical Drive Technology, Chair of Machine Elements, Gears and Tribology (MEGT), Department of Mechanical and Process Engineering, Rheinland-Pfälzische Technische Universität Kaiserslautern-Landau (RPTU), Kaiserslautern, Germany

16:30 Measuring instantaneous angular speed using a gear wheel as 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

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.

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 Karampatzakis, PhD Candidate, Laboratory of Machine Elements and Machine Design, Aristotle University of Thessaloniki; Prof. Christopher Provatidis, Full Professor, School of Mechanical Engineering, National Technical University of Athens, Greece; Dr. Angelos Mantzafaris, 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 Cihak-Bayr, Projectmanager, Key Scientist – Material Simulation, Thomas Wopelka, PhD, Senior Scientist for Nanoscale Wear Analysis, Christoph Wintersteiger, PhD, Junior Scientist, AC2T 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

2nd Conference day

Thursday, September 14th, 2023

Lecture Room A



Load capacity

Moderation: Dr.-Ing. Carsten Gitt, Mercedes-Benz AG, Germany/**Prof. h.c. Dr.-Ing. Aizoh Kubo**, Research Institute for Applied Sciences, Japan

08:30 Crack growth based tooth root life prediction model

- Crack growth based tooth root lifetime 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

09:00 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

09:30 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

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

10:30 - 10:50 Poster presentations in the poster exhibition area

Lecture Room B



Planetary gears: Simulation and lubrication

Moderation: Prof. Dr.-Ing. Berthold Schlecht, Technische Universität Dresden, Germany/**Prof. Dr.-Ing. Michael Weigand**, TU Wien, Austria

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
- TEHL contact simulation

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, Ferrières-en-Gâtinais; Christophe Changenet, PhD, Researcher and Lecturer, Academic Research Department, ECAM La Salle, Lyon, France

Wetting and oil flow analysis of planetary gearboxes using oil flow simulations

- Optical validation of simulation data
- Evaluation of fluid flow of 2- & 3-stage planetary gear units
- 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-Pfälzische Technische Universität Kaiserslautern-Landau (RPTU), Germany/**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 Marchesse, 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

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

Gowrisankar Devaraj, B. Eng., Technical Specialist – Light Vehicle Advanced Engineering, Dana Lindley Technology Centre Ltd, Lindley, UK, Thibault Devreese, M. Sc., Jr Program Manager, Engineering, DANA Incorporated, Belgium

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

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

13:00 - 13:20 Poster presentations in the poster exhibition area

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

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

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 Concli, PhD**, Professor of Machine Design, Head of the Materials Characterization Lab, Faculty of Engineering, Free University of Bozen, Italy

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
- Dr.-Ing. Moritz Oliver Gebhardt**, Senior Manager Data Analysis, Dr.-Ing. Alexander Rhode, Head of Engineering Wind, NGC Transmission Europe GmbH, Duisburg, Dipl.-Ing. Benjamin Legrady, Customer Success Lead, dive solutions GmbH, Berlin, Germany

Lecture Room C



Bevel and hypoid gears

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

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

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

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

Lecture Room A



Design, application, standardization

Moderation: Eng. Amir Aboutaleb, American Gear Manufacturers Association, USA/**Prof. Dr.-Ing. Dr. h. c. Albert Albers**, Karlsruhe Institute of Technology (KIT), Germany

14:00 Review of different calculation approaches for the mean coefficient of friction in ISO 6336

- Analysis of approaches due to origin and validated ranges
- Exemplary comparative calculations for various applications

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

14:30 Forward performance-driven design of gear parameters

- Multi-objective optimization design of gear parameters
- Universal design method of symmetric and asymmetric gears

Shuxin Chen, Master Student, Prof. Changzhao Liu, PhD, Associate Professor, Prof. Datong Qin, PhD, Professor, State Key Laboratory of Mechanical Transmissions, Chongqing University, China

15:00 Analysis of quasi-static mesh characteristics of gear transmission considering system deformation

- LTCA method considering system deformation
- Coupling characteristics of multi-gearbox system

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



15:30 Coffee break – meet & greet in the exhibition area, poster presentation area and GearArena

15:45 - 16:00 Poster presentations in the poster exhibition area

Lecture Room B



Planetary gears: Design

Moderation: Prof. i.R. Dr.-Ing. Dr. h.c. Bernd-Robert Höhn, TUM emeritus of excellence, Technical University of Munich, Germany/**Prof. Wenzhong Wang**, Beijing Institute of Technology, China

Design and analysis of compound stepped planetary gear drives for better transmission performances

- Design rules for compound stepped planetary gear sets
- Effects of meshing-phase on transmission performances by LTCA

Ling Chiao Chang, M. Sc., PhD Candidate, Dr.-Ing. Shyi-Jeng Tsai, Associate Professor, Qi-You Zhuang M. Sc., PhD Candidate, Department of Mechanical Engineering, National Central University Taiwan, Taoyuan City, Taiwan

Evaluation of the effect of the rim thickness on the root stress cycle of helical planet gears with integrated rollers

- Stress analyses of planet-sun and planet-ring models
- Finite element modelling considering the rollers rigidity

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

Experimental investigation of moving contact pattern in planetary gearboxes

- Impact of shaft misalignments on the contact pattern, depending on the carrier rotational position
- Tooth root strain and coordinate measurements

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

Lecture Room C



Strength: Bevel, hypoid & worm gears

Moderation: Prof. Dr.-Ing. Athanassios Mihailidis, former Aristotle University of Thessaloniki, Greece/**Prof. Dr.-Ing. Michael Weigand**, TU Wien, Austria

Transferability of the scuffing load capacity of gear oils determined on spur gears to hypoid gears

- Comparison of test methods
- Transferability of test results from spur to hypoid gears

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

Fatigue testing of large sized bevel gears

- Novel testing setup capable of fatigue tests with high power and large gears
 - Proven capability to produce TFF failures in testing environment
- Erkka 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

Calculation method for wear of steel-bronze rolling-sliding contacts relating to worm gears

- Wear behavior of steel-bronze rolling-sliding contacts
- Wear calculation of steel-bronze pairings

Dipl.-Ing. (FH) Philipp Schnetzer, 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

Lecture Room A



Tooth flank load capacity

Moderation: Dr.-Ing. Bernhard Bouché, Getriebbau 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, 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-

18:05 Dinner speech

What is the taste of gears like?

Dr.-Ing. Bernhard Bouché, Director of Research and Development Mechanics, Getriebbau NORD GmbH & Co. KG, Bargteheide, Germany

18:45 Organized bus transfer to the evening reception

You can look forward to a special evening event. Enhance your personal network and use the informal atmosphere for deeper-going discussions.

19:30 Evening reception at the "Löwenbräukeller" in Munich

Lecture Room B



NVH: Analysis

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

A comparison of time and frequency domain approaches for NVH

- Calculation approaches and major setting parameters
- Comparison of results regarding amplitudes and frequencies

Dipl.-Ing. Jürg Langhart, Senior Engineer - Global Sales, Prof. Dr.-Ing. Saeed Ebrahimi, Software Developer, KISSsoft AG, Bubikon, Switzerland; Dipl.-Ing. Thomas Kelichhaus, General Manager, FunctionBay GmbH, Munich, Germany

Investigation of sound and vibration behavior of cylindrical gears

- Nonlinear frequency response analysis
- Determination of equivalent radiated power

Andreas Beinstingel, M. Sc., Chair of Vibroacoustics of Vehicles and Machines, Technical University of Munich (TUM), Garching & Computational Engineer, 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

- Systematic experimental validation of the dynamics of an industrial gear unit
- 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

Lecture Room C



Design geometry

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

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



3rd Conference day

Friday, September 15th, 2023

Lecture Room A



Planetary gears: Load distribution

Moderation: Prof. Dr.-Ing. Manfred Hirt, Past President, Research Association for Drive Technology (FVA), former board of Renk GmbH, Germany/**Prof. Ahmet Kahraman**, The Ohio State University, Columbus, USA

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, NVH & Loads, ZF Wind Power, Lommel, Belgium

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

Lecture Room B



Smart gears

Moderation: Prof. Dr.-Ing. Oliver Koch, Rheinland-Pfälzische Technische Universität Kaiserslautern-Landau (RPTU), Germany/**Prof. Dr. Geng Liu**, Northwestern Polytechnical University; Shaanxi Engineering Laboratory for Transmissions and Controls, China

Helicopter drive system safety dissertation

- Helicopter gearbox failure detection system design & testing
- Loss of lubricant conditions: design & testing phase

Sergio Sartori, Eng., Head of Analysis & Innovation, Transmission Systems Design & Development, Leonardo SpA, Samarate, Italy

Smart gearboxes for a sustainable and reliable industry

- Smart gearbox as a multichannel sensor within the drive train
- Process optimization using knowledge of real load conditions

Dennis Meyering, M. Eng., Data Scientist, Carsten Hussmann, M. Eng., Data Scientist, Digital Business – Data Analytics and Operations, Flender GmbH, Voerde, Germany

High ratio gearbox with very low bearing loads

- Smart gear system for health monitoring
- Wireless health monitoring during operation

Dr. Daisuke Iba, Professor, Department of Mechanical Engineering, Kyoto Institute of Technology, Kyoto, Japan

Lecture Room C



Efficiency & friction

Moderation: Dr.-Ing. Ralf Möllendorf, Flender GmbH, Germany/**Dr.-Ing. Toni Weiss**, Gear Consultant, ret. from RENK GmbH, now GanaCon – Gear analysis and Consulting, Germany

Simulation-based optimization of gearing efficiency using DLC coatings

- Potential of tooth flank coatings for friction reduction
- Impact of thermo-physical properties of a coating

Dipl.-Ing. Ronny Beilicke, Project Engineer, Prof. Dr.-Ing. Dirk Bartel, CEO, Dr.-Ing. Lars Bobach, Software Developer, Tribo Technologies GmbH, Magdeburg, Germany

Gearbox efficiency of eDrives: Correlation between measurement and calculation of load-dependent torque losses

- Calculation of gearbox efficiency
- Correlation between measurement and calculation

Dr.-Ing. Mustafa Yilmaz, Development Engineer Gear Design, Gear Development, ZF Friedrichshafen AG, Friedrichshafen, Germany

Modifying gear surface to achieve higher efficiency

- Modifying gear surface by superfinishing and coating
- Quantifying efficiency gains by surface engineering

Jishan Zhang, PhD, Senior Test Engineer, Design Unit, School of Engineering, Newcastle University, Newcastle upon Tyne, United Kingdom

Lecture Room A



Load capacity

Moderation: Prof. Dr.-Ing. Karsten Stahl, Technical University of Munich, Garching, Germany

- 11:00 **Review of the definition of the loads for spur and helical gears in standards and handbooks**
 - Gear load definition
 - Teaching exercise

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
- 11:30 **Hybrid models for the simulation of displacements and stresses in light-weight gears**
 - Model showing displacement and stress within the gear body
 - Interaction between body stress and dynamic mesh force

Dr.-Ing. Bérengère Guilbert, Associate Professor, Prof. David Dureisseix, Full Professor, Prof. Dr.-Ing. Philippe Velex, Full Professor, LaMCoS, INSA – Institut National des Sciences Appliquées de Lyon, Villeurbanne Cédex, France
- 12:00 **Development of damage-based accelerated life test code for gearbox using genetic algorithm**
 - Methodology for mechanical component life test estimation
 - Guarantee the mechanical components life within short period of time

Jung-Ho Park, PhD Student, Biosystems engineering, Seoul National University, Seoul, Republic of Korea

■ 12:30 **Closing remarks**



■ 12:45 **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, German

+ Lunchtime snack



■ 14:15 **End of the conference**

Lecture Room B



NVH

Moderation: Dr.-Ing. Bernhard Bouché, Getriebbau NORD GmbH & Co. KG, Germany

- **Electromechanical coupling modeling and torsional vibration analysis of helicopter electric propulsion system**
 - Electromechanical model of electric propulsion system
 - Prediction and suppression of torsional vibration

Hanjie Jia, PhD, Lecturer, Datong Qin, PhD, Professor, Guanghong Hu, Master Student, Xiangyang Xu, PhD, Professor, Chongqing Jiaotong University, China
- **Numerical analysis of bevel gear transmission acoustic emission using a 3D gear contact force model within a multibody system dynamic simulation**
 - Accurate 3D gear contact analysis of spiral bevel gears using flexible multibody simulation
 - Vibro-acoustic performance simulation of bevel geared drivetrains

Dr. Mathijs Vivet, Research Engineering Manager, Product Development – Simulation 3D Mechanical, Siemens Digital Industries Software, Leuven, Belgium
- **Experimental investigation of influence of spacing errors on gear rattling**
 - Vibro-impacts of gearshaving spacing errors under lightly loaded operating conditions
 - Gear set-up with external torque fluctuation capabilities and associated instrumentation

Prof. Ahmet Kahraman, 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

Lecture Room C



Digitalization of the product development process

Moderation: Dr.-Ing. Burkhard Pinnekamp, RENK GmbH, Germany

- **Digitalization of the gear development process – Chances, benefits and risks**
 - Data exchange during the complete product development cycle
 - Integration of digital twin models and services into Catena-X

Dr.-Ing. Johannes König, Manager Gear Fundamentals & Digitalization, Dr.-Ing. Martin Obermayr, Manager CoE Digital Twin, Tobias Klein M. Sc., R&D Engineer, ZF Friedrichshafen AG, Friedrichshafen, Germany
- **Opportunities arising from digital twins in gear development**
 - Photogrammetric mapping of 2D photo data onto a virtual 3D gear
 - Automatic correction of the contact pattern for bevel gears

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
- **The impact of different reliability data on a cloud-based gearbox digital twin using telematic data**
 - Set up of a cloud-based digital twin using telematic data from vehicles
 - Interpretation of different reliability data in this digital twin and implications

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

Location/Venue



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!

www.mec.ed.tum.de/en/fzg/contact-and-directions/fzg/



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Poster Exhibition

Combined with
5-minute talks!

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 Exp. 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 Development of simulation model considering various manufacturing errors of 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

Bahadır 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

Bahadır 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

Bahadır 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, Amiens, 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 Matkovič, 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 thin-rimmed gear transmission

Jiayu Zheng, M. Sc., PhD student, State Key Laboratory of Mechanical Transmissions, Chongqing University, China

Free of charge
for participants of the "International
Conference on Gears 2023"



5th International Conference on Gear Production 2023

September 13 - 15, 2023, Garching/Munich, Germany



Source: © WZL, RWTH Aachen/Ahmad

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

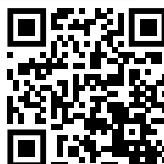
Prof. Dr.-Ing. Christian Brecher, Full Professor, Chair of Machine Tools, Laboratory for Machine Tools and Production Engineering (WZL), Faculty for Mechanical Engineering, RWTH Aachen University, Germany

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



Source: © HORST SCHOLZ GmbH & Co. KG

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

Conference Board:

Dr.-Ing. Marco Baccalaro, Chassis Systems Control, Gear Development and Test Conception/Realization, Robert Bosch GmbH, Heilbronn, Germany

Ingo Decker, M. Eng., Gear Development, Group Wide Components, Corporate Research & Development, ZF Friedrichshafen AG, Friedrichshafen, Germany

Dr.-Ing. Ulrich Kissling, President, KISSsoft AG, Bubikon, Switzerland

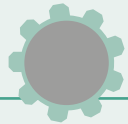
Dr.-Ing. Andreas Langheinrich, Development Drive Technology, Horst Scholz GmbH & Co. KG, Kronach, Germany

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





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.



Source: Löwenbräukeller Archiv

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



Conference Board/Vice President:

Dr.-Ing. Bernhard Bouché, Director of Research and Development Mechanics, Getriebbau NORD GmbH & Co. KG, Bargteheide, Germany



Prof. i.R. 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, Germany

Board of gear excellence

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Prof. Dr.-Ing. Manfred Hirt, Past President, Research Association for Drive Technology (FVA), Frankfurt/Main; former board of RENK GmbH, Augsburg, Germany

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Prof. Dr.-Ing. Athanassios Mihailidis, Full Professor, Former Head of the School of Mechanical Engineering, Laboratory of Machine Elements and Machine Design, Aristotle University of Thessaloniki, Greece

Dr. Michel Octrue, former Senior Gear Expert Mechanical Power Transmissions, CETIM (Technical Center for Mechanical Engineering Industries), Senlis, France

Prof. Dr.-Ing. Bernd Sauer, Full Professor, Chair of Machine Elements, Gears and Tribology (MEGT), Department of Mechanical and Process Engineering, Rheinland-Pfälzische Technische Universität Kaiserslautern-Landau (RPTU), Kaiserslautern, Germany

Prof. Ray Snidle, Emeritus Professor of Mechanical Engineering, Cardiff University, United Kingdom

Dr.-Ing. Toni Weiss, Gear Consultant, ret. from RENK GmbH, Augsburg, now GanaCon – Gear analysis and Consulting, Inning, Germany

National members

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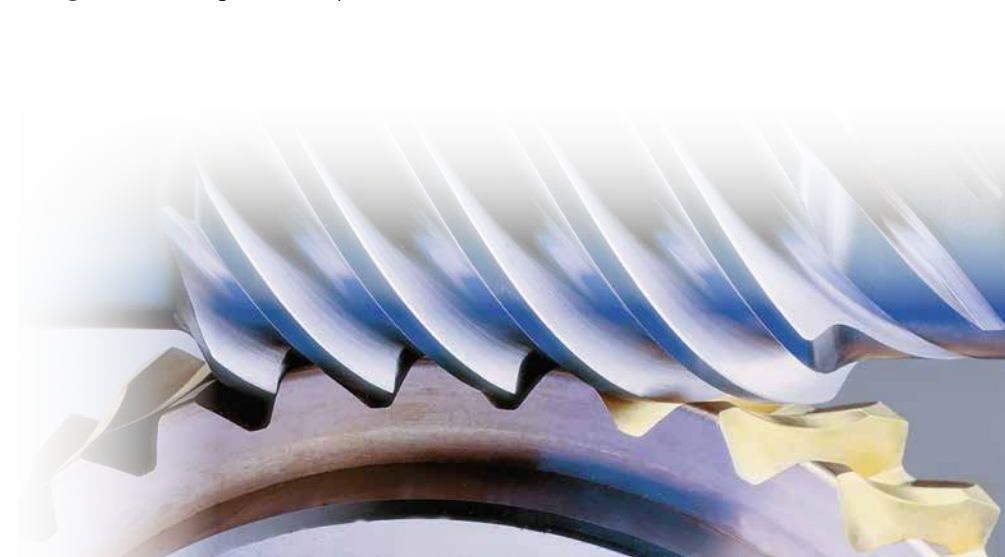
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