

# PRESS RELEASE

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Fraunhofer IWU presents highlights in adaptronics at Hannover Messe 2018

## **Intelligent materials, components and systems**

**It sounds like Science Fiction, and yet it has already become reality for the scientists of the Fraunhofer Institute for Machine Tools and Forming Technology IWU: wireless power transmission. Among other things, the experts in adaptronics want to use the new technology for making machines lighter and more dynamic, and for integrating sensors at positions which have previously been inaccessible in order to continuously monitor production systems. These and other solutions for intelligent production are presented by the researchers at Hannover Messe, at the booth of the Fraunhofer Adaptronics Alliance (Hall 2, Booth C22) from April 23 to April 27, 2018.**

All users of electric tooth brushes know this principle: if the batteries of the device are empty, the device is put onto the charging station, and the energy storage is recharged. This works without any mechanical electric contacts made of metal, and it is based on the principle of electromagnetic induction. A live metal coil in the charging station generates an electric current in the coil of the tooth brush, which is in its direct vicinity. "We exploit this principle for intelligent production of the future", says Prof. Welf-Guntram Drossel, Executive Director of the Fraunhofer IWU. "Using this method, savings can be achieved in the movable components of manufacturing machines, especially regarding weight, installation space, wires and contacts. As a result, these components are lighter and also more efficient. Furthermore, the induction principle allows us to attach sensors to positions which have previously been inaccessible in order to monitor the machines – an indispensable prerequisite for numerous applications of Industrie 4.0."

### **Toothed belts used for energy and data transmission**

At Hannover Messe scientists of Fraunhofer IWU show how this principle can be applied in manufacturing systems by demonstrating the example of a gripper which is moved vertically by a toothed belt. The belt contains integrated conductors transmitting energy to the gripper via induction in order to open or close it. Power transmission up to 100 Watt is possible as well as the provision of a supply voltage of 24 or 48 Volt for actuators. Data transmission takes place

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#### **Editing**

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via Wireless Profinet Bridge. Since the toothed belt takes care of the energy supply, cables and electric contacts are no longer needed for supplying the gripper. By reducing the weight of the moved components, the system becomes more dynamic and in addition, energy is saved. The elimination of calibration work after battery changes also reduces the required maintenance. And yet the scientists go even further: via induction and Wireless Profinet Bridge, sensors and actuators can be supplied with power in air-tight and dust-free installation spaces or even in entirely encapsulated areas, and their data can be read.

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### **High performance machining with ultrasonic assistance - "PermaVib"**

Another highlight of intelligent production technology is demonstrated by the experts in adaptronics of Fraunhofer IWU: "PermaVib", a vibrational system for drilling and milling tools. By using ultrasound, these tools can be excited to vibrate in such a way that the machining of metals is considerably facilitated. "This system allows for a reduction of tool wear by up to 50 percent. Additionally, up to 40 percent less force is required for machining when applying "Perma Vib". These two aspects save money", summarizes Prof. Drossel. The specific benefit lies in the fact that existing machine tools can be retrofitted with this system without any large expenditure, since it can be integrated into any machining center as a module.

### **Smart materials as actuators and sensors in fiber-reinforced plastics**

Smart materials have the ability to adapt independently to changing environmental conditions or to specifically alter their properties due to external influences so that they are optimally adapted to their environment. In contrast to the previous separation of function and structure, they make it possible to integrate the functionality into the structure of the material. One example for smart materials consists of thermal shape memory alloys (SMA). Upon heating they assume an initial shape that had previously been programmed into the material. At Hannover Messe the Fraunhofer scientists show how this smart material can be used for actuators and sensors in fiber-reinforced plastics: it is introduced into the composite material in the form of wires in order to utilize the deformation movement to achieve the initial state. Fields of application for this technology include tempering of engines, fuel cells or batteries in a car. If air inlets, which are made of fiber-plastic composites and equipped with SMA, are applied in this situation, they can be used as a self-sufficient cooling system, for example: if the engine is heated, the inlet opens at a defined temperature only due to the simultaneous heating of the integrated SMA wires. In contrast to currently implemented solutions, this method reduces the

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weight and the required maintenance. Visitors at Hannover Messe can experience a functional model of such an air inlet.

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SMA wires cannot only be used as actuators; they can also serve as sensors. Here the scientists utilize the properties of SMA allowing them to register strains of up to 8 percent and to remain stable for a very high number of load cycles. If power is applied and the electric resistance is measured, the deformation of the wires can be deduced, which also implies deducing the deformation of the entire structure. The particular properties of the SMA achieve a sensitivity that is 2.5 times higher than the previously applied sensors. This technology can be used, for example, to check the condition of airplane wings or rotors of wind power plants. The scientist will also present current research results of this area at Hannover Messe.

#### **Experiencing the added value of networked production: from Machine 4.0 up to Human-Robot-Interaction**

The integration of sensors and actuators is also essential for digitization in manufacturing. Visitors can even experience its specific added value at Hannover Messe: digitization in manufacturing is demonstrated by a forming press and its digital twin. The researchers of Fraunhofer IWU show a fully functional "Machine 4.0", and they use it to demonstrate the possibilities which digitization can provide for manufacturing, under the heading of "Touching, Experiencing, Utilizing" ( Hall 2, Booth C22). In Hall 2, Booth C28, the focus lies on the safe and already industrially applied Human-Robot-Interaction.

## Images

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**Image 1, Demonstration unit "Wireless Energy Transmission":**

This toothed belt offers wireless energy transmission to a gripper via induction, resulting in the opening and closing of the gripper. This new technology allows for the reduction of installation space and weight of machines. Moreover, using this method, sensors can be attached to positions that had previously been inaccessible.

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**Image 2, Demonstration unit "PermaVib":**

Using ultrasound, "PermaVib" excites drilling and milling tools to vibrate so that the machining of metals, fiber-reinforced plastics and ceramics is considerably facilitated. The vibrational system reduces tool wear by 50 percent and the force required for machining by 40 percent.

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**Image 3, Demonstration unit "Air Inlet":**

**Shape memory alloys can be utilized for completely self-sufficient functioning of ventilation systems for engines, fuel cell or batteries.**

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For more than 25 years **Fraunhofer-Institute for Machine Tools and Forming Technology IWU** has been successfully conducting application-oriented research and development in the field of production technology for the automotive industry and mechanical engineering. As the leading institute for resource-efficient production, solutions are developed together with industrial and scientific partners for improving energy and material efficiency. With over 550 highly qualified engineers and scientists, Fraunhofer IWU is recognized as one of the most significant institutes for research and development in production technology worldwide. The research competences at the locations in Chemnitz, Dresden and Zittau range from machine tools, forming technology, joining, assembly technology to precision technology and mechatronics, production management and virtual reality.