



Foreword “Best of Gears 2019”

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Gears are still the best choice to convert torque and speed in a very wide power range—at lowest cost, with minimal losses and with minimal noise emission. However, demands on gears are rising continuously, and they have to face up to the challenge of the competition: digitally enhanced electric drives. Indeed, digitalization offers many opportunities for development, production and use of gears. The chances and challenges of digitalization on gears is the topic of the opening session of the VDI International Conference on Gears 2019 in Garching/Munich. Digitalization includes the use of digital tools on a system level, like multi-body models to analyze the dynamic behavior, on component level, like CFD-simulations of the oil flow and TEHL simulations and even on smallest scale, like atomic simulations in tribology. Therefore, digital twins do not only offer potential in production, but also allow a deeper understanding of the properties of gears and transmissions during development on various scales and offer the potential to optimize gears further.

At the VDI International Conference on Gears 2019 in Garching/Munich, the latest developments and research results in the powertrain industry and academic research are presented and discussed by more than 600 leading experts within more than 186 contributions. These contributions cover a wide range of applications, gear types, materials and manufacturing processes. Furthermore, methods and technologies to meet the rising demands regarding the efficiency, NVH-behavior, cost and load-carrying capacity of gears are presented.

The necessity to reduce CO₂-emissions is one of the most important megatrends and poses a crucial challenge to gears. Therefore, efficiency is a key topic for gear research and development. Measures like the application of tailored synthetic or even water-based lubrication fluids are typical. Several contributions to the conference will discuss

additional possibilities for further improvement. Another subject of the conference is the NVH-behavior of geared transmissions. Not only for automotive powertrains, NVH-behavior gets more and more into the focus. Several contributions to the conference address the subject of modelling and simulating the noise behavior of geared transmissions and describe methods to reduce gear noise. Finally, the demand for weight saving will continue to increase, not only because of the progressive electrification of automotive powertrains. Here, high-speed electric motors with high ratio transmissions are a promising approach. Besides, the use of plastics for power train components offers favorable properties such as low friction, dry-running capabilities or good damping at minimal costs. High-performance plastic materials offer the opportunity of substantial improvements, but the limited knowledge about the performance of the material still restricts their direct application to machine elements. Here, focused research is required to set the bar higher.

The topics above will be discussed using a wide variety of gears and gearbox systems for different fields of applications as examples. Several speakers will talk about new results from theoretical and experimental investigations as well as experience from the field. These talks confirm that the performance and efficiency of gears will continue to play an important role.

In addition to the complete arrangement of proceedings of the presentations during the VDI International Conference on Gears 2019 within the VDI Berichte, you will find 46 full papers within this Special Issue “Best of Gears 2019”. Each paper was thoroughly selected with the support of the guest editors Prof. Bernd-Robert Höhn and Dr. Bernhard Bouché utilizing a double-blind peer review process with renowned international experts from industry and academia. Based on the cooperation between the VDI Wissensforum and the Springer-Nature journal “Forschung im Ingenieurwesen” and with thanks to the authors and more than 80 reviewing experts, we were able to process all papers in a very short lead time and to publish this Special Issue concurrent to the VDI International Conference on Gears 2019.

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I wish you an instructive and enjoyable reading of this Special Issue and many suggestions for your own work.

On behalf of the editors of the special issue “Best of Gears 2019”

Your

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