# PRESS RELEASE

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**More accurate than the Oracle of Delphi   
Predictive maintenance saves lots of money – solutions at the EMO Hannover 2017**

***Frankfurt am Main, 27 March 2017.*** *In classical antiquity, the visions of the future revealed by the Oracle of Delphi were often enigmatic and even incomprehensible. By contrast, the production scientists of the Fraunhofer Institute for Production Systems and Design Technology (IPK) are able to foresee the future of machine tools a lot more clearly and accurately with the aid of predictive maintenance: it helps its users to identify the optimum juncture for maintenance work, to avoid lost production, and to optimise the processes involved. In our interview, Eckhard Hohwieler, Head of Production Machines and Line Management, and Claudio Geisert, both from the Fraunhofer Institute for Production Systems and Design Technology (IPK) in Berlin, report on the salient considerations and the role the EMO Hannover 2017 plays in their work.*

**Eckhard Hohwieler, how does predictive maintenance (PM) differ from condition monitoring?**

**Eckhard Hohwieler**: Condition monitoring detects and monitors the wear-and-tear status, whereas predictive maintenance forecasts the putative development of the machine’s future status, and plans the appropriate maintenance work required.

**Claudio Geisert, how does PM specifically benefit the owner of machine tools?**

**Claudio Geisert**: Care and maintenance are governed by the condition of the machine. This means the staff concerned carry out precisely the care and maintenance work that is actually required. Effective PM reduces the number of maintenance routines needed, and increases machine availability levels. It also enables line use to be more efficiently planned, because care and maintenance work will now be carried out on pre-specified dates.

**One of your specialisms is process monitoring and condition diagnostics: can you give us a highlight from your research work?**

**Eckhard Hohwieler**: For one machinery manufacturer, we have created a tool monitoring feature without any additional sensors or other electronics. A software package integrated into the control system monitors tool wear-and tear and fracturing. On this basis, we developed further algorithms enabling the machine’s condition and behaviour to be checked. This allows an employee to determine weak points with astonishing accuracy using the characteristic values of the drive shafts: even textile flaws in belt drives have been discovered in this way.

**Where are the data actually located – at the IPK or the company concerned? Who owns the data, and who is entitled to use them?**

**Claudio Geisert**: The data created during the utilisation phase belong (unless something to the contrary has been contractually agreed) to the operating company. As a rule, the companies concerned will not reveal these data to outsiders, since they fear that sensitive information will be among them, or can be derived from them. One solution commonly adopted is to install an appropriate server inside the company’s own network. This, however, will in its turn deprive the manufacturer of an option for gaining additional insights into the behaviour of his machines in the field. In order to master this problem, a relationship of mutual trust between the manufacturer and the operator is always imperative, though contractual safeguarding for utilisation of the data is indubitably helpful.

**How has this new form of monitoring evolved into PM at your institute?**

**Eckhard Hohwieler**: While working on a project on e-maintenance, we took a long, close look at how information from condition monitoring can be utilised for planning maintenance work. As an aid here, we used an electronic service checkbook that specifies the next worksteps required. It also explains how users are supposed to prepare and carry out the maintenance routines; and where they can order the requisite tools.

**Is there a practical example of a PM solution that you’ve developed together with a machine tool manufacturer?**

**Claudio Geisert**: The automotive industry demands guarantees on availability from the machinery manufacturers, plus particulars of the anticipated lifecycle costs. This, however, necessitates complete-coverage monitoring of the machine involved. Our solution developed in conjunction with the grinding machine manufacturer Schaudt-Mikrosa – electronic monitoring of the drive elements using the machine’s own control system – acquires and evaluates all messages and signals from the machine, which the system then uses to determine the dynamic behaviour of the drive shafts and spindles over a lengthy time period. This solution is meanwhile being utilised in all machines.

**How does the PM tool benefit the manufacturer?**

**Eckhard Hohwieler**: Schaudt-Mikrosa is already using it as an important tool for purposes of quality assurance – in machinery acceptance-testing, for example, or in the warranty phase to clarify the causes of damage, such as collisions between drive elements, tools and components.

**Claudio Geisert**: The service personnel use the tool for looking backwards into the past: thanks to complete-coverage data acquisition and storage, they see when and under what circumstances problems occurred for the first time, and can thus more easily identify how they can be remedied.

**Monitoring and condition diagnostics involve huge quantities of data. When acquiring 20 values (64 bits) per millisecond, the electronics will already be storing more than four gigabytes during an 8-hour shift, according to the Machine Tool Laboratory in Aachen. How do you proceed for evaluating this kind of big data?**

**Eckhard Hohwieler**: It’s not a problem for us, because we don’t acquire the raw data, but true to our motto of “ “smart data, not big data”, we determine and store only the typical characteristic values. My impression is, you know, that quite often, big data accumulate merely because it’s possible to store huge quantities and generate redundant data copies. It’s more sensible to make an intelligent pre-selection near the machine concerned before storage, so that a reduced data record is then transferred to the cloud.

**How can users ensure that a reduced data record does not overlook effects that can then no longer be reconstructed? What options are already available for making a selection?**

**Claudio Geisert**: Compression of raw data to selected characteristic values always entails concomitant losses. So the possibility cannot be ruled out that some effects will be overlooked. However, this also applies to data acquisition: what physical variables are to be actually acquired using what sensors with what accuracy? Without a certain amount of domain-specific expert knowledge, a monitoring concept cannot be translated into viable reality.

In order to make the correct selection, users can utilise machine learning processes in the development phase. This helps They help the expert to choose meaningful characteristic values. It must always be remembered that for developing a sustainable monitoring concept you need both knowledge of the fundamental theory involved and experiential knowledge as well.

**What are the long-term benefits of predictive maintenance for the manufacturer?**

**Eckhard Hohwieler**: You get a fleet effect: over the course of the production lines’ lifecycle at the customer’s facility, you see, huge amounts of information are created, which enables the manufacturer’s service capabilities to be improved.

**Please tell us about your personal vision: what – in conjunction with Industry 4.0 – might an optimum PM solution look like?**

**Eckhard Hohwieler**: It would be conceivable that the machine itself utilises the information created in order to optimise its process or to “call” the maintenance service.

**What are you expecting (not least in regard to your research work and predictive maintenance) from your visit to EMO Hannover 2017, the world’s premier trade fair for the metalworking sector?**

**Eckhard Hohwieler**: I’m keenly looking forward to seeing how the machinery manufacturers are responding to the issue, and what apps they will be presenting. Perhaps, too, someone will even be premiering the Machine Tool 4.0, one that tweets on Twitter and allows visitors to the EMO to contact it on their smartphones.

*The interview was conducted by Nikolaus Fecht, specialist journalist from Gelsenkirchen*

**A look at actual practice: predictive maintenance in the machine tool industry**

Machine tool customers’ interest in and requirements for predictive maintenance are increasing. Industry 4.0 is perceived here as an accelerating factor. “Predictive maintenance is also a part of Industry 4.0, even though our customers definitely view them in a highly differentiated context,” says Dr. Holger Rudzio, Managing Director of **DMG Mori Software Solutions GmbH** from Kempten. “Thus predictive maintenance can be implemented even without an Industry 4.0 approach.”

Predictive maintenance, and thus the requirements of DMG Mori’s customers, aim to detect possible defects of a machine or problems in a process before they actually occur. The company possesses the requisite predictive maintenance components, including the relevant programs for acquisition, evaluation and visualisation (see “Joint development of Machine Tool 4.0 with INA Schaeffler”) sensors in the machine record even the tiniest of changes, which are compared with the relevant limit values so as to predict future events from them.

**Artificial intelligence in the data cloud**

The acceptance and the success of predictive maintenance stand and fall with the quality of the information obtained and the benefits to the customer of the predictions concerned. This is why DMG Mori is prioritising the development of high-performance evaluation logics, so as to join forces with its customers to effectively filter out the necessary information from the mass data and to use it to calculate dependable predictions for its machines and its customers’ processes. To quote Dr. Rudzio: “In future, cloud-based solutions featuring artificial intelligence will gain steadily in perceived importance. We shall be presenting the relevant results to the trade public at the EMO Hannover 2017 in Hall 2.”

For more than ten years now, **Schwäbische Werkzeugmaschinen GmbH** from Waldmössingen has been working on comprehensive data acquisition, under the term “life data”, designed to support predictive maintenance. There’s increasing interest in this, as Sandra Schuster, Industrial Data Services, has observed: “In the past one or two years, it’s been increasingly evident that due to the trend towards Industry 4.0, we are seeing significantly greater acceptance of the cloud concept, or at least the will and the desire to engage with it.”

**Changing awareness among customers**

The company used to have to take the initiative in approaching customers in order to talk to them about data acquisition, and in some cases this needed a lot of persuasion. But meanwhile, many customers are keen to use the products from Waldmössingen, and in most cases are grateful for advice as well. To quote Sandra Schuster: “The requirements involved, however – meaning cost reduction, transparency in the production and maintenance processes, plus better resource planning – have basically remained the same.” It’s only that awareness has altered in terms of how companies are approaching the issue, she adds.

Digital transparency is also a major priority with the manufacturers of systems for sheet-metal forming. For example, the Machine Monitoring System (MaMS) from **Schuler AG** in Göppingen provides entirely new insights into presses: thanks to comprehensive line monitoring, the user can upgrade availability levels, improve production and part quality, and downsize the energy consumption involved. The MaMS is part of Schuler’s Smart Press Shop, in which the company collects solutions for networking in the field of forming technology. It brings together data for intelligent diagnostics, condition, process and energy monitoring, and production data. This means a company can use the MaMS to collect and analyse characteristic values and data of all kinds. Line owners can thus obtain an overview of the production status and the requisite basis for calculating the overall equipment efficiency (OEE). The system also acquires and archives for every part produced all the data of importance for quality (e.g. typical process parameters like cycle time or mechanical strength of the formed materials). This enables the user to provide the requisite documentary evidence regarding safety-related components in the automotive or aircraft industries, for example – experts speak of parts subject to mandatory documentation.

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Text: Nikolaus Fecht

**Background**

**Fraunhofer Institute for Production Systems and Design Technology (IPK), Berlin**

The institute operates in the field of corporate management, virtual product development, production systems, automation technology, joining and coating technologies, quality management and medical technology. The IPK offers application-driven system solutions for the entire spectrum of industrial tasks – from product development and the production process, the maintenance of capital goods and recovery of products, all the way through to the design and management of complete factories. The staff also transfer their solutions in terms of production technology to application categories outside the industrial sector – to fields like medicine, transportation and safety, for example. Budget: 19.85 million euros; staff: 396, [www.ipk.fraunhofer.de](http://www.ipk.fraunhofer.de)

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**EMO Hannover 2017 – the world’s premier trade fair for the metalworking sector**

From 18 to 23 September 2017, international manufacturers of production technology will be spotlighting “Connecting systems for intelligent production” at the EMO Hannover 2017. The world’s premier trade fair for the metalworking industry will be showcasing the entire bandwidth of today’s most sophisticated metalworking technology, which is the heart of every industrial production process. The fair will be presenting the latest machines, plus efficient technical solutions, product-supportive services, sustainability in the production process, and much, much more. The principal focus of the EMO Hannover is on metal-cutting and forming machine tools, production systems, high-precision tools, automated material flows, computer technology, industrial electronics and accessories. The trade visitors to the EMO come from all major sectors of industry, such as machinery and plant manufacturers, the automotive industry and its component suppliers, the aerospace sector, precision mechanics and optics, shipbuilding, medical technology, tool and die manufacture, steel and lightweight construction. The EMO Hannover is the world’s most important international meeting point for production technology specialists from all over the planet. In 2013, the fair attracted more than 2,130 exhibitors, and around 143,000 trade visitors from more than 100 different countries. EMO is a registered trademark of the European Association of the Machine Tool Industries CECIMO.

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