SCHAEFFLER
AT THE THIRD EDITION OF
BEARING WORLD 2020

Dr. Oliver Koch,
Vice President Bearing Analysis Tools
at Schaeffler

FVA – The German Research Association for drive technology is organizing the third International Bearing Conference in Hannover on 31 March – 01 April 2020.

The FVA always focuses on areas where something is driven, controlled and moved. Research projects concentrate on mechanical and electrical or mechatronic drive technology in stationary industrial plants, in motor vehicles and mobile machines, through to aircraft. All links in the value added chain are put to the test, from materials, production technologies and quality assurance, components and systems and their calculation, lubricants, through to environmental compatibility, quality, costs and innovation management. Currently approx. 180 ongoing projects are coordinated each year by 25 active working groups.

Schaeffler is one of the main sponsors and supporters of the Bearing World conference, and sees it as a leading event to exchange state of the art technology and latest research results in order to make machines more powerful and more reliable.

We tried to reveal why Schaeffler, the global bearing supplier and leading company in bearing research and technology is sponsoring the Bearing World Conference during an interview with Dr. Oliver Koch, Vice President Bearing Analysis Tools at Schaeffler.

1. What is the purpose of your sponsorship of the bearing world conference?

Knowledge is one of the most important resources in our times. We strongly believe that an exchange of experts is necessary to generate new knowledge – also in the field of bearing technology. The FVA Bearing World is the biggest international bearing conference, so it's just consequent to sponsor this event.

2.What is your role at the company and why are you chosen for this function?

To increase the R&D efficiency, computational simulations becomes more and more important. Schaeffler started to develop the well-known and established tool called BEARINX more than 25 years ago. With BEARINX we can simulate single bearings, shaft systems or whole drive trains under consideration of all relevant boundary conditions. Nearly every bearing we sell has been simulated using BEARINX. In addition, we also have tools for dynamic simulations, system simulations and very detailed contact simulations. These tools are embedded to the BEARINX SIMULATION SUITE. In my organization I'm responsible for the development of those tools – including the physics, software developments and cloud integrations. Before joining Schaeffler, I did my Ph.D. in a bearing simulation topic as well. I developed a model for predicting friction in the rib contact of cylindrical roller bearings. After joining Schaeffler, we

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implemented this model into BEARINX, and generalized the model for all kind of contacts. So my heart is still beating for bearings and simulations.

3.What are the differences between your company and other competitors in the market?

There are four main aspects which lead to the fact that Schaeffler is one of the world`s leading bearing suppliers. First of all, we focus on good engineering. This means for us that we must have a very good knowledge about our customers' applications and needs. Second, we need excellent domain know-how and simulation possibilities to provide the right products for each customer's needs. Third, we have great manufacturing know-how for highly precise productions. And last but not least we are a very innovative company. With more than 2,400 patent applications in 2018, Schaeffler is Germany's second most innovative company according to the DPMA (German Patent and Trademark Office).

4. Can you tell us more about your presentation topic at the Bearing World?

We have several presentation topics. Let me give you two examples. In the context of e-mobility, noise and vibration behavior of all kind of machine elements is becoming more important. So it would be necessary to predict the noise of bearings in the system at the early stages of product development. Bearing noise simulations are complex and very time consuming. Now we have developed a new method in BEARINX which allows us to predict the running noise of bearings within a few seconds. This is unique in the world and will be presented at the FVA Bearing World for the first time.

Another presentation is about the influences of non-metallic inclusions (NMIs) on white etching cracks (WEC). According to literature, it's still not clear if NMIs are the root cause of WEC or not. For an adequate interpretation of this matter, a mechanical evaluation of NMIs under rolling contact conditions is desirable. One option for an analytical evaluation of internal defects could be
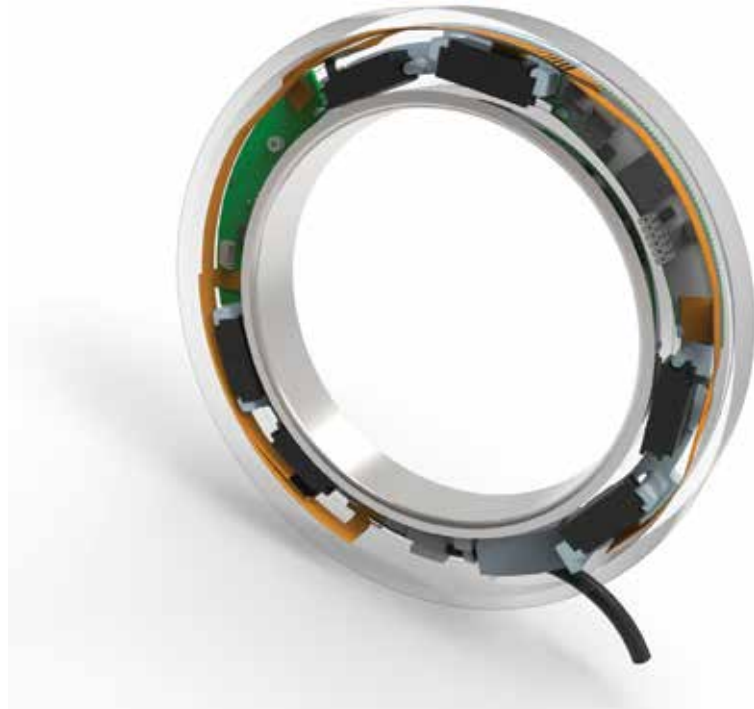
— *Schaeffler integrates sensor technology into its spindle bearings*

explained by Linear Elastic Fracture Mechanics (LEFM). With understanding of LEFM, experts could determine critical defect sizes depending on the stress distribution and the defect position in a component, and the calculation of a permissible stress for a given defect size.

However, the required consideration of the complex stress state under rolling contact conditions is challenging. A combined approach for the analysis of subsurface fatigue initiation and the development of – so called – butterflies has been developed. The comparison with test results and determinations in different standards (e.g. ISO 281) shows a good accordance. So we'll discuss in our talk about the influences of NMIs on different damage mechanisms including WEC formations.

5. What can your company add to the reduction of Co2 content?

Schaeffler`s high precision products have been facilitating and shaping mobility for decades. The continuous optimization of our product solutions, e.g. with regard to the reduction of friction losses and the extension of the product life-cycle (predictive maintenance,

remanufacturing), enables our customers to realize significant efficiency gains during the use-phase, and thus, provides contributions to reduce the overall climate impact. In order to additionally mitigate the carbon footprint of our products along the entire value chain, the Schaeffler Climate Program aims on further increasing energy efficiency in our own operations, the upscaling of the share of renewables in our power mix and the engagement with our suppliers to identify and realize reduction potentials.

6. How important is the exchange between research at universities and industry for you?

This exchange is very important because you need to get new ideas in the company to stay innovative. We have a very good worldwide university network and for special topics we have established so called Schaeffler Hubs for Advanced Research (SHARE). The research at the SHAREs is oriented towards the main future topics, which Schaeffler has identified. So we have for instance a SHARE for interurban mobility at Southwest Jiatong University China, a SHARE for urban mobility at Nanyang Technological

University Singapore and a SHARE for digitalization at the Friedrich Alexander University in Erlangen Germany. At the Karlsruhe Institute of Technology the SHARE focuses on e-mobility.

"There are a lot of opportunities, especially for the bearing industries."

— The FAG VarioSense is a rolling bearing system that is based on standard products and can be configured in a modular fashion using a range of different sensors, which allows virtually every desired bearing position to be equipped with sensors. Schaeffler is thus paving the way towards a future in which even simple assemblies and machines will have access to digitalization and the Internet of Things.

7. What does Schaeffler mean by smart bearings and how far is your company in implementing them?

When digitalized machines and equipment are designed, the rolling bearing generally represents an ideal "measuring point" for recording operating loads, process parameters, and the condition of machines. These variables occur directly in the bearing in most machines. It therefore makes sense to develop sensor systems for determining operating loads mainly in the rolling bearing. A very compact design can be achieved by clustering several sensor elements in a single, compact sensor unit. Schaeffler has implemented this approach in its VarioSense sensor bearings. The sensor unit can be flexibly configured with various measured variables such as speed including rotation direction detection, shaft position, bearing temperature, vibration, and the resulting radial shaft displacement. The radial shaft displacement is determined with micrometer precision and correlated with the internal forces and torque in many machines. These measured variables enable the intelligent, i.e., data map-oriented operation of machines and equipment, for example. The bearing load and thus the machine load can also be determined from the displacement measurement using the bearing model. This opens up entirely new possibilities in the fields of machine control and condition and process monitoring.

Customers are already using our service range comprising condition monitoring products, smart rotary and linear products, digital services, sector-specific solution packages, and new, data-based business models in different project stages. In the next stage, Schaeffler will use this experience to further develop its range of platform-based services and thus respond to customer requirements in a quick and flexible manner.

8. What consequences will the upcoming economic situation have on the bearing industry?

We all know that the next few years will be challenging. The economy is cooling down and we have technology changes in the automotive industries at the same time. But I'm convinced that there are a lot of opportunities, especially for the bearing industries. Of course, we would need less parts and less bearings in electrical cars, but the requirements especially for the electrical motor bearings are quite high in terms of speed and electrical resistance, which means we have the chance to generate USPs with excellent and innovative products for the new technology. In addition, the global bearing market is still growing and a lot of new trends are arising. One example for the industrial business is robotics,

which provides opportunities not only for mechanical products, but also for smart bearings and bearing systems.

9. What challenges will the bearing industry have to face in the future?

As bearings are needed nearly everywhere where motion occurs, the spread of applications would increase. One of the main challenges would be to handle the wide range of applications in an effective and competitive manner. In many applications, a bearing is the place, where all information such as speed, load, and temperature of a device is available and therefore the additional purpose of bearings is to act as an information generator. The future bearing is more than just a bearing; it would become an integrated sensor. Therefore, the importance of bearings would increase in the future with digitalization and industry 4.0.

One example of a bearing as information generator is the Schaeffler SpindleSense, which is a very compact solution from Schaeffler for main spindles. It integrates the sensor technology, the evaluation unit for determining the measured values and the overload message output into a single unit.