Research and Development at the Production Technology Center

FUTUR

Vision Innovation Realization

Digital Transformation

Adaptation? Done!

Digitally Integrated Production

Showcase

Lifecycle Monitoring with the Digital Twin

Fraunhofer IPK
INSTITUTE
PRODUCTION SYSTEMS AND
DESIGN TECHNOLOGY

IWF
INSTITUTE MACHINE TOOLS
AND FACTORY MANAGEMENT
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Editorial

Prof. Dr. h. c. Dr.-Ing. Eckart Uhlmann

Dear Readers, our Berlin Center for Digital Transformation is gaining momentum. Since its successful start in March 2017, the center has supported Berlin's and Brandenburg's local economy on the path to digitization. Thanks to the IT industry, the manufacturing industry and the support of science and research, Berlin-Brandenburg offers great potential to excel as an attractive and competent innovation location.

Together with the other Fraunhofer Institutes FOKUS, HHI and IZM we bundle our competencies in the fields of information and communication technologies, data processes as well as production and microelectronics. In a joint effort, we bring ICT providers and automation outfitters together with the manufacturing industry. Our stated goal is to jointly develop technologies and solutions that utilize the ongoing digitization and networking in industry and production, mobility and infrastructure, as well as the life sciences. The center is funded by the Governing Mayor of Berlin, Senate Chancellery – Research and Technology and the European Regional Development Fund (ERDF). Some of the R&D projects that have been launched in the first nine months of this year can be found in this issue of FUTUR.

In our new Industrie 4.0 Lab, we provide production machines, robot systems as well as Internet of Things (IoT) and cloud platforms. This allows enterprises to test and optimize prototypical solutions in a production-related environment. Plug-and-play IT environments can also integrate and qualify virtual development tools and intuitive interaction in virtual reality environments. Using specific showcases, we demonstrate how digital transformations can succeed – nationally and internationally.

In collaboration with the Instituto Tecnológico de Aeronáutica (ITA), we recently opened the Fraunhofer Project Center for Advanced Manufacturing @ ITA in Brazil. The expertise found in both research institutes complements each other perfectly. The available skill sets allow the development of complete system solutions for digitally integrated production systems, including the creation of prototypes. The project center will greatly benefit the Brazilian industry as well as German and European companies in Brazil.

In all our R&D, we are convinced that scalable modular Industrie 4.0 and IoT concepts are economically viable for companies of all sizes, from start-ups to large international corporations. Come see for yourself – we welcome you to the Berlin Center for Digital Transformation and look forward to sharing our digital transformation expertise and experience with you.

Yours sincerely,

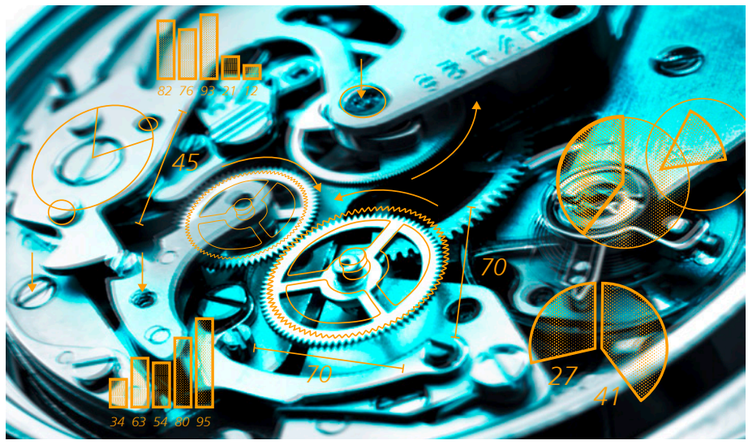
Eckart Uhlmann

Digital Technologies

Adaptation? Done!

Digitally Integrated Production

Our answer to Industrie 4.0 is called »dip – digitally integrated production«. This approach allows us to achieve speedy processes even for customized orders. We efficiently provide simple solutions, single technologies or specific process changes, all of which will have a major impact on production pace and manufacturing costs. However, dip will tap its full potential pursuing a holistic approach which integrates technological aspects and the re-organization of entire process networks. Thanks to our interdisciplinary hnow-how we are ready to master both.



Speedy production processes and custom products – how does it work?

► Custom Products

»Off the peg« was yesterday. Today, many enterprises execute custom processes for every client or even every single order – often with annual repetition rates of 1.3. Letting buyers choose the color or styles of custom trainers or designing custom car interiors are no major problem. System suppliers regularly face completely different challenges: Their clients order components made from materials they have never used before or require certifications that their standard production processes were not designed to accommodate.

Such special requests are a tough test for the economic viability of production processes. The problem is simple: They take time. Mass production is designed to function like a Swiss clockwork: An order is received, and everybody knows what needs to be done. From initial logistics down to the finishing touch, every process step is intricately linked with the next to keep the entire process running smoothly. This is far from straightforward with custom orders, which require much more coordination. A change in the raw materials needs careful checks whether the available machines can process the material, where the material can be procured, and how to proceed in general when it is not predetermined who does what at which point. This makes custom products much more expensive than mass production.

The many advantages of customized products let clients accept greater costs to some extent – but truly flexible manufacturing can only become economically sustainable, if it is faster and cheaper than before. Throughput speeds and production costs need to hold their own with more established mass production. Is that possible?

► The solution: Digitally integrated production!

Industrie 4.0 or digitally integrated production (dip) offers thousands of promising solutions for the challenge »Speed up, costs down«. The spectrum of options reaches from pin-point interventions in existing systems to sweeping restructuring of entire process chains. However ambitious your plans to make your production faster and more flexible, Fraunhofer IPK will support every level of configuration with bespoke solutions. At Hannover Messe 2017, we showed how this can work in practice.

Production of plastic components can be quick and economical, even if key production parameters are changed, thanks to integrated modular product, production, and IT architectures, smart data, and cloud-based control systems. Novel technologies keep the entire process speedy and responsive: Modular Shopfloor IT combines manufacturing facilities flexibly in ever new process chains, ready to handle customized orders. This becomes even more responsive when the machine controls are moved into the cloud: All software is brought together in one place, for easier maintenance and the speedy integration of changes. Smart data transmits the data from production facilities into a digital twin that tests the feasibility of requested product or process changes without stopping production. The end result: Cheaper and faster manufacturing.

Digitally integrated production (dip) makes processes faster and more flexible.

► Modulare Shopfloor IT: Complex IT Architecture from Simple Building Blocks

So far, any changes to products or processes requested by a customer have to be programmed manually in all systems involved in the process. Time and quality constraints make such change requests an unpopular part of industrial life. Modular Shopfloor IT facilitates such change requests enormously. It integrates with the machine controls and makes them available for remote management and integration with higher systems. Changes to processes are then communicated through the IT system – e.g. from order management directly to production. The software relies on a building block principle: Even if a factory uses machines of all different makes and types, the control and monitoring functions will be similar. That means that only few modules are needed to cover the entire value chain of any company.

► Digital Twin: Virtually Validate Product Changes

The custom order has reached the production facilities directly. But can it be produced at all? Product developers need to make sure that e.g. the space for the requested label is sufficient and that no other conflict arises. All of these details can be checked with the digital twin, a virtual copy of production facilities. It not only reflects its geometry and layout, but also the actual behavior of the plant. Multiple sensors, both physical and virtual, track the operating state of the real production hardware and transfer it to the twin. The twin can model the production of product variants before they enter actual manufacturing – or test whether and how new facilities could be integrated into the existing manufacturing processes.

► pICASSO: Cloud-based Robot Control

Modelling facilities in flexible production, we have developed a special robot cell: all its components are designed as cyber-physical systems (CPS). The conveyor belt, camera, and robot are each handled by one service that is recorded in the »Yellow Pages for Industrie 4.0« and readily available from anywhere in the world. In addition, there are purely virtual services, such as object recognition features used to identify grip points. When a component is delivered by the conveyor, the service will tell the camera to send an image to the object recognition service. The service tells the robot the exact grip point for the product. Such flexible service integration illustrates all advantages of cloud solutions: they are economical, readily available and secure. ■

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Showcase

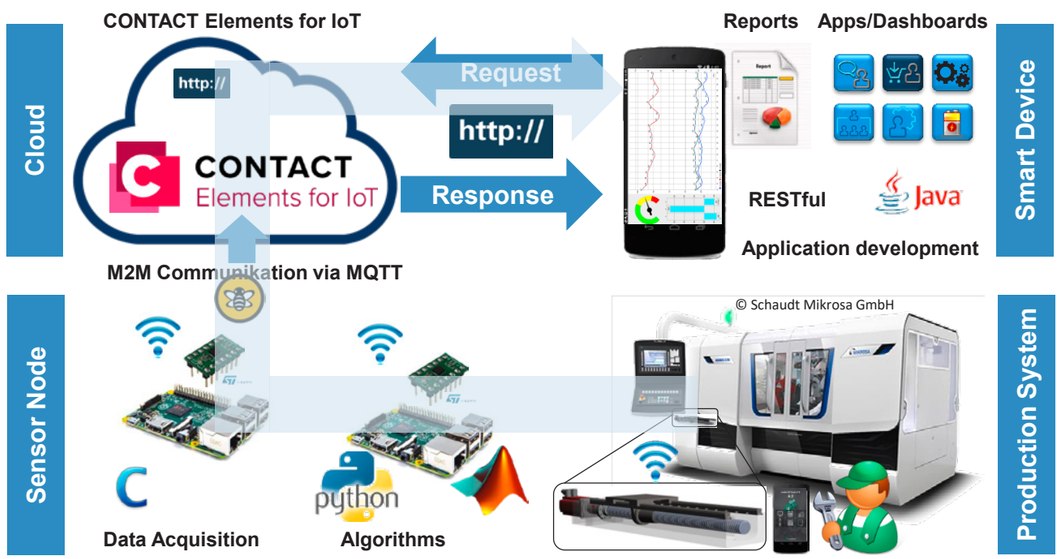
Lifecycle Monitoring with the Digital Twin

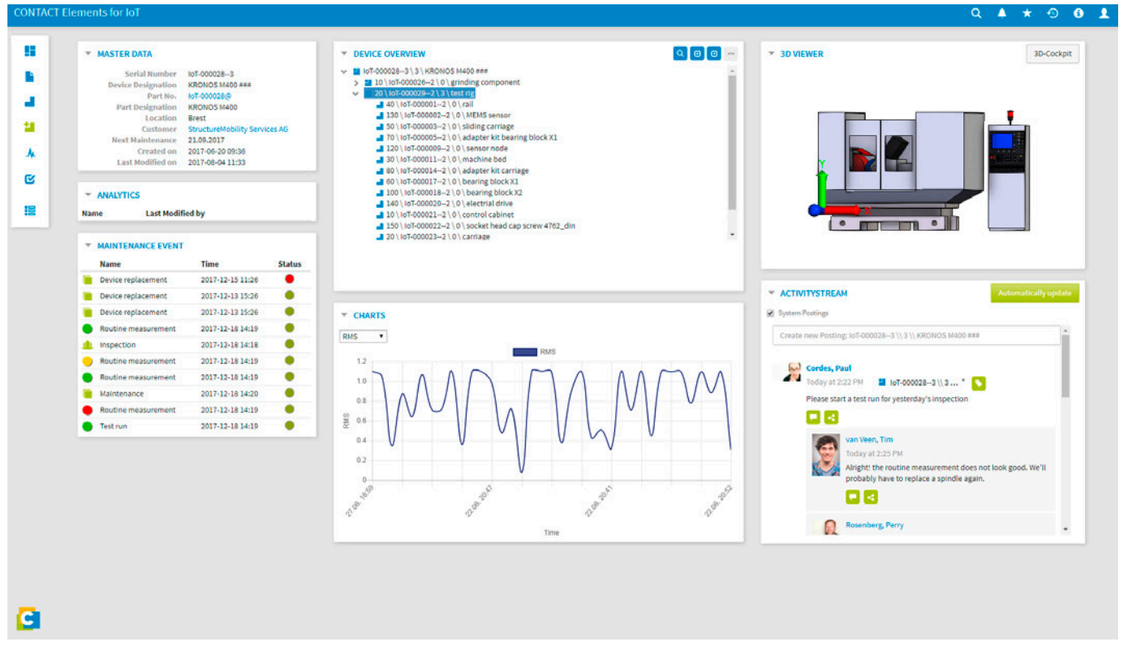
Together with CONTACT Software, Fraunhofer IPK developed a showcase that demonstrates the potential of IoT-based services for industrial production. The showcase can be seen in the Industrie 4.0 Lab of the Berlin Center for Digital Transformation. Condition monitoring of a machine tool for specific operating parameters enables the operator or manufacturer to practice prognostic maintenance.

Usually, the digital twin of a production line displays the virtual map of the actual physical production line or selects components of this line. At the core of such digital twins are cyber-physical production systems (CPPS). These intelligent systems contain sensors and actuators. They evaluate data and communicate with other systems via integrated micro controllers. Digital twins play a role in practically all phases in the lifecycle of production facilities. In the product emergence phase (PEP), digital twins safeguard manufacturing processes before the physical product actually exists. The process works with the design and engineering data from the design data management system. In the final stage of this process, the product exists in virtual reality. The useful life span of the production facility is an equally exciting application of digital twins. In this phase, digital twins depict live manufacturing processes. Aside from PEP data, digital twins also collect sensor data, internal control data (e. g. from the condition monitoring system) and maintenance and repair data. These data are linked in the cloud. This service provides the user with up-to-date information on current and past configurations and on the integrity of the facility.

The equipment manufacturer uses this information in the data-driven business model offering added value to the customer beyond providing the equipment for the production process. Companies advertise such offers as »pay per x« services. The customer no longer buys the product itself but only the desired added value, which the equipment provides. For example, monitoring the production equipment and analyzing the recorded data may uncover a hidden problem in the digital twin, thus allowing the operator to take preventive measures. The shorter down times increase the technical availability of the equipment. Moreover, the insights gained will serve as »feedback to design« for future developments.

System structure and information flow in the CONTACT showcase





Screenshot of the test bench scenario in the new CONTACT Elements Platform 15.2 (© CONTACT Software)

Fraunhofer IPK together with CONTACT Software, a PDM/PLM provider from Bremen, used an agile approach to developing a showcase. This showcase now serves as the demonstration model for the partner's new offer »CONTACT Elements for IoT« to producers of industrial products. For this project, the engineers re-purposed an existing machine tool-based axle test bench into a cyber-physical production system. With its simple sensors and one-circuit board computers, the system now measures the wear condition of the feed axis and sends the data to the IoT application. The sensors and circuit boards started their useful life in the automotive and consumer equipment sections.

Once the system detects a critical wear status, the system triggers a service call and transmits via cloud supporting information to the service technician on-site. The technician uses his/her mobile device to log on to the platform. First, he/she sends the QR code to identify the equipment. Then he/she aligns the existing configuration with the one sent by the system. The technician will replace the defective equipment components, if both configurations are identical. There are two more steps. A self-test confirms the flawless functioning and the system registers the installed new part as change in the system configuration. Finally, the new equipment status is stored in the cloud platform. This keeps the entire history of the equipment in the long-term computer memory of the system. Analyses using machine learning methods and other methods allow the development of further innovative business models based on the stored data for the digital twin. ■

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Showcase

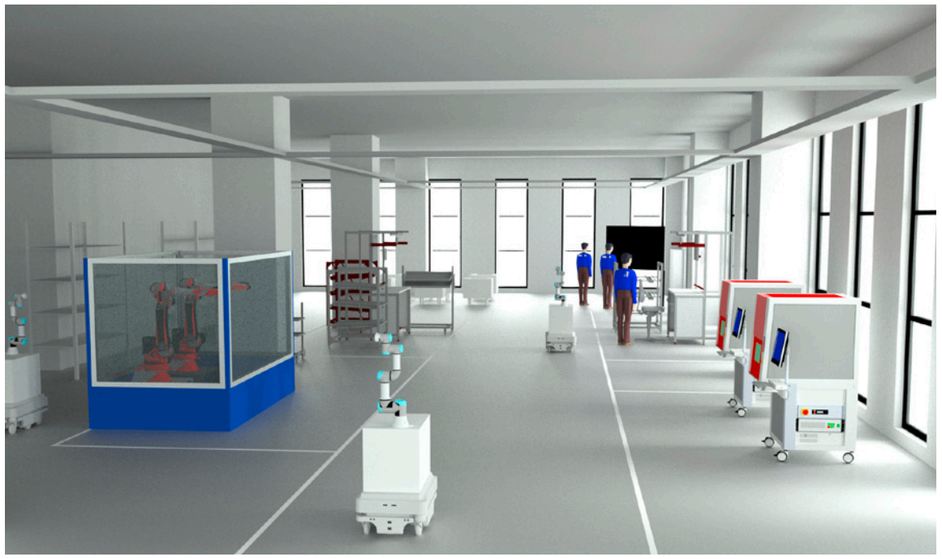
Industrie 4.0 Application Center in China

»Combine Chinese Speed with German Precision« is the motto of Fraunhofer IPK while the institute supports the implementation of a Sino-German Intelligent Manufacturing Research Institute (SGIMRI) in Nanjing, China in the next five years. SGIMRI pursues an integrated training, demonstration and application approach in the field of intelligent production for Chinese and foreign companies.

The Sino-German Intelligent Manufacturing Research Institute (SGIMRI) in Nanjing is a private enterprise. It integrates training, demonstration and application research to create a comprehensive offer for companies in the Jiangsu Province. Fraunhofer IPK will provide assistance for the strategic, organizational and technical planning and implementation of the five-year project. Fraunhofer IPK has already developed a comprehensive curriculum for the specific application of Industrie 4.0 in China and used the curriculum for initial training sessions to develop expertise. Important in this context are the integration of specific ancillary conditions and the enterprise culture in the Chinese business environment. The training addresses the leadership and management strategy changes, which are particularly necessary in China, as well as the ability to transform the area's still running. In the process, experts from Fraunhofer IPK and the SGIMRI jointly develop concepts, in which the technology-oriented Chinese views and German focus on methods complement each other to meet the challenges the Chinese face.

Through this project, Fraunhofer IPK seeks to establish an increasingly strong network with the thriving Chinese economy. To achieve this goal, Fraunhofer IPK, in close cooperation with the SGIMRI develops new solutions for the local market. In the process, the SGIMRI combines German engineering with the proverbial Chinese speed to turn innovative business models into innovative solutions. The benefit for the German economy is twofold. First, German machines and equipment will have a market in China, thus increasing German exports. Second, offerings of the SGIMRI will help German companies in China to optimize their processes and technologies according to the needs of the local Chinese markets. This creates methods and tools for the development of fast solutions for production prototypes, which will bridge long analysis and concept development phases.

The planned SGIMRI training center

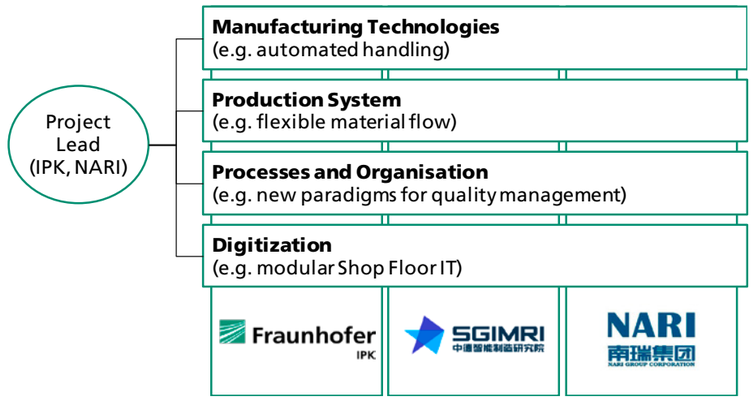


Applied research and demonstrators at SGIMRI

As early as in the first year, the collaboration realized technology-oriented innovation projects in Nanjing. While the teams worked together, the interplay of interdisciplinary and intercultural human assets emerged as the important engine for success. An example of this successful cooperation is the development of an innovative factory concept for systems used to control energy networks. This concept is slated for implementation in 2018 for the NARI group, a subsidiary of China State Grid. It integrates modular production systems consisting of manufacturing facilities and shop floor IT with intelligent intra-logistics (materials flow) solutions.

This project is considered a role model for the development of intelligent manufacturing solutions. Under the joint leadership of Fraunhofer IPK and NARI, multicultural teams consisting of Fraunhofer experts, SGIMRI employees and NARI production experts are developing the integrated concept using an Integrated Enterprise Model as common project backbone. During the development SGIMRI employees are trained according to project management and intelligent manufacturing technologies. By integrating NARI experts into the project team the specific conditions and constraints of Chinese production systems is efficiently taken into account. After implementation, the system is expected to shorten processing times up to 60 percent, among other benefits. ■

Intercultural project team structure for technology-oriented factory planning



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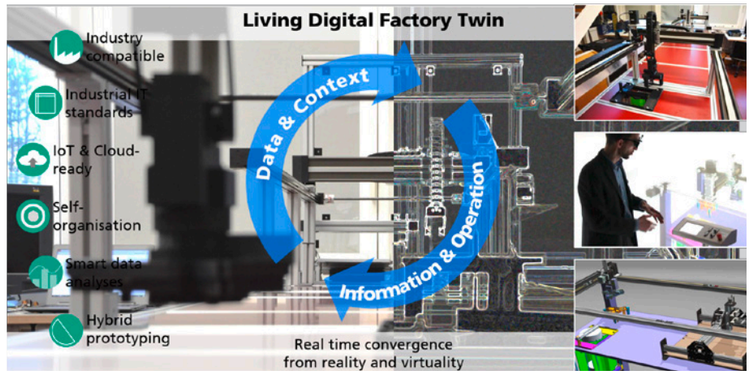
Perceptibly Securing Factory Processes

Intuitive Interactions between Virtual Reality and Digital Twin

The digital twin is the computer-generated simulation of the real manufacturing facility. Reality and its digital twin mirror each other. Creating this digital twin is prerequisite to the self-organization of production systems. Added planning and simulation tools make the digital twin even more useful. The digital twin enhances the transparency of processes and is a vital tool for the development of cyber-physical systems.

Technologies used in virtual reality (VR) render digital product models to scale, ready for further analysis and collaborative development. Using these technologies shortens the time required for product development processes and helps to catch errors early on in the process. Most importantly, users have an opportunity to interact with virtual models. Intuitively and naturally, they experience the dimensions and the behavior of components, machines and facilities.



Within the projects of the Berlin Center for Digital Transformation, experts of Fraunhofer IPK work on connecting the technologies used for virtual reality projects and for the creation of digital twins. The plan is to develop a virtual interaction platform to back up the RC code of robots and to create an adaptive worker assistance system. Virtual reality has great advantages. For example, it allows engineers to observe the traverse paths of robots at the workpiece. This is beneficial, because for safety reasons direct observation at the real production line is not an option. Moreover, without the costs of building actual structures, it is possible to test, validate and optimize the worker assistance features. In addition, the VR System will be multiple-user ready and allow remote assistance.

As visualization occurs in real-time, the digital twin must be enhanced with continuous data and information updates. The digital twin mirrors the actual condition of the production facility and, in addition, performs functions, which would require a great deal of operating expenses for calculations and/or hardware, if they were implemented by a real control. In this way, the digital twin benefits the real facility or replaces real sensors with virtual ones to reduce costs and failure probability.

Fraunhofer IPK has already developed the demo cell »Smart Factory 4.0«, which serves as the basis for further research and is used to test the concept of the comprehensive robot showcase. The team has built a manufacturing line using the demo cell and is now able to model, test and optimize the different facets of Industrie 4.0. They demonstrate the information technology-related interactions, the potential of cyber-physical systems and the use of digital twins in an industrial application. The goal is to develop strategies for digital transformation at the interface between research and application. ■

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More Than Just a Product

Smart Service Customization

In the project »Smart Service Customization«, engineers of Fraunhofer IPK and Fraunhofer FOKUS develop intelligent services for the next generation of customized products. In this context, smart services describe the comprehensive exploitation of lifecycle data through individual services and data-driven business models.

The pool of data continues to grow from development to production and throughout the entire product lifecycle, due to the accelerated development and integration of Industrie 4.0 solutions in industrial applications. The heterogeneous nature of the data makes analyzing and exploiting them a challenge for many companies. The systematic compilation and processing of data from sensor networks and smart data is the first step. This step allows companies to optimize the management of the product lifecycle. The second step comprises the systematic exploitation of the processed information for the development of individualized services based on the continuously compiled lifecycle data. Smart services also support deliberations in the process of improving products. One example is the question of which one of the components should be more unitized to allow the easier replacement as modules.

In order to target our support for companies during the development of smart services, the project engineers assemble a methods kit. This methods kit enables companies to develop smart services, which implement high-value information requests based on heterogeneous data sources. The adaptive modular kit comprises two components. One component enables the analysis, integration and interpretation of heterogeneous data sources available on an integration platform for high-value information. The other component provides a smart service cockpit for the generation of customized process and service layouts for data-driven business models.

Support engineers are able to adapt the methods kit for many industries to facilitate the adaptation to custom products and services. This applies, for example, to the maintenance and upkeep services for end users as well as for operators or owners of infrastructure. Adapted methods and tools allow interested companies to gather the required information for company-specific layouts or blanks, so that they can configure suitable product and service offers. Fraunhofer IPK and Fraunhofer FOKUS support their project partners in the analyses and definition of requirements and interfaces, data integration on the platform, and the extraction of high-value information. They also assist in the development of smart services all the way to the creation of prototypes and demonstrators. ■

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Security Technology

Traffiic

Protects Company Networks against Misuse

Violence, extremism and child abuse: There are hardly any crimes, which are not recorded in the form of images or videos. Frequently, these data appear on the Internet and in the social media. How can companies avoid the misuse of their networks for such purposes and avoid helping the perpetrators? Fraunhofer IPK and SEC Technologies developed the Traffiic software, which recognizes such content and enables companies to prevent such misuse of their infrastructure in time.

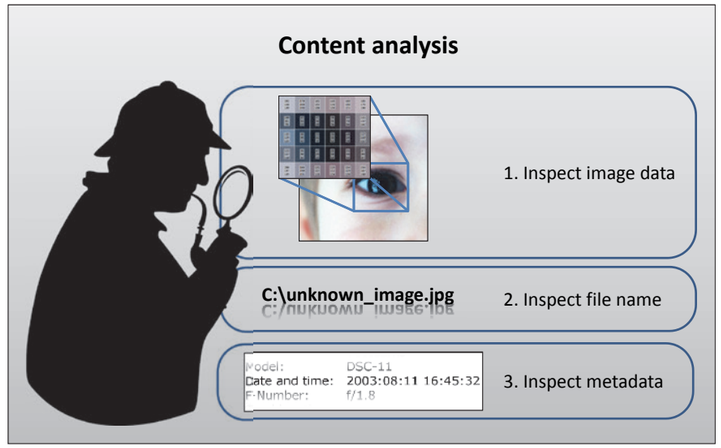
Until now, it has been difficult to put an end to the distribution of images and videos for criminal, propaganda or illegal commercial purposes via the Internet and social media platforms. This is a dilemma, especially for companies running their own networks, because network operators are held partially liable unless they can prove that reasonable preventive measures had been in place at the time of the breach. Aside from this liability, companies also suffer considerable damage to their image. What is more, before a company can implement effective defenses, the company managers must be aware of the security breach.

Traffiic »Traffiic analysis for incriminating image content« is the name of the joint software development of Fraunhofer IPK and its partner company SEC Technologies. The objective was to create a software for the recognition of the above-described content with the intent to thwart such misuse. The collaborators developed a modular system for the integration into a company network as passive component. This prevents lagging network traffic and the hardware requirements are a minimum. At the core of the software is a data extraction module. In the event the module flags network misuse, the network operator receives a message immediately and is able to stop the network invasion.

▶ Intelligent and Adaptive Analysis

For the analysis of image data, Fraunhofer IPK developed an innovative system for the recognition of child abuse scenes. The software designers used a series of different and specifically learned classifiers so that the recognition rates are high at low error rates. For example, the first classifier leads to the recognition of erotic images. This »positive« find then activates another classifier, which is designed to recognize the abuse of a child. To develop these features, the software engineers collaborated tightly with Dr. Franz Fotr, an Austrian court-certified IT expert specialized in forensic work. By comparison with image hashing procedures, which store a unique fingerprint for every file for the purpose of remembering an image, using the mentioned approach allows the recognition and classification of unknown images.

Aside from image data, the software also processes file names. Robust searches for pertinent keywords allow the recognition of deliberately misspelled words such as »g1rl«, which are often used to circumvent software based on simple keyword recognition. The Traffiic software is also able to recognize image groups. For this feature, the software correlates image information, file names and eXIF information.



▶ The correct evaluation of distinctive content

For this project, SEC Technologies developed solutions for the detection of data security-relevant events in IT networks. The data extraction module enables the software to identify image and video data in network transmissions. These data are then extracted and stored for analysis. The implementation emphasized modular design criteria. In this modular system, intercommunication takes place via SQL databases. This design allows the quick addition of new modules. Other advantages are the ability to distribute data via several computers and independence from operating systems.

Along with the extraction of pure image and video data, review of the image source is crucial. Using prior data analyses, the module for the assessment of network sources evaluates the reputation of a target system by way of analyzing and correlating various network-oriented data sources such as Who-is-Database and IP Reputation Services. The determined reputation of a data source, together with the analysis of the image improves the quality of the overall data analysis. ■

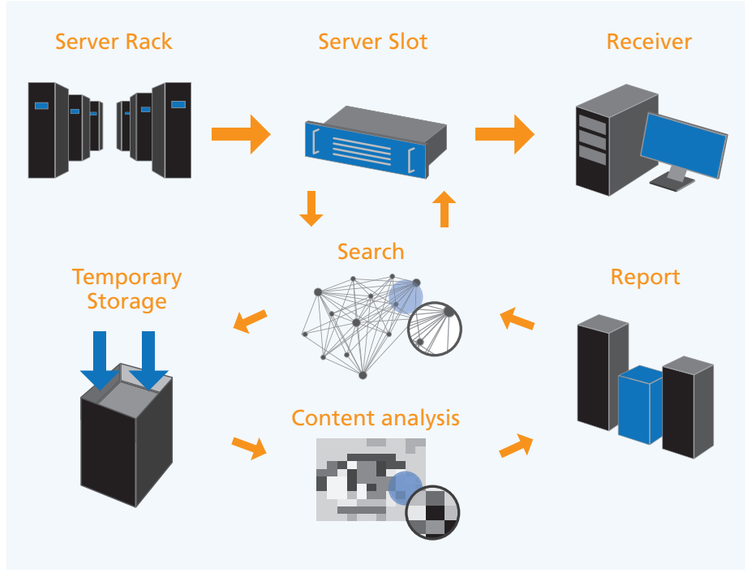


Diagram of the content analysis (top); operating mode of the software while monitoring the company networks (bottom)

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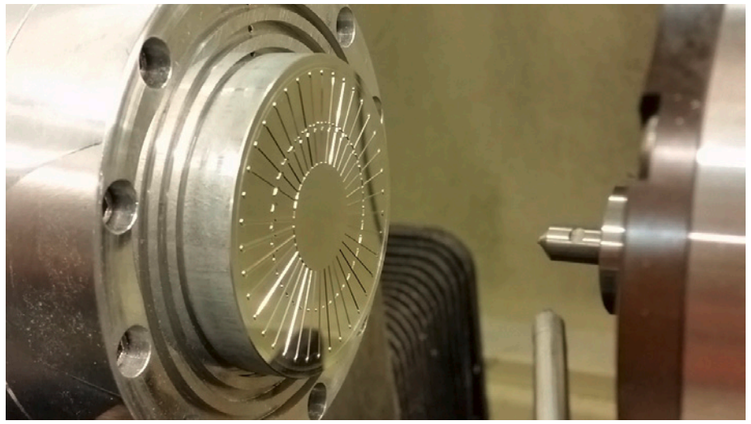
Production

Process Chains for Micro-Production

CIRP Keynote Advances the State of the Art

The ability to manufacture high-precision components with micro-features is of growing importance for companies in many industries. The production spectrum ranges from manufacturing individual parts for specific applications, e. g. astrophysics, to large-scale manufacturing of items for medical technologies. Manufacturing technologies must meet comprehensive requirements in terms of quality and costs. In this context, meeting standards for accuracy, reliability and reproducibility of processes is of the utmost importance. For the first time, scientists working in Germany and the USA have investigated topics in micro-production technology comprehensively in context with manufacturing technologies, mechanical engineering and measuring techniques. The result of this collaboration is a summary of the current state of the art for the production of micro-components, which goes far deeper than previous research and has attracted international attention.



Manufacture of a molding tool for the production of blood plasma separators based on micro-fluid principles with a minimal structural dimension of 15 µm

► Products

Research of the international team focused on four major topics, namely applications, manufacturing procedures, machine systems and measuring technologies, as well as process chain. Initially, the examination of industrial application examples became the basis for product classifications and for discussions about how to establish production chains to manufacture these products. In the course of their discussions, the team elaborated on the fact that the classic process chain model »from rough to intricate« does not directly fit the addressed applications. Instead, a continuing changeover between precise, highly precise and ultra-precise processing and measuring must take place in process chains to accurately meet the requirements for the structure and component.

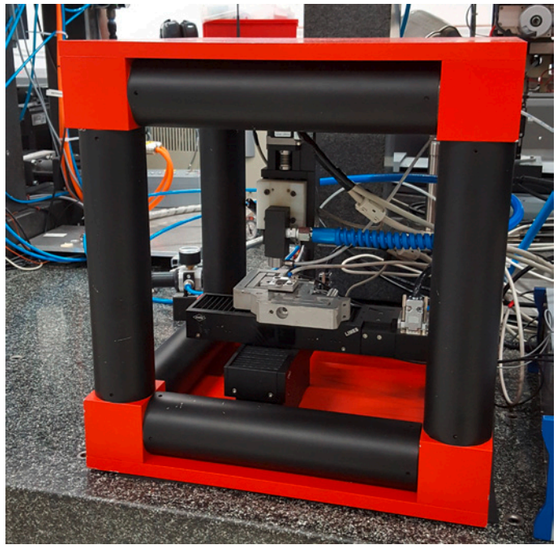
► Manufacturing Technologies

This realization is a prerequisite to the proper analysis of high-precision components with microstructures, which must conform to the international state of the art in manufacturing. Here, micro-cutting is of utmost importance. Manufacturing technologies using geometrically defined and geometrically undefined cutting edges are improving constantly so that they are fit for precision cuts in the micrometer range with submicrometer precision. The team recognized advances particularly in the modeling of processes or process steps for the prediction of process results. Ultra-precise micro-cutting is also now available for processing very hard materials. Procedures involving geometrically undefined cutting edges make the grade when new technologies are used such as vortex processing and the use of new tools for producing microstructures. The team also found improvements in non-conventional and forming processes for the addressed applications. Electrical discharge machining of ceramic materials and metal as well as the stamping of lattice textures are only two of the many examples for these developing trends.

► Machine Systems and Measuring Technology

Worldwide, the required machine technology shows a clear development toward serviceable and flexible hybrid machine systems with the highest possible integration density. Aside from the integration of various manufacturing procedures, the integration of high-quality measuring technology into processing equipment is of increasing significance. Research and development work in the past ten years reveals comprehensive efforts to combine maximum resolution of measured data and maximum measuring field size with the highest measuring accuracy. New kinematic implementations of Abbé's Principle, which demands that the physical representation of a measuring device should be linearly aligned with the test object, as well as the optimization of existing tactile and optical measuring methods, lead to crucial advancements in the accuracy of workpiece measurements. Standardization of optical measuring procedures especially increases the reproducibility and traceability of measurements. In addition, newly introduced process control measures lead to increased process stability. The produced structures are very small and require very small tools, in most cases. Because of this and because the point of action is often hard to reach, engineers must use non-conventional high-resolution procedures. An example is the use of solid-borne sound sensors to monitor especially micro-cutting tools.

Miniaturized modular machine concept for manufacturing high-precision workpieces with microstructures: in this case, dry EDM.



► Process Chain

Finally, the team used an actual component as an example to evaluate the theoretical insights gathered in recent years. More than 20 international institutes participated in the execution of the experiment: Engineers at the institutes were asked to create a component with precisely specified dimensions. Each team was free to design the component. The variations in dimensions and tolerances of the used sample component corresponded to actual industrial demands. Most of the ditch structures, ridges, faces and cylindrical surfaces of the component find their close match in the areas of precision tool design and construction for molding and casting processes such as injection molding and hot embossing. The evaluation objective was to verify the published state of the art regarding flexible manufacturing of precision structures and creation of process chains for manufacturing components of various structures and specifications in the one-digit micrometer range. Then, standardized processes were deduced from the results and verified by the participants.

Convincingly, the evaluation indicated that manufacturing high-precision components with microstructures in process chains is feasible. The process chain is not limited to the production in a hybrid machine system, but also works across borders and continents. To a large degree, the process results depend on the used machining and measuring techniques, the environmental conditions and the specified standard parameters. With these results, the team of researchers proved that high and ultra-precision technologies are controllable even though many parameters may influence the results. ■

Keynote Paper

This research was carried out in close cooperation with leading international scientists and presented in a Keynote Paper for the International Academy for Production Engineering (CIRP). Koordiniert wurden die Arbeiten am Fraunhofer IPK has coordinated the research and its publication. Co-Authors are:

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Well Designed

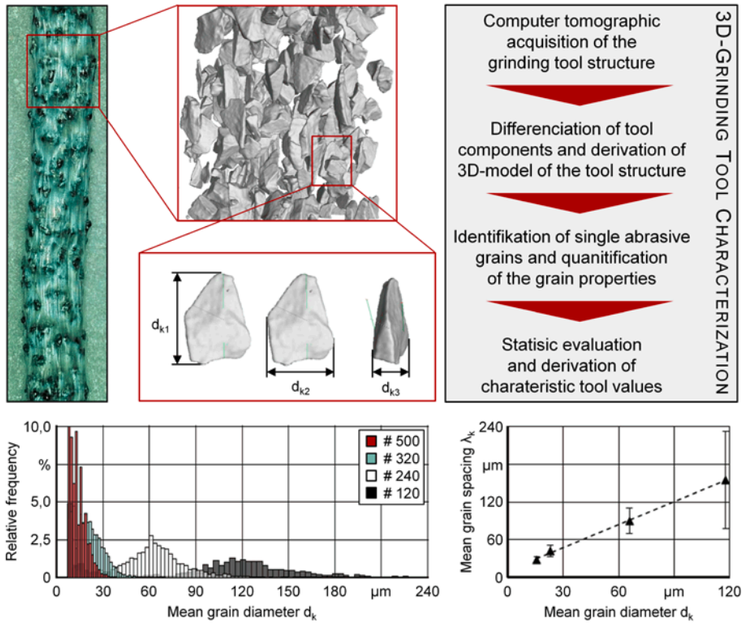
3D Grinding Tool Characterization Using Computer Tomography

Grinding is usually one of the last process steps in the manufacturing of functional surfaces. In recent years, the requirements regarding economic efficiency, lifetime and quality have steadily increased. At the same time, product lifecycles have become shorter, particularly for consumer goods. As a result, the product development as well as the subsequent market introduction must be more efficient and faster. Therefore, both manufacturing processes and the involved tools need to be designed more flexibly and dynamically.

The design of grinding tools evolves mostly based on empirical knowledge in a series of development steps. To develop in-depth insights into the composition, topography, hardness, rigidity, and quality of the production process of grinding tools, engineers at IWF develop and use various methods for grinding tool characterization. Aside from 3-D optical and tactile topography measurement as well as the identification of e-modules, the engineers perform structural investigations using computer tomographic (CT) images.

During CT imaging, the test piece rotates. This allows to create a three-dimensional model of the test piece. In cases of abrasive grinding tools, the model differenciates the individual components of the piece such as the bond, the porosity or the abrasives, because the X-ray absorption varies for different materials. With the help of specifically developed software tools, the images reveal the distribution, size and shape of the different components. This gives the engineers the opportunity to investigate the influence of pore forming materials or the shape, surface and volume of individual abrasive grains. In conjunction with technological examinations of different grinding processes the developed measurement tools help to comprehend the influence of the grinding tool on the process behaviour and work results. Characteristic values describing the complex nature of grinding tools can make a significant contribution to optimizing the design process of grinding tools in regard to a specific process task. ■

3D tool characterization for an abrasive filament with embedded abrasive particles



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Know-how

Simulation-assisted Design of Robot-guided Drag Finishing

Surfaces and edges on machined components often have to meet high standard requirements. The selection of an appropriate post-process is mostly carried out on the basis of quality and economic criteria. Besides conventional finishing processes such as grinding, brushing and polishing, mass finishing has established itself in the industrial environment. Scientists at IWF developed and patented a special mass finishing process known as robot-guided drag finishing. The scientists continue to optimize the procedure using a special simulation method.

All vibratory finishing processes use a bulk of abrasives called media. In the grinding process, the media and the workpiece move relative to each other. In classical vibratory finishing, both are set in motion using an unbalanced drive. The resulting relative motion cuts material off the workpiece. In the robot-guided drag finishing process, the robot controls the path of the workpiece through the media. This increases the material removal rate and allows a controlled processing of specific surfaces and edges of complex workpieces. This innovative robot-guided drag finishing was developed and patented at IWF TU Berlin. Robot-guided drag finishing offers a high kinematic flexibility in regards to the angle of attack, the trajectory and the immersion depth of the workpiece due to the six axes of the robot, and can be specifically adapted to the respective application. For technological investigations, a flexible drag finishing machine with two Rösler circular vibrators, R 220 DL, with a diameter of 1000 millimeters as well as a Walther Trowal circular vibrator, MV 21/3, with a diameter of 600 millimeters are available in the institute's test field as well as a centrifugal disc finishing machine. A 6-axis robot NJ 370, Comau Robotics, is used for workpiece guidance in drag finishing processes.

Robot-guided drag finishing at IWF

▶ Simulation-guided Process Design

Since a direct observation of the vibratory process in the area of contact between the media and the workpiece is not possible, a suitable simulation is indispensable for an application-oriented process design. The engineers at IWF TU Berlin use the Discrete Element Method (DEM) to analyze the contact conditions for complex workpieces. This method has a great potential of increasing the economic efficiency for finishing processes of premium-quality workpieces with complex geometry. Moreover, the use of the Discrete Element Method (DEM) makes it possible to design centrifugal disc and rotary barrel grinding processes because engineers can calculate the relative movements and contact intensities between media and workpiece so that they are able to adjust the process parameters. ■

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Digital Transformation

»More digitization on our fingertips than ever«, was the overall assessment at CeBIT 2017. The organizers of Hannover Messe, too, announced the progress in digitally networked industry by offering the first mature Industrie 4.0 technologies. Which effects linking both worlds, real and digital, has on production, cooperation and communication was part of our interview with Professor Eckart Uhlmann, Director of Fraunhofer IPK.

FUTUR: Professor Uhlmann, in your opinion, how has digital transformation in society and economy progressed so far?

Prof. Eckart Uhlmann: Digital media have shaped our everyday lives for quite a while, now. Classical production technologies are now following suit. By now, entire production process chains are digitized. Internet technologies venture into companies, production and systems engineering. Mobile technologies such as cloud computing account for crucial changes in industrial processes. Embedded systems help components and machines to communicate with one another. They are able to optimize, configure and diagnose themselves and assist people in their increasingly complex decision making processes. Centralized companies are being transformed into decentralized and dynamically controlled manufacturing sites, which excel through their individuality, flexibility and speed.

FUTUR: How does this influence the manufacturing of products?

Uhlmann: Up to this point, the focus was on mass production. Now, flexible manufacturing of customized products has all the attention. Take for example the pump manufacturer KSB. From 600,000 pumps the company builds in two years, only two will be identical. Another example is adidas in the consumer goods industry. Consumers can now go online and personalize their favorite shoes by choosing the material and color. This is always based on data access, everywhere and in real-time. Using IT to link all participants in the product chain – people, workpieces and machines – we create dynamic, real-time optimized and self-organizing value-added networks. At the same time, digital transformation optimizes business and value-added processes in and across companies under the keyword »Industrie 4.0«. Also, it creates completely new business models. Together with their products, manufacturers now also sell the services associated with the product. When Rolls Royce sells an engine, it also offers the associated maintenance and repair package. Alternatively, consumers do not buy the engine but rather »power by hour«. BMW or Daimler are no longer just automotive manufacturers, but also mobility service providers. They also lead the flexible car sharing services worldwide. Such success would not be possible without digital transformation.

FUTUR: Back to the production level again: What are the real advantages of digitization?

Uhlmann: The use of cutting-edge information technologies makes manufacturing more flexible and efficient. Digitized factories are able to produce customized products in a cost-effective way. This means that the order status and the state of the machine are available everywhere, at any time. This contributes to the optimization of production processes and increasingly flexible work processes. It also obviates the need for central organization and planning. Employees are able to assume more responsibility for the control of production processes at all levels. Smart technologies assist them in their work.

FUTUR: Are there also reservations against the digitization trend in the economy?

Uhlmann: Of course, mostly small and medium-sized companies are very fearful of these changes. They are afraid of high investment costs for mere survival. Hence, our motto is: Industrie 4.0 has to be affordable for manufacturing facilities of all sizes. Together with our customers we decide on realistic scenarios. This may result in upgrading existing facilities to Industrie 4.0 and finding smart ways to analyze and use existing data. Usually, 80 to 90 percent of the IT tools needed already exist, even though they are not fully networked. In response to industry demands, we develop simple and cost-effective solutions under the motto »Industrie 4.0 Kit«. These solutions consist of readily adaptable modular technology. And let me emphasize at this point: There is no ONE solution for Industrie 4.0. Every manufacturer must find the most practical individual solution for his or her factory. This does not only apply to small and medium-sized companies, but also for large manufacturers and manufacturing conglomerates worldwide.

FUTUR: Speaking of worldwide matters, which countries make the greatest effort in introducing Industrie 4.0?

Uhlmann: Aside from Germany, large economies try the hardest: The USA, China, Brazil and Japan implement their own Industrie 4.0 programs. »Made in China 2025« is an impressive example for the tremendous investments in China. Under the motto »Combining Chinese Speed with German Precision«, we assist in building the Sino-German Intelligent Manufacturing Research Institute (SGIMRI) in Nanjing and the German-Chinese Institute for Technology Transfer (IFT) in the Chinese-German Metal Eco City in Jieyang.

FUTUR: Fraunhofer IPK is at home in Berlin. How is Berlin positioned in the international competition?

Uhlmann: As part of a study for the Senate of Berlin in 2015, we analyzed the potential of Industrie 4.0 for our metropolitan region and the local industry. The result was clear: Building on the existing conglomerate of IT industry, manufacturing industry as well as science and research, Berlin has the chance to establish itself as an attractive and competent location for innovation in digital transformation. We are excited that we can advance this process in the Berlin Center for Digital Transformation thanks to support from the State of Berlin and the Fraunhofer Society. In this center, we explicitly bring together information and communication technology providers, automation outfitters and the manufacturing industry. All participants will jointly identify relevant research and development topics and initiate the implementation of the respective projects. This includes building and providing infrastructure, so that we can develop and test the various scenarios for applied digital solutions for the production and manufacturing equipment.

From Berlin for Berlin

The Berlin Center for Digital Transformation is a cooperation of the four Berlin Fraunhofer Institutes FOKUS, HHI, IPK and IZM. At the center of its activities are technologies and solutions, which stay abreast of the increasing digitization and connectivity across all aspects of life. The research focuses on basic and cross-sectional technologies as well as on solutions for four areas of application:

- healthcare,
- mobility and city of the future,
- industry and production,
- critical infrastructures and energy.

The Governing Mayor of Berlin, Senate Chancellery – Research and Technology and the European Regional Development Fund (ERDF) fund the Berlin Center for Digital Transformation with 6.4 million euros.

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Smart Technologies

in the Industrie 4.0 Lab

The Industrie 4.0 Laboratory at Fraunhofer IPK is one of four transfer centers of the Berlin Center for Digital Transformation. With its research and innovation offers aimed at digitalization in industry and in particular with its concept of a digitally integrated production, the I4.0 Lab fully supports the industry along the value-added chain of industrial production – from virtual product development, production planning and control, the production equipment and technologies for parts manufacturing all the way to the comprehensive automation and networking of all company processes.

Robot programming and path manipulation using Augmented Reality (© IWF TU Berlin / Jens Lamprecht)

In the Industrie 4.0 Laboratory, scientists of Fraunhofer IPK develop their visions and scenarios for business cases, work on and test key technologies, and provide services and tools for digital transformation. To test prototypes and to apply and optimize realized systems in a production-related environment they draw upon an excellent infrastructure consisting of production machinery, robot systems, IoT and cloud platforms. Plug-and-play IT environments can also integrate and qualify virtual development tools and intuitive interaction in virtual reality environments.

▶ Your Path to Industrie 4.0

The Industrie 4.0 Lab offers newcomers to the topic comprehensive assistance with its »Start DIP« program:

- With its information and qualification offers, it gets companies ready for digital transformation.
- Status quo and demand analysis: Together with companies, the I4.0 Lab will assess how well they are prepared for Industrie 4.0, what their digitally integrated production scenarios would look like and what would be a practical approach for further implementations.
- Hands-on prototypes are developed in a short time – to help with skill development and to integrate and raise awareness among employees.
- Implementation Support: The I4.0 Lab works out implementation strategies and supports the stepwise introduction of processes and IT systems.
- Learning factories will train employees for their work in an intelligently networked production.

▶ Industrie 4.0 Kit – Quick Realization of Prototypes

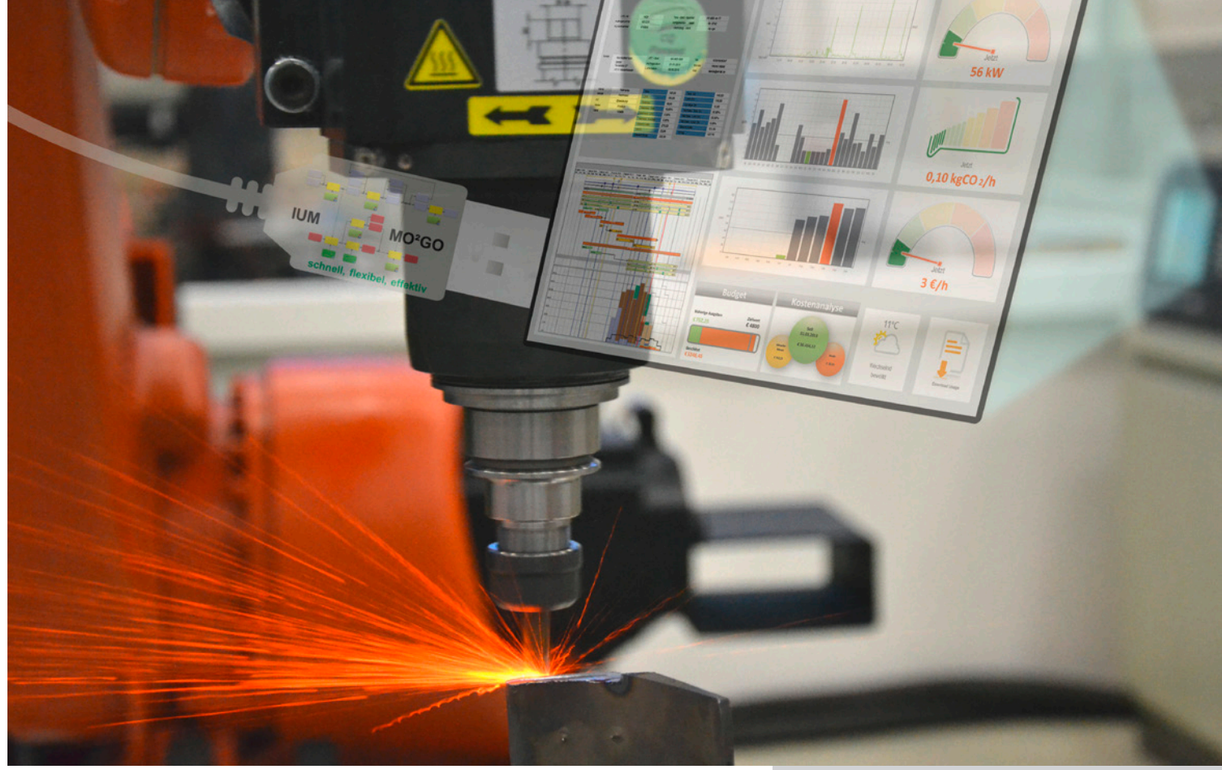
One of the current projects in the Industrie 4.0 Laboratory is the Industrie 4.0 Kit. This kit allows small and medium-sized manufacturers to trace their specific value creation process with high efficiency. For these companies, investment costs as well as the time to plan and implement solutions for the control of manufacturing processes are being reduced. The system also provides order-specific parameters on the individual parts level. The Industrie 4.0 Kit helps small and medium-sized companies to quickly implement prototypes for the networking of machines and equipment in order to process and trace individual orders.

▶ Digital Factory Twin

The objective of this project is to build a test bed for digital factory twins. This test bed will serve as a virtual interaction platform for controlling and securing manufacturing processes. Visualization and interaction will be based on a mobile virtual reality system in combination with a human-machine interaction device. The system will continuously feed data and information to the digital twin so that the digital twin reflects the real actual state. The digital twin enhances the transparency of processes, and it is an indispensable tool for the development of cyber-physical systems. The test bed will allow the implementation of practice-relevant applications for the virtual launch of systems or for re-engineering.

▶ Digital Assistance in a Smart Production Environment

The rising demand for product variations requires increasing flexibility and shorter response times in production. This requires shorter and less complex installations and optimizations. Digitalization and Industrie 4.0 provide new possibilities for cooperation between people and machines for increased efficiency of working with equipment. The integration of innovative technologies from different areas such as the projection of equipment and process information into the real manufacturing environment in the respective work situation, the use of digital assistance systems and gesture-based commands create comprehensive assistance while working with production systems.



Control and monitoring of flexible process networks for the manufacturing of customized products using the Industry Cockpit

BMBF Program »I4KMU«

With its Industrie 4.0 Laboratory, Fraunhofer IPK is one of the officially certified Industrie 4.0 national test environments in Germany. With grants for »Industrie 4.0 Test Environments – Mobilization of Small and Medium-sized Companies for Industrie 4.0«, also known as »I4KMU«, the German Federal Ministry for Education and Research (BMBF) supports digital transformation in this sector. In this program, the BMBF provides small and medium-sized companies access to a nationwide network of I4.0 test environments, enabling companies to test digitized processes and products as well as innovative system approaches. With this assistance, companies can test comprehensive networked business models under realistic conditions. Small and medium-sized companies are invited to apply for grants to cover part of the costs, which help finance their individual I4.0 projects in a I4.0 test environment. For further information see: www.i4kmu.de

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Fraunhofer IPK in China

World Intelligent Manufacturing Summit

»More cooperation, smarter manufacturing« – this was the motto of the World Summit for Intelligent Manufacturing from December 06 until 08, 2016 in Nanjing in the Eastern part of the Chinese province Jiangsu. The Chinese Ministry for Industry and Information Technology organized the summit, which brought together representatives from political decision-makers, industry organizations and research institutes as well as almost 300 manufacturers from ten nations. Visitors attended keynote presentations and eight parallel sessions in the Nanjing International Expo Center. The Expo Center also offered an exhibition of the newest technologies in the areas of artificial intelligence, smart manufacturing and automation.

Fraunhofer IPK was the official cooperation partner of the summit. Together with its Chinese partner, Fraunhofer IPK introduced the new Sino-German Intelligent Manufacturing Research Institute (SGIMRI) in an approximately 300 m² booth. The Chinese and German partners will build SGIMRI in the coming five years in Nanjing. The new institute will support domestic as well as foreign companies with their intelligent production projects. SGIMRI has already developed successful technologies, a fact which is underscored by the Innovation Prize received by the Chinese-German project team for one of its exhibits. The exhibit allowed visitors to use their Chinese »WeChat« app to communicate with a robot controlled by IPK technologies. In addition, SGIMRI and Fraunhofer IPK entered into a framework contract with the power plant manufacturer NARI on the design and implementation of intelligent processing to increase flexibility of production.

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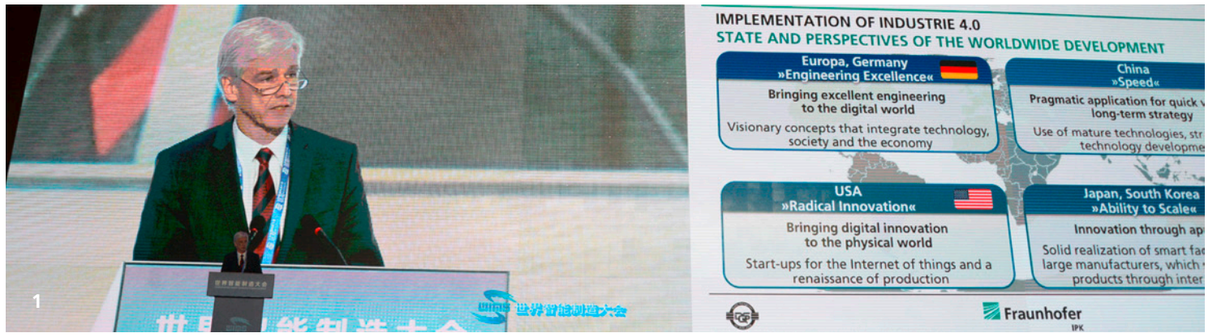

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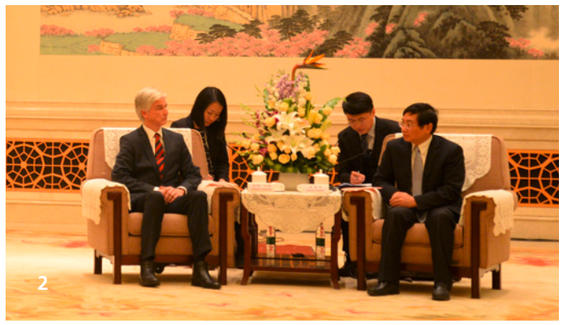

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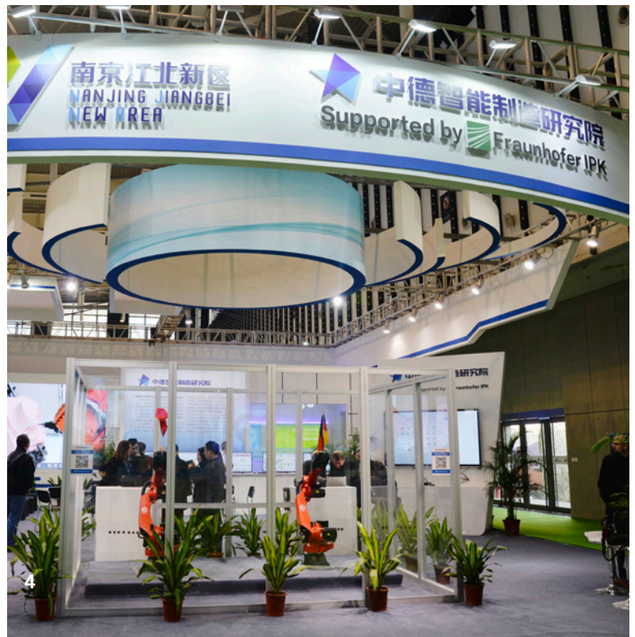

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CEBRABIC

New Cooperation with Brazil

CEBRABIC Kick-off meeting at Fraunhofer IPK in late January 2017

On January 23 and 24, 2017 a consortium of twelve European and Brazilian organizations launched a new collaboration under the European Commission's Horizon 2020 Programme (Grant Agreement n° 733531). »CEBRABIC – the Centre for Europe-Brazil Business & Innovation Cooperation« aims at enhancing cooperation in research, technology and entrepreneurship between the EU member states and Latin America's leading economy, Brazil. The diverse project consortium will work together for four years to set up the CEBRABIC center and is coordinated by Fraunhofer IPK, division Corporate Management.

CEBRABIC will be a center working on a network basis. Creating synergies and complementarities is the core value of CEBRABIC, particularly with European research and innovation (R&I) structures located in Brazil, to complement, expand and enhance its service portfolio. Different types of stakeholder incorporation into CEBRABIC network is foreseen, either from the demand or supply service: members, service providers, regional innovation hubs, and focal points.

The project foresees three main stages for CEBRABIC development: a planning stage of up to one year, in which the CEBRABIC business model will be fully developed and drafted; a piloting stage, in which CEBRABIC will provide services as a project office and on an experimental basis; and a full implementation stage, in which CEBRABIC as an independent legal entity will be providing the services fully independent from the partnership, bearing all the costs and revenues related to its activities. CEBRABIC aims at achieving financial self-sustainability during the project lifetime.

The CEBRABIC consortium comprises twelve Brazilian, European and Turkish institutions. CEBRABIC partnership is not only geographically diverse, but presents a balanced institutional diversity, involving companies, universities, funding agencies, R&I organizations and not-for-profit organizations.

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Left page: ***1*** *Big stage: Professor Eckart Uhlmann, director of Fraunhofer IPK, was one of the keynote speakers at the World Summit for Intelligent Manufacturing.* ***2*** *Vice-governor Zhang Jinghua of the Jiangsu Province welcomed the Fraunhofer IPK delegation.* ***3*** *Wide media coverage: Prof. Uhlmann und Prof. Holger Kohl, division head of corporate management at IPK (seen here), were in great demand as interview partners.* ***4*** *Great performance: The joint booth of SGIMRI and Fraunhofer IPK received the innovation prize for intelligent manufacturing at the World Summit.*

History of Jewish Immigration

The Head of the Leo Baeck Institute in New York Visits IPK

Fraunhofer IPK welcomed Dr. Miriam Bistovic of the Berlin branch of the Leo Baeck Institute International and Dr. William H. Weitzer, Chief of the Leo Baeck Institute in New York on January 24, 2018. Together with Dr. Bertram Nickolay they discussed opportunities to use virtual reconstruction technology in support of the work of the institutes. Topics were the reconstruction of damaged documents and the proper scanning and presenting of documents via the Internet. The Leo Baeck Institute is an association of three independent documentation and research institutes, which preserve the history and culture of German-speaking Jewish people. Leo Baeck Institutes exist in New York, London and Jerusalem, the centers of Jewish emigration.

Dr. Miriam Bistovic and Dr. William H. Weitzer attend a demonstration of the reconstruction technology with Dr. Bertram Nickolay.

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Collaboration Plans

Industrie 4.0 for the Oriental Republic of Uruguay

In the beginning of February 2017, Carolina Cosse, the Minister for Industry, Energy and Mining in Uruguay, visited Fraunhofer IPK. Following a preparatory visit of Alberto Guani Amarilla, Uruguay's ambassador to Germany in 2016, Mrs. Carolina Cosse and director of Fraunhofer IPK, Professor Uhlmann signed a »Memorandum of Understanding on Applied Research, Innovation and Industrie 4.0«.

After an introductory presentation featuring the Fraunhofer model, the functioning of Fraunhofer IPK and its Industrie 4.0 activities, Mrs. Carolina Cosse was informed about specific projects during a walk through the institute. The focus was on condition monitoring using cloud systems, flexible robot-assisted processing and the human-centered automation, which the engineers demonstrated using collaborating robot systems. The next step planned in the collaboration is a workshop with industry representatives in Montevideo before the end of 2017.

Uruguay's Minister for Industry, Energy and Mining Carolina Cosse and Professor Uhlmann, director of Fraunhofer IPK, sign the »Memorandum of Understanding« about the future collaboration.

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Opening Celebration

Berlin Center for Digital Transformation

On March 06, 2017, the Head of the Senate Chancellery and State Secretary for Media Björn Böhning and the President of the Fraunhofer-Gesellschaft Professor Reimund Neugebauer opened the Berlin Center for Digital Transformation. More than 200 guests from business, science and government attended the celebration at the Fraunhofer Forum in Berlin. The Berlin Center for Digital Transformation offers companies of all sizes comprehensive one-stop research and implementation services. The center combines the expertise and know-how of four Fraunhofer institutes. The opening of the Berlin Center for Digital Transformation represents another milestone as Berlin positions itself as the leading digitization site.

Michael Müller, Berlin's Governing Mayor and Senator for Science and Research, emphasized in advance: »The new Berlin Center for Digital Transformation is both: A sign of the special appeal our city has as a site for future technologies and at the same time a huge offer to our dynamic region. It is furthermore an important pillar in our digitization strategy, which also involves the Einstein Center for Digital Future, more the 60 new professorships in digitization, as well as applying for the German Internet Institute.«

In the Berlin Center for Digital Transformation, four Fraunhofer Institutes in Berlin, namely FOKUS, HHI, IPK and IZM, cooperate closely with regional companies and universities. According to Professor Reimund Neugebauer, President of the Fraunhofer Society, the objective is to »ensure innovation- and application-oriented excellence in key areas for the competitiveness of the German industry.« Professor Manfred Hauswirth, speaker of the new center, defined its task: »The Berlin Center for Digital Transformation is a one-stop-shop for the industry, from hardware to transmission technologies to software up to production.« As part of the Berlin Center for Digital Transformation, Fraunhofer IPK advances the topics Enterprise and Connected World as well as Smart Factory and Cyber-physical Systems. Fraunhofer IPK also develops customized integrated solutions for production systems.

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From left to right: Prof. Dr. Eckart Uhlmann (Fraunhofer IPK), Prof. Dr. Ina Schieferdecker, Prof. Dr. Manfred Hauswirth (Fraunhofer FOKUS), Prof. Dr. Reimund Neugebauer (President of the Fraunhofer-Gesellschaft), Björn Böhning (Head of the Senate Chancellery), Prof. Dr. Thomas Wiegand (Fraunhofer HHI), Prof. Dr. Angela Ittel (TU Berlin), Prof. Dr. Klaus-Dieter Lang (Fraunhofer IZM).

Full House! Approximately 200 guests attended the opening of the Berlin Center for Digital Transformation in the Fraunhofer Forum located in the heart of Berlin.

RBB moderator Britta Elm speaking with the director of Fraunhofer IPK, Professor Eckart Uhlmann during the final podium discussion.

Visit from the Luxemburg Embassy

Help for Damaged Cultural Assets

Georges Santer, ambassador of the Grand Duchy of Luxembourg, and vice administrator of the Luxembourg embassy Claude Faber visited Fraunhofer IPK on April 18, 2017. Together with Professor Jörg Krüger and Dr. Bertram Nickolay from the Automation Technology division, the visitors discussed the future cooperation in the restoration of damaged cultural assets. The visitors were particularly interested in the virtual reconstruction technology developed by Fraunhofer IPK. It is used in many applications to reconstruct damaged, shredded or torn documents. Currently, the technology assists in the reconstruction of the »Leibniz Fragments«, and the reconstruction of the archival documents of the collapsed city archive of Cologne.

Georges Santer, ambassador of the Grand Duchy of Luxembourg (2nd from the left) and the acting administrator of the embassy Claude Faber (on the right) with Professor Jörg Krüger (2nd from the right) and Dr. Bertram Nickolay (left) watching the live demonstration of the reconstruction technology.

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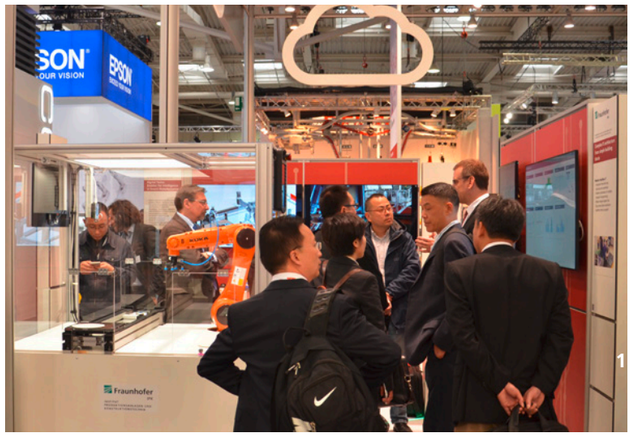
dip Speeds It up

This Was the 2017 Hannover Trade Show

At the Hannover Trade Show from April 24 - 28, 2017, Fraunhofer IPK demonstrated how digital production methods allow the quick and economic manufacturing of customized products. The motto was »dip Speeds It up«. A team of engineers from the areas of corporate management, virtual product creation and automation technology introduced state of the art research topics in practice-oriented interplay to show the integral perspective of Fraunhofer IPK. For example, the team presented a robot cell consisting of components, which were designed as cyber-physical systems. The robot was controlled via cloud platform.

Gregor Thiele, research engineer at the process automation and robotics department reported: »Aside from the application of research results, issues of standardization and committee work, e. g. about the further development of the OPC standards, came up. The trade show was an ideal opportunity to discuss even those topics across the institute borders.« In this way, the scientists also forged new relationships to cooperate on interdisciplinary projects and exploit synergies, aside from engaging in new contacts with companies.



Fraunhofer IPK's cloud-based robot cell generated much interest, particularly from international visitors of the Hannover Messe.

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German Chancellor Scholar Gustavo Melo

A New Asset of the Brazil-German Cooperation at Fraunhofer IPK

The Alexander von Humboldt Endowment awards 50 German Chancellor Scholarships annually to future business leaders from Brazil, China, India, Russia, and the USA. The scholars have opportunities to visit various companies and ministries in Germany and participate jointly in a fast-track German language course. Once they have completed the language course, they spend eleven months at a German guest institute to carry out their own independently devised projects. While in Germany, the scholars have the opportunity to meet with Federal President Frank-Walter Steinmeier and Chancellor Angela Merkel.

Gustavo Melo is one of these scholars. Since November 2016, Brazilian-born Melo has worked as a guest scientist in the department of Business Excellence Methods at Fraunhofer IPK on a research study, in which he compares Brazilian and German innovation systems. In this study, he interviews companies, research institutes, agencies and support organizations in Germany and Brazil.

Based on his own analysis and his own experiences with technology, research and entrepreneurship, he also supports the strategy planning of the large EU Horizon 2020 project named CEBRABIC (Center for Europe-Brazil Business & Innovation Cooperation) as well as the cooperation with SENAI, the National Service for Industrial Training in Brazil. Fraunhofer IPK supports SENAI in the construction and strategical planning for 23 research institutes all across Brazil. The area of Gustavo Melo's specialization is Industrie 4.0.

In his free time, he engages in volunteer work: In a dance project of the Humboldt University in Berlin, Gustavo teaches the Brazilian dance Forró. Even some of his peers from Fraunhofer IPK have fun joining his dance class. Gustavo Melo himself is delighted to foster a deeper understanding of Brazilian culture.

Thanks to his stipend, Gustavo Melo will be part of Fraunhofer IPK until February 2018. Gustavo would like to stay in Germany after his scholarship expires and attempts to earn his doctoral degree at a German institute. His special interest would be a cooperation with SENAI in applied science, because he would like to continue to strengthen the relation between Brazil and Germany.

Gustavo Melo is one of seven Brazilian scientists at Fraunhofer IPK. His work is financed by a Chancellor scholarship.

The reception with German Chancellor Angela Merkel was the climax of this year's commencement meeting of all Chancellor Scholars. (© German Federal Government / Guido Bergmann)

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New MoU with China

Signed in the Federal Chancellery

Professor Eckart Uhlmann and Wang Xizheng sign the »Memorandum of Understanding« in the Federal Chancellery in the presence of German Chancellor Angela Merkel and Chinese Prime Minister Li Keqiang (© German Federal Government / Guido Bergmann).

On June 01, 2017, Professor Eckart Uhlmann, director of Fraunhofer IPK, signed a »Memorandum of Understanding« on the planning, implementation and evaluation of innovation centers in China in the presence of German Chancellor Angela Merkel and Chinese Prime Minister Li Keqiang. Wang Xizheng, Director of the Human Resource Center at the Talent Exchange Center of the Ministry of Industry and Information Technology (MIITEC) in Beijing, signed the MoU for China.

As part of the Chinese Government program »China Manufacturing 2025« national and provincial innovation centers will emerge all across China. The Memorandum of Understanding provides for the participation of Fraunhofer IPK in an effort to strengthen Chinese-German cooperation. Together with the Ministry of Industry and Information Technology, the cooperating parties will find suitable sites for innovation centers in China. Fraunhofer IPK will accompany the construction and development of the innovation centers. In the process, experts of Fraunhofer IPK will work closely with the respective province offices of the MIITEC and will provide management and intelligent production training for Chinese managers, both in China and in Germany.

A long term objective is to establish a continuous exchange of Chinese and German experiences with Industrie 4.0 which will benefit both nations. The focus will be the technical project cooperation and the technology transfer in support of the program »China Manufacturing 2025« as well as the identification of potential cooperation partners of Fraunhofer IPK.

With this Memorandum of Understanding, Fraunhofer IPK continues on its established path of entering into long-term cooperation with the Chinese government. As early as 2015, Fraunhofer IPK signed a similar agreement on an Industrie 4.0 cooperation with the Jiangsu Economic and Information Technology Commission. At that time, the parties agreed on the development of joint strategies for the standardization of Industrie 4.0 and the cooperation in the areas of intelligent manufacturing as well as information and communication technologies. In 2016, based on the above-described cooperation, the parties agreed on the joint planning of the private Sino-German Intelligent Manufacturing Research Institute (SGIMRI) in the Jiangsu Province. This institute will be financed through economic revenues, and will provide engineering services to Chinese companies in the area of intelligent production. Fraunhofer IPK will support the Chinese colleagues significantly in the acquisition and realization of these projects and will consult with the Chinese peers on business strategies and business plans for SGIMRI.

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German Mobility Award 2017

InREAKT Received an Award as Flagship Project for Intelligent Mobility

Proud Winners: The partners who worked on the project InREAKT, among them Dr. Bertram Nickolay and Dr. Aki Zaharya Menevidis (3rd and 5th person from the left) from Fraunhofer IPK. On the outer right: Jury chairperson Dorothee Bär, member of the German Parliament and Secretary of State at the German Federal Ministry for Traffic and Digital Infrastructure, left in the picture: Ute Weiland, CEO of the Initiative »Germany – Nation of Ideas«. (© Germany– Nation of Ideas / Bernd Brundert)

On June 29, 2017, the »Germany – Nation of Ideas« initiative and the German Federal Ministry for Traffic and Digital Infrastructure announced the ten winners of this year's best practices phase of the German mobility award. One of the ten awards went to the project InREAKT, a cooperation of STUVA e. V., VBK Karlsruhe, INIT, Fraunhofer IPK, Infokom and the Ruprecht-Karls University in Heidelberg, Psychology Institute.

InREAKT provides an improved emergency management in public transport systems which shall foster an increased sense of security. Violence and vandalism can cause passengers to feel concerned for their safety using public transportation, particularly at night. Employees of public transportation companies may also face critical safety situations or medical emergencies. Effective emergency management is therefore of the utmost importance in order to strengthen trust in public transportation systems. This is the objective of the InREAKT system, which was developed as part of a project funded by the German Federal Ministry for Education and Research (BMBF).

The core idea is the IT-supported processing of an integrated emergency reaction chain comprised of the following elements: Recognizing that a person needs assistance, reporting a situation, informing response forces, and intervening at the site of the incident. The project is based completely on digital technology: The system applies optical sensors to recognize situations, a software-based incident management system with action recommendations which assists the control center of the public transportation company, and a specifically programmed App for employees. Fraunhofer IPK uses depth and RGB sensors for optical detection, selection and classification of scenes in a defined segment of a vehicle or a stop. In the process, the system creates an online situation detection image (image frame) as well as a status analysis of sequential frames, which are searched for similarities with offline-defined sequences of movements, movement patterns ,and scenes. All technical work was supported by interdisciplinary research provided by social scientists to guarantee acceptance by the passengers.

Approximately 170 Start-ups, companies, associations and research institutions in Germany handed in their entries for the nationwide award. With the German Mobility Prize, the »Germany – Nation of Ideas« initiative and the German Federal Ministry for Traffic and Digital Infrastructure give public visibility to intelligent mobility solutions and innovations. Safety and reliability in mobility was the focus for the 2017 projects.

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FPC@ITA – Advanced Manufacturing in Brasilien

Fraunhofer IPK opens Fraunhofer Project Center in São José dos Campos

Prof. Anderson Correia, president of ITA (center left) and Prof. Uhlmann (center right) signed the founding document for FPC@ITA. (© ITA / Raquel Caratti Piani)

Participants of the signing ceremony from Technological Institute of Aeronautics ITA, Competence Center for Manufacturing CCM, Fraunhofer Headquarters and Fraunhofer IPK. (© ITA / Raquel Caratti Piani)

Fraunhofer IPK has opened the Fraunhofer Project Center for Advanced Manufacturing @ ITA, Brazil. Abbreviated FPC@ITA, the center is considered the official seal on a strategic cooperation between the German research institution and one of the top engineering schools in Brazil.

ITA offers research and education in distinct engineering fields, including aerospace, aeronautical, civil, mechanical, computer and electronics engineering. It is located inside the Department of Aerospace Science & Technology (DCTA), which is considered one of the biggest research centers in Latin America. ITA was responsible for some major achievements in Brazil in the last 60 years, including the foundation of the Brazilian Aeronautical Industry (EMBRAER), the development of the Automotive Ethanol Program as well as the enhancement of the Telecommunications Industry (Telebrás). »In the future, the Fraunhofer Institute for Production Systems and Design Technology in Berlin and the Competence Center for Manufacturing (CCM) at ITA will jointly develop production technology solutions for the benefit of industry in Brazil, including German and European companies producing there«, said Prof. Dr. h. c. Dr.-Ing. Eckart Uhlmann, Director of Fraunhofer IPK and Executive Director of the Fraunhofer Project Center, during the signing ceremony in São José dos Campos on November 7, 2017.

São José dos Campos is the perfect location for a Fraunhofer Project Center focusing on industrial research and development in Brazil. About 50 percent of Brazilian industrial enterprises are located within 200 km of the city. But this is not all: The same region also hosts 70 percent of all German enterprises that run Brazilian branches. Many of these German enterprises have expressed an interest in cooperating with FPC@ITA; a few cooperations have already started. In total, projects amounting to about 11 million euros are currently running or were recently finished by Fraunhofer IPK in Brazil, many of them already in close collaboration with ITA and CCM. The liaison in the R&D area started simultaneously with an educational cooperation: For about five years, the German-Brazilian university exchange program »Science without Borders« has led numerous Brazilian students to Fraunhofer IPK. Many of these now support Fraunhofer IPK's research activities in their home country.

The research services of the new project office are based on the process chain in industrial companies and include sustainable innovations in the areas of corporate management, product development, production systems as well as manufacturing and automation technology. The complementary competencies of the two research institutes allow the development and prototypical implementation of complex system solutions for digitally integrated production (dip).

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Opening of »ENRICH in Brazil«

First achievements of the EU Horizon 2020 Project CEBRABIC

The project CEBRABIC, which has been launched in the beginning of 2017, has passed its first milestone as the »European Network of Research and Innovation Centres and Hubs (ENRICH)« in Brazil has been ceremonially inaugurated on November 29, 2017 in Brasília. »ENRICH in Brazil« aims to become the main hub and contact point for European and Brazilian science, technology and innovation actors. The center will encourage and facilitate the cooperation in research, technology and entrepreneurship between Europe and Brazil by supporting and empowering innovation actors along the innovation value chain. The launch of the first center in Brazil was supported by the Ambassador of the European Union to Brazil, H.E. João Gomes Cravinho, who highlighted in his keynote address the close relationship between Brazil and Europe in terms of innovation.

»ENRICH in Brazil« will offer services to public and private innovation actors, such as companies, research organizations and governmental actors. The services offered will support internationalization by offering tailor-made trainings, networking opportunities such as pitching sessions and matchmaking events, as well as informative studies and competitive analyses. To complement the »ENRICH« experience, customized legal and financial consulting services are part of the portfolio.

The consortium with EU ambassador João Gomes Cravinho, representative of the Brazilian Foreign Ministry Luis Fernando Corrêa da Silva Machado and the Director of Operations of the SENAI, Gustavo Leal Salles Filho at the opening of »ENRICH in Brazil«. (© CNI – Confederação Nacional da Indústria)

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I-ESA 2018

9th International Conference on Interoperability for Enterprise Systems and Applications, March 22 – 23, 2018

The I-ESA conference connects the world's leading researchers and practitioners of enterprise interoperability and related domains, including interoperability aspects of enterprise systems and applications. It joins new business models, smart services, IoT and cloud technologies. I-ESA will be an outstanding opportunity to exchange experiences and business ideas between researchers, service providers, entrepreneurs and industrial stakeholders. I-ESA 2018 will be held at Fraunhofer IPK in Berlin. The program involves research paper presentations, prominent international keynote speakers, a Doctoral Symposium as well as pre-conference workshops.

More information: www.i-esa.org

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Profile

Production Technology Center PTZ Berlin

The Production Technology Center PTZ Berlin comprises of the Institute for Machine Tools and Factory Management IWF of the Technical University of Berlin and the Fraunhofer Institute for Production Systems and Design Technology IPK. The PTZ develops methods and technologies for management, product development, production processes, and design of industrial manufacturing plants. Furthermore, we also leverage our proven expertise to engineer novel applications in emerging fields such as security, transport and medical technology.

The PTZ is equally committed to making its own contributions to application-oriented basic research and to developing new technologies in close collaboration with industry. The PTZ works together with its industry partners to transform basic innovations born in research projects into fully functional applications.

With the methods and techniques we develop or improve, we offer our partners comprehensive end-to-end support from product development and fabrication through to product recycling. This also includes the conception of means of production and its integration in complex production facilities, and innovation of all corporate planning and controlling processes.

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