Key topics discussed:

- Increasing productivity in gear skiving
- Higher tool life for hard finishing processes
- Improved gear quality inspection
- Methods for designing and manufacturing face, bevel and worm gears
- Improved tribo system within the manufacturing process
- Enhanced simulation methods for improving the gear manufacturing process

Presidency:
Prof. Dr.-Ing. Thomas Bergs, WZL, RWTH Aachen University, Germany
Prof. Dr.-Ing. Christian Brecher, WZL, RWTH Aachen University, Germany
Prof. Dr.-Ing. Karsten Stahl, FZG, Technical University of Munich (TUM), Garching, Germany

With experts from:
1st Conference day
Wednesday, September 15th, 2021

08:15 Registration

Plenary lectures

09:45 Joint welcome and opening of
- International Conference on Gears 2021
- International Conference on High Performance Plastic Gears 2021
- International Conference on Gear Production 2021

by Prof. Dr.-Ing. Karsten Stahl, Gear Research Centre (FZG), Technical University of Munich (TUM), Garching, Germany

Every participant gets a voice - you will be involved via digital polls during the speeches

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: Innovation flashlights: What will be the next game-changing innovations and technologies?

Moderation: Prof. Dr.-Ing. Karsten Stahl, Gear Research Centre (FZG), Technical University of Munich (TUM), Garching, Germany

Demands in gear technology in structural change in the economy
- High performance in inflating the structure of the economy
- Motive force behind human activity is desire
- Necessary performance in sustainable structure of the economy

Prof. h.c. Dr.-Ing. Aizoh Kubo, General Manager, Research Institute for Applied Sciences, Kyoto, Japan

The innovator’s DNA
- Exploration
- Acceleration
- Serendipity


New ways to lubricate
- Sustainability requirements change in raw material landscape
- Sensor technologies – what’s possible
- New basefluids – why not water

Dr. Lutz Lindemann, Member of the Executive Board (CTO), FUCHS PETROLUBE SE, Mannheim, Germany

High performance plastic gears in future applications
- Intelligent plastics material design
- Processing and design freedom of plastic gears
- Evaluation of plastic gears for new mobility vehicles

Prof. Dr.-Ing. Karl Kuhmann, Head of Polymer Technology Development, High Performance Polymers, Evonik Operations GmbH, Marl, Germany

Roller pairings with lubricant-impregnated sintered material
- Lubrication of the contact by escaping lubricant
- Separation of the contact of the Roller pairings, without metallic contact
- Influence of the surface structure

Prof. i. R. Dr.-Ing. Bernd-Robert Höhn, TUM emeritus of excellence, Gear Research Centre (FZG), Technical University of Munich (TUM), Garching, Germany

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

Opening of 4th International Conference on Gear Production 2021

Manufacturing of internal gears
Moderation: 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

13:30 Modelling and prevention of meshing interference in the gear skiving of internal gears
- Modelling of the distance between workpiece and tool along the clearance face
- Determination of maximum tool height
- Strategies for collision prevention in: process kinematics, cut distribution and tool design

Andreas Hillgart, M. Sc., Research Associate, Jan Klose, M. Sc., Team Leader Gearing Technology, Prof. Dr.-Ing. habil. Volker Schulze, Director of Manufacturing and Materials Technology, wbk Institute of Production Science, Karlsruhe Institute of Technology (KIT), Germany

14:00 Practical analysis of productivity of grinding tools in the process of internal generating gear grinding
- Tool life and gear quality analysis of various high-performance corundum grinding tools using internal generating gear grinding
- Benchmarking against CBN grinding tools and evaluation of productivity and economic performance
- Showing the method of improving corundum wheel performance closer to that of CBN-wheels

Dr.-Ing. Alexander Spatzig, Head of Machine Tool Business Development Europe, Engineering Development Department, Noritaka Fujimura, M. Sc., Engineering Manager, Mitsubishi Heavy Industries Machine Tool Co., Ltd., Rittol, Japan; Patricia de Oliveira Teixeira, M. Sc., Research Assistant, Gear Hard Machining, Gear Department, Laboratory for Machine Tools and Production Engineering (WZL), Faculty for Mechanical Engineering, RWTH Aachen University, Germany

14:30 Tool wear development in gear skiving process of quenched and tempered internal gears
- Machining high strength material from the massive blank
- Comparing the wear of dry and wet process
- Tool wear phenomena and workpiece surface quality

Tassilo Arndt, M. Sc., Research Associate, Dr.-Ing. Michael Gerstenmeyer, Chief Engineer, Prof. Dr.-Ing. habil. Volker Schulze, Director of Manufacturing and Materials Technology, wbk Institute of Production Science, Karlsruhe Institute of Technology (KIT), Germany

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

Innovative manufacturing processes
Moderation: 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

16:00 Increasing the safety against the scuffing of additively manufactured gear wheels by internal cooling channels
- Optimization scuffing, lubrication, splashing losses
- Additive manufacturing of metal powder with laser powder bed fusion (LPBF)
- 30CrNiMo6 steel for quenching and tempering

Dr.-Ing. Hans-Jörg Deng, Senior lecturer, School of Engineering, Livia Zumofen, M. Sc., Scientific Employee, Centre for Product and Process development, Zurich University of Applied Sciences, Dipl. Masch.-Ing. ETH Daniel Stergi, Team Leader Gear Technology Renk-Maag GmbH, Winterthur, Switzerland

www.vdiconference.com/02TA411021
16:30  Tribological design of sintered gears through mechanochemical surface finishing

- Mechanochemical surface finishing: roughness, waviness, densification, compressive stress
- Efficiency and NVH optimisation of gears: FEA simulations, FVA efficiency tests
- FZG test results: scuffing load, friction, wear, micropitting

Boris Zhmud, Ph. D., Assoc. Prof., FRSC, Chief Technology Officer, Martin Bengtsson, M. Sc., Development Engineer, Linus Everlid, M. Sc., Development Engineer, Applied Nano Surfaces Sweden AB, Uppsala, Sweden

17:00  Analysis of friction of bowl-shaped surface structures resulting from alternative gear manufacturing processes

- Evaluation of electrical discharge machining (EDM) process in regard to gear applications
- Analysis of friction EDM and hammered surface structures in comparison with a ground reference

Dieter Mevissen, M. Sc., Research Assistant, Dr.-Ing. Jens Brimmers, M. Sc., Chief Engineer Gear Department, 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

17:30  End of the first conference day

18:00  Organized bus transfer to the evening reception

Get-together
At the end of the first conference day we cordially invite you to our evening reception.

19:00  Evening reception at the Hofbräuhaus in Munich
You can look forward to a special evening event. We cordially invite you to our evening reception at the Hofbräuhaus and to enjoy tradition. The Hofbräuhaus is the cradle of Bavarian tavern culture - the origin of tradition, "Gemütlichkeit" and hospitality. Enhance your personal network and use the informal atmosphere for deeper-going discussions.

Source: @ Hofbräuhaus München

Dinner speech
"Mobility is not only an essential feature of freedom – without it, living nature is unimaginable. The key to mobility of humankind and its communities has always been innovation, shaped by our engineers, coming full circle back to living freedom."

Prof. Dr. Dr. h. c. mult. Wolfgang A. Herrmann, President Emeritus, Technical University of Munich (TUM), Garching & Chairman of the Founding Board, Deutsches Zentrum Mobilität der Zukunft (DZM), Munich, Germany
Advances in special gearings

Moderation: Dr.-Ing. Joachim Thomas, Managing Director, ZG Hypoid GmbH, Aschheim, Germany

14:00 Direct flank geometry calculation for face gears
- New face gear geometry calculation method without numerical post-processing
- Comparison with gear geometry calculation software

14:30 Improved design and manufacturing of face gears
- Overview of current manufacturing methods for face gears
- New manufacturing strategies for 5-axis machines
- Analysis of face gears in the same way as bevel gears

15:00 Challenges for lead-free brass alloys in worm gears
- Reduction of lead in brass due to REACH
- New lead-free special brass with comparable performance
- Investigation into new high-strength alloy

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

Modeling in gear production

Moderation: Dr.-Ing. Franz Völkel, Sr. Vice President R&D, Business Division Transmission Systems, Schaeffler Technologies AG & Co. KG, Herzogenaurach, Germany

16:30 Approach for multiscale modeling the thermomechanical tool load in gear hobbing
- Derivation of load functions from orthogonal cut simulations
- Coupling of the load functions with penetration calculation
- Evaluation of tool load based on multiscale model

You are invited!

We are pleased to invite you to our evening reception at the end of the second conference day. Enhance your personal network and use the relaxed and informal atmosphere for deepening talks with other participants and speakers.

Dinner speech

“Despite all digitalization in the world, also in future real forces will have to be transmitted. Thus, developing and manufacturing transmission systems which aim at the best efficiency factor as well as the lowest possible lifetime costs will always be a challenge for all people involved.”

Prof. Dr.-Ing. Sebastian Bauer, President, German Federation of Industrial Research Associations “Otto von Guericke” e. V. (AiF), Cologne & Managing Director (Research and Development), BAUER Maschinen GmbH, Schrobenhausen, Germany

Reasons why you should visit the conference:

- Get insights into recent developments in gear research
- Unique platform for the international community of gear manufacturing experts
- Discuss current challenges in gear production e. g. need for finishing internal gears
- High-quality presentations on the latest trends in gear manufacturing
- Valuable insights into best practices for gear manufacturing in industry
- Outlook and discussion of future gear manufacturing challenges
3rd Conference day  
Friday, September 17th, 2021

Measurement technology  
**Moderation:** Prof. Dr.-Ing. Karsten Stahl, Full Professor, Institute of Machine Elements, Director, Gear Research Centre (FZG), Technical University of Munich (TUM), Garching, Germany

**08:30** Validation of evaluation algorithms for cylindrical involute gears measured on coordinate measuring machines – new challenges according to standardization

- Software test: profile, helix and pitch deviations including common modifications
- Gear data exchange format: container for simulated points and evaluated results
- Traceability for computation-intensive metrology – TraCIM

**Dr.-Ing. Karsten Lübke**, Software development special geometries, Hexagon Metrology GmbH, Wetzlar, Dr. rer. nat. Martin Stein, Dr.-Ing. Shan Lin, Working Group S.33 “Gears and Threads”, Physikalisch-Technische Bundesanstalt, Braunschweig, Germany

**09:00** Gear calibration in scanning mode on CMMs

- High accuracy measurement strategy in scanning mode
- Gear calibration from medium size up to large gears
- Analyzing measurement results using single-point and scanning mode

**Dipl.-Ing. (FH) Achim Wedmann**, Technical Engineer, Dr. rer. nat. Martin Stein, Head, Working Group “Gears and Treads”, Dr.-Ing. Karin Kniel, Head, Department “Coordinate Metrology”, Physikalisch-Technische Bundesanstalt Braunschweig, Germany

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

Gear hard machining  
**Moderation:** 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

**11:00** Potential and challenges of profile gear grinding with vitrified bonded CBN grinding wheels

- Tool performance and gear properties
- Economic efficiency analysis
- Analysis of the grinding-in behavior and tool topography

**Babette Schalley, M. Sc.,** Research Assistant, Dr.-Ing. Jens Brimmers, M. Sc., Chief Engineer Gear Department, 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

**11:30** Gear hard finishing with 100 % inline quality inspection

- High productive threaded-wheel grinding: double spindle machine, short idle and fast setup times
- Gear measurement using laser technology: 100 % inline gear inspection, replacing SPC control, noise analysis
- Closed loop correction: automatic correction of measured gear parameters

**Dr.-Ing. Antoine Türich,** Director Product Management, Hard Finishing Solutions, Gleason Corporation, Munich, Germany

**12:00** A topological flank modification method considering contact trace in continuous generating grinding

- Topological flank modification of tooth flank
- Anti-twist gear flank based on sensitivity matrix
- Correction of flank deviation by additional axes movement

**Dan Li,** School of Mechanical Engineering, Hefei University of Technology, China

**12:30** Closing remarks

**12:45** Awarding of the best presentation for junior engineers by the conference president

**Prof. Dr.-Ing. Karsten Stahl,** Gear Research Centre (FZG), Technical University of Munich (TUM), Garching, Germany

**Awarding of the best paper by**

**Dr.-Ing. Franz Völkel,** Sr. Vice President R&D, Business Division Transmission Systems, Schaeffler Technologies AG & Co. KG, Herzogenaurach, Germany

**+ Lunchtime snack**

**14:15** End of the conference

Extract from poster exhibition

**Material database for the mechanical design of components made of powder metallurgy material**

**Miao Jiacheng, M. Sc.,** State Key Laboratory of Mechanical Transmission, Chongqing University, China

**Thermal deformation characteristic of gear hobbing based on multivariable integrated model**

**Zheyu Li, B. Eng.,** State Key Laboratory of Mechanical Transmission, Chongqing University, China

**Quality inspection of common step gearings – overview of different types and their assessment**

**Dr.-Ing. Karsten Lübke,** Software development special geometries, Hexagon Metrology GmbH, Wetzlar, Germany

**Light in the Black Box: identifying unknown mechanisms of action with AI software and solving acoustic/NVH problems of gears – practical example of the car power train**

**Dipl.-Ing. (FH) Frank Thurner,** Managing Director, Management, Lean Six Sigma Master Black Belt, mts Consulting & Engineering GmbH, Fürstenfeldbruck, Germany

**Advanced method of cutting spiroid, worm and bevel gearwheel teeth by running cutter head double-stage gearboxes for pipeline valves**

**Evgeniy Trubachev, D. Sc.,** Professor, Institute of Mechanics, Kalashnikov Izhevsk State Technical University, Head, Small Innovative Enterprise “Mechanic” Ltd, Izhevsk, Russia

**Design method for global properties of point-contact tooth surface based on envelope-approximation theory**

**Prof. Kaihong Zhou, Ph. D.,** Professor, Engineering Mechanics, Mechanical transmission, Robot and CNC Manufacture Technology for Sculptured Surface, College of Mechanical and Control Engineering, Guilin University of Technology, China

**Research on tooth flank twist compensation of continuous generating grinding gear based on flexible electronic gearbox**

**Lei Zhou,** Research Center, School of Mechanical Engineering, Hefei University of Technology, Hefei, China
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 Centre (FZG), Technical University of Munich (TUM), Garching, Germany

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- KISSsoft AG
- Metal Improvement Company Inc.
- SMT
- Telemetrie Elektronik GmbH

(May 2021)

Gears interactive – new ideas, more added value for your business

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.

Speakers meet up

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 speakers and to connect with them. They will be available for at least 15 minutes after their session.

Two gear community nights

Your networking hotspot for the international gear community!
Enjoy the evening reception at the Hofbräuhaus as well as another social event on the second conference day at the university. The Hofbräuhaus is the cradle of Bavarian tavern culture – the origin of tradition, “Gemütlichkeit” and hospitality. 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.
**Parallel conferences**

**International Conference on Gears 2021**
September 15 - 17, 2021, Garching/Munich, Germany

Key topics:
- Improved simulation methods
- Lubrication for enhanced efficiency
- Condition monitoring with smart gear systems
- Multi-body simulation and NVH prediction
- Improved calculation methods for strength and efficiency

Presidency:
Prof. Dr.-Ing. Karsten Stahl, Full Professor, Institute of Machine Elements, Director, Gear Research Centre (FZG), Technical University of Munich (TUM), Garching, Germany

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

Prof. i. R. Dr.-Ing. Bernd-Robert Höhn, TUM emeritus of excellence, Gear Research Centre (FZG), Technical University of Munich (TUM), Garching, Germany

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

With experts from:

Further details and the final program can be found here: www.vdi-gears.eu

**Venue:**

![FZG and TUM logos](Source: Scharger, Albert/TUM)

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**Parallel conferences**

**4th International Conference on High Performance Plastic Gears 2021**
September 15 - 17, 2021, Garching/Munich, Germany

Key topics:
- Latest developments for enhanced performance of plastic gears
- Status and future of standardized plastic gear strength calculation
- High performance plastic gear applications
- Potential of composite gears with fiber reinforcement
- Lubrication and tribology of plastic gears

Presidency:
Prof. Dr.-Ing. Karsten Stahl, Full Professor, Institute of Machine Elements, Director, Gear Research Centre (FZG), Technical University of Munich (TUM), Garching, Germany

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

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

With experts from:

Further details and the final program can be found here: www.vdi-conference.com/02TA409021

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<td>Early bird price until July 1st, 2021</td>
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<td>EUR 1,490.−</td>
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