Fraunhofer
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FRAUNHOFER INSTITUTE FOR MACHINE TOOLS AND FORMING TECHNOLOGY IWU

SMART FACTORY
Digitization and Automation

DESIGN OF PRODUCTION SYSTEMS

TODAY'S THINKING FOR TOMORROW'S PRODUCTION

Resource-efficient digital production is the foundation for sustainable increase of the economic and social success of German SMEs in an increasingly globalized future. The Division »Smart Factory – Digitization and Automation« investigates the associated challenges and develops customized industrial solutions.

Together with our partners we develop concepts for combining business organization, information technology and manufacturing. In this context we focus on the value-adding implementation of these concepts into practical production applications. For numerous years we have been cooperating with a network of established industrial partners, service providers and research organizations – from local SMEs to OEMs. Using our long-term experience in regional, national and international projects, we accompany our clients starting from the idea all the way up to the operation of our specific developments.

The division focuses its research and development activities on implementing the concept of smart factory on all company levels. We concentrate on designing efficient and ergonomic factories and work environments, using effective production organization and innovative software or automation solutions as a basis for optimizing added value. The cornerstone of our developments consists of managing data and information, starting from sensors and reaching all the way up to the employees. Thus, we successfully improve the quality and quantity of production processes while creating more transparency in order to increase productivity.

Leading themes

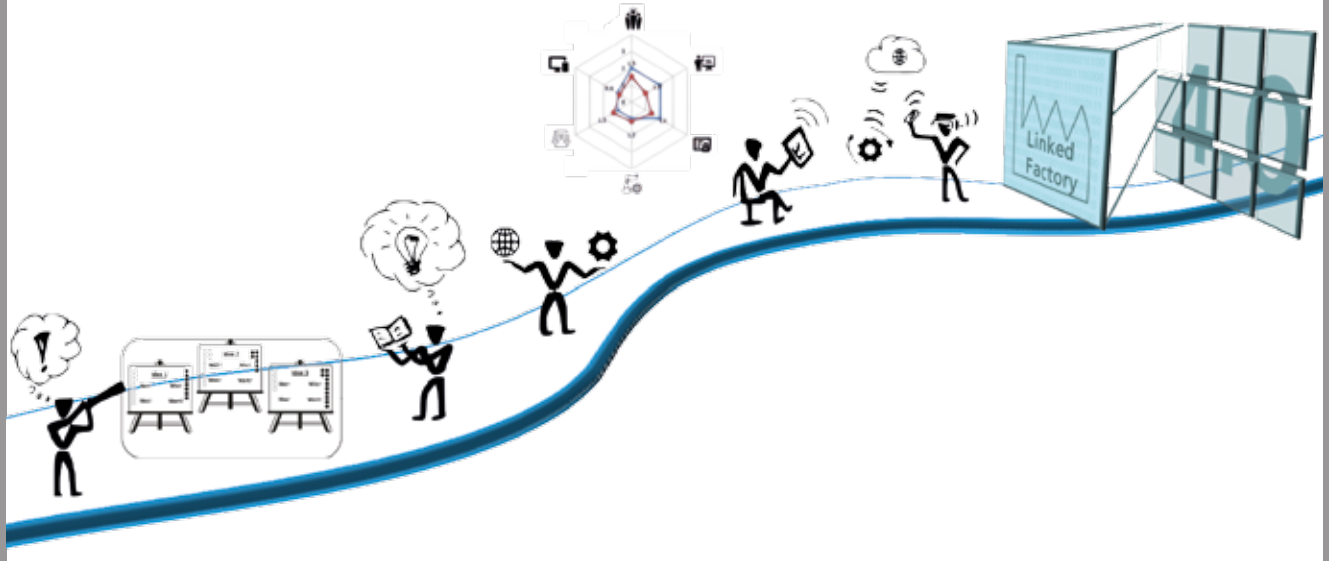
We rely on profound knowledge of methodology, interdisciplinary innovations and advanced technologies in order to guarantee the highest quality of our services and solutions. Our services and main research areas are driven by the latest leading themes of industrial production in Germany and Europe.

■ Resource-efficient factory
Energy and resource-efficient creation of added value as a permanent competitive advantage – supported by individual planning approaches, innovative process control and integrated management

■ Digitization in production, Industrie 4.0
Transparency and controllability of processes, machines and plants through intelligent linking; targeted digitization and value-driven reorganization of processes

■ Automation and monitoring
Zero-defect production: task-related automation of production systems to ensure high throughput while maintaining the required quality, warranted through inline monitoring and control of machines and production processes

■ Value by people in production
Efficiency and ergonomics for future work stations through the application of established design methods, lean organization and intuitive mobile assistance systems



DIGITIZATION – WHILE ADDING VALUE

Identification and utilization of the potentials of digitization

The ongoing digital permeation in every sector of social and business life increases the value of the »Resource« Data. But what kind of data has to be collected and manipulated in which way in order to extract value-adding information? The Division »Smart Factory - Digitization and Automation« uses a maturity model and a modular digitization toolbox to support companies in developing and realizing a sustainable digitization strategy. The potentials of digitization are realized step-by-step in a holistic and profit-generating concept, regardless the degree of digital transformation in the company.

The starting point is highlighted by the evaluation of the company`s degree of digitization across the TOP areas of technology, organization and personnel. Products, strategies, key performance indicators and competences are evaluated and rated regarding their level of expertise in Industrie 4.0 topics. Based on the results, a strategic definition is performed regarding a desired target state in every functional area. The next step consists of an individually created recommendation of digital transformation. The result is a customized framework for the iterative and value-adding digitization of the company.

Afterwards modular digital technologies are ready to be implemented within the identified key areas. For this purpose we provide various digitization tools that can be combined arbitrarily by semantic technologies in order to provide customized process architectures. Flexible management of data and information, interface engineering on machines, sensors and controls, contextually provided information, factory-wide object identification and localization using Auto-ID or scalable IT infrastructure are the basic technologies on the path to a virtual and real-time driven image of production.

Systematic approach

– Analysis of the digital in-company structures and competencies
– Evaluation of the digital degree of maturity in the TOP areas
– Strategy development to reach the desired level of digital maturity
– Implementation of customized digitization solutions

Results

– Detailed analysis of the company´s digital maturity level
– Comprehensive recommendation of digital transformation
– Increased transparency and efficiency of the valued-adding processes through modular digitization
– Customer-oriented and iteratively performed support in follow-up digitization projects

RESOURCE-EFFICIENT FACTORY

Energy efficiency and energy flexibility

Energy efficiency is important in industrial production. The integration of decentralized renewable energy sources becomes more and more important as well as the flexibilization of industrial loads. The question arises whether cost for the procurement of energy can be decreased in the short-term and how businesses can prepare for new energy supply business models. We identify potentials and leverage items for optimizing energy supply and energy consumption by using energy analysis und best practices. In order to use the best flexibility options on the future energy market, we offer our support to identify potentials in enabling technical facilities in the factory.

Simulation of material and energy flows

Stochastic influences and complex interactions are prime challenges when it comes to increasing efficiency in production facilities. Even complex manufacturing processes can be represented, investigated and optimized by using material flow simulation and other tools of the digital factory. For this purpose we have been using a software called Siemens Tecnomatix Plant Simulation very successfully in numerous industrial sectors. Moreover we have developed the extension eniBRIC that allows for the simultaneous simulation of material and energy flows in production facilities. It enables us to examine the effects of a wide array of individual measures in advance.

Planning and operation of resource-efficient factories

In future production systems, the highest priority will still be placed on the pursuit of goals regarding production logistics such as minimum processing times and minimum stocks as well as maximum timeliness. The achievement of these objectives is decisively influenced by the selection of the correct control strategies. Additional goals such as resource efficiency further increase the complexity of the factory. Thus, our current research activities focus on integrating MES, building management systems and energy management systems in order to continuously plan and control material and energy flows efficiently on all distribution levels. Together with our clients we design and realize concepts for resource-efficient production organization, including the building, infrastructure and processes.

Trends and development

The structural changes in industrial manufacturing have become increasingly important for businesses as well as for industrial associations and stakeholders from politics and society.
We offer in-depth scientific analyses for decision support in order to exploit innovation potentials early to successfully co-design development processes and to identify promising fields of action. In particular, we focus on conveying systematic understanding for complex topics of the future, on assessing potentials and on determining the suitability of sustainable technologies. Furthermore, we analyze and develop management systems in order to increase resource efficiency.

GREEN AUTOMOBILE PRODUCTION

Advantages

Savings of primary energy at an output quantity of 250,000 carbodies:*
– Press plant 8.1%
– Tool making 1.4%
– Carbody construction 16.5%
– Painting 6.7%

Future potentials are considerably higher.

** Project result InnoCaT®*

When it comes to the contribution of cars to climate protection, fuel consumption is very important. Not least, fuel consumption depends on the weight of the carbody. However, already during manufacturing there is a huge savings potential and potential for increasing efficiency. After all, a fourth of the total energy requirements in the lifecycle of a car is associated with its production, of which a considerable portion is allotted to carbody manufacturing.

How can products be manufactured in a resource-efficient manner? Which new manufacturing processes are required to save material and energy? These questions were investigated by the Innovation Alliance Green Carbody Technologies (InnoCaT®), funded by the Federal Ministry for Education and Research (BMBF) and coordinated by Fraunhofer IWU and its industrial partner Volkswagen. Over 60 partners from industry and research developed solutions for automobile production in 30 sub-projects, using a total investment volume of approx. 100 million euros.

The content of the joint research ranged from tool making to press plants, carbody construction and painting. The same challenge applied to all these areas: improving the degree of material utilization and the energy efficiency. It was not only a matter of adjusting the individual parameters in the production process, but it also involved considering manufacturing as a whole. For this reason a major assignment consisted in establishing continuous planning for energy- and resource-efficient processes across the trades, i.e. individual process steps and complete process chains.

In order to demonstrate the individual results and the approaches, including detailed verification, a concept was developed and used for a reference carbody manufactured in an adequate reference factory. The novelty of this reference carbody lies in its use as a benchmark independent from any companies and specific cars. Thus, the achievable savings potentials are illustrated as one entity for the first time. In addition, they serve as reference values for a more energy- and resource-efficient automobile production when it comes to the implementation of new technological concepts, enhanced manufacturing technologies and extended planning tools.

starting situation – until now

planning software – new

PRODUCTION PLANNING IN THE AUTOMOTIVE SUPPLIER INDUSTRY

At Magna Exteriors (Meerane) GmbH, the production of painted exterior parts is a highly complex process chain. The customers usually report their demands through specialized interfaces at very short notice. Raw parts must be produced coated and tested on a fully automated painting line with approx. 350 parts and color combinations. The production planners and logistics planners are faced with the challenge of minimizing stock levels while satisfying all customer orders in time. The previous planning process had been characterized by mostly manual steps and daily production plans.

In the summer of 2016 the open-minded team of logistics, production planners and IT developers initiated a project to greatly simplify the production planning of the paint shop.
A web-based planning software was realized that automates most of the planning and supports the employees with a modern user interface. Maintaining the employees decision-making powers was a key success factor for the resulting software solution.

The software has been operated successfully since the spring of 2017. The server-client architecture enables good maintainability for new features and ensures long-term operation. Manual processes were automated by the tool, thus decreasing the risk of errors significantly. The planning procedure was streamlined, which positively influences the work ethic.

Advantages

Up to 60% reduction of the daily planning effort

Faster training for new production planners

Increased delivery reliability through demand-responsive planning and clearly structured planning statistics

100%-check for formal planning mistakes

Quote from the client

»The challenges that confront us daily in the automotive sector can hardly be mastered manually due to increasing complexity. It was very exciting for us to create something that can improve processes and their quality in the field of production planning and control.«
Sebastian Lohmann, Team Leader Industrial Engineering, Magna Exteriors (Meerane) GmbH


Nehmen Sie sich mit, was Sie brauchen!
Stationen
10
95
29
7
1158
0.90

DIGITIZATION IN PRODUCTION

Interfaces and data management

Data is the decisive basis for economic production and the development of new business models. Our research activities focus on new developments that enable acquisition, combination and evaluation of data from various sources. Our services range from setting up digital infrastructures and tapping into data sources to conceptualizing and implementing data architectures up to introducing modular solutions of Industrie 4.0. For this purpose we have developed the Industrie 4.0 stack, a conceptual framework that can be individually adapted to the respective challenges.

Software development

Modern software solutions for planning, controlling and optimizing production plants are an essential part of smart factories. The focus lies on the entire life cycle of software systems – ranging from task analysis to architectural design, software development up to installation and maintenance of software. By following concepts of Industrie 4.0, suitable databases, software libraries and application frameworks are brought together in particular. In this context we create innovative solutions for planning and monitoring processes for the intelligent control of production systems as well as the acquisition and evaluation of production data.

Virtual und augmented reality

Innovative virtual technologies for industrial applications can simplify maintenance, avoid human errors during assembly and machine operation, and can quickly train new staff members. Our services of research and development range from design reviews assisted by virtual reality (VR) to presentations using a mobile VR system, up to complex augmented reality solutions in the context of Industrie 4.0.

Human-machine interaction and assistance

In future production scenarios human creativity and flexibility are decisive competitive factors. In order to provide the best possible support in this area, we develop innovative concepts of interaction, methods of modularization and interface concepts for intelligent assistance solutions in production environments. The effects of such systems include, among other things, the reduction of set-up times and maintenance times.

Data analysis and machine learning

Big data analysis and the application of machine learning approaches become more and more important to achieve the optimal design and control of production systems. We realize editing, analysis and modeling for machine data and business data. For this purpose we combine visual methods of analysis with tools for statistical evaluations in order to derive knowledge from collected data, which we then implement into software modules for automated analyses and prognoses.

»LINKED FACTORY« – CONNECTED FACTORY AND DIGITAL TWIN

Advantages

Smart connections between devices, controls and applications

High speed of data acquisition; easily expandable for data analysis

Derivation of previously hidden relationships used as a basis for increasing productivity

Faster reaction times of the workers due to supply of context-based information

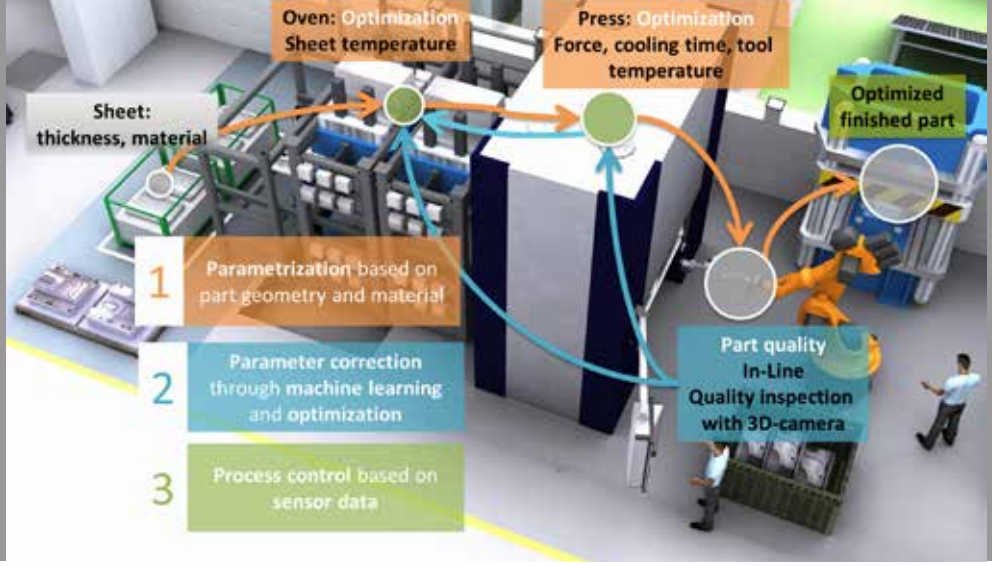
Assistance systems and optimization algorithms for production environments require the integration of data related to products, production processes and plants. These include digital models for the design, structure and connectivity of machine and sensor systems along with relevant parameter data. Intelligent assistance functions can be developed in combination with operating data such as sensor measurements, performance indicators and fault conditions as well as the status and quality of manufactured products.

The concept of the »Linked Factory« is mainly based on the ability to combine static and rarely changing master data with highly dynamic operating data and semi-structured semantic data in a unified database (Data Lake). This is accomplished by combining Linked Data technologies and REST interfaces with standards such as OPC UA or MTConnect for exchanging machine data.

As an extended semantic knowledge base, the »Linked Factory« complements existing IT systems with additional options for the collection, management and retrieval of highly heterogeneous data. It offers a SPARQL-based interface for standardized data access to digital models of machines and processes as well as their operating data. It can provide status signals and instructions for manual assembly and service tasks by considering skill profiles of personnel. Using a context sensitive approach for linking information from the knowledge base with operating data from the production in real-time, workers can receive interactive instructions according to their role in order to quickly diagnose and resolve issues in production systems and to prevent or decrease downtime. As for the actual mobile devices used for human-machine interaction, the »Linked Factory« targets the whole range from laptop computers to smartphones or even voice-user interfaces.

Furthermore, by using semantic technologies, the concept of the »Linked Factory« conforms with the requirements for the administration shell of Industrie 4.0 components defined by the Reference Architectural Model Industrie 4.0 (RAMI 4.0). Thus, existing production systems can also be upgraded to support typical Industrie 4.0 functions.

Blockchain technology is used to ensure maximum security in distributed production environments.



MACHINE LEARNING IN PRODUCTION

The increasing digitization in the industrial world and the constant desire for optimized production processes necessitate the integration of new algorithms that go beyond condition monitoring and offline process control for improving the component quality. Machine learning gives us this opportunity.

Especially in the field of production, machine learning offers great potential for the optimization of processes because production systems generate large amounts of data every day, which only have to be converted into usable information. Machine learning techniques can be applied to extract important features and complex relationships from large amounts of data. If production machines are capable of learning from the past, predictions can be made using machine learning methods in order to optimize production processes. However, the use of machine learning also requires a lot of time and effort, and in particular expertise in statistical procedures, but also problem-specific knowledge. Data has be preprocessed, appropriate models have to be selected, desired solutions defined and presented for the respective target group. It is also important to critically scrutinize assumptions related to machine learning and to explore the limits of statistical data analysis. Only in this way data-driven models can flourish in production.

Machine learning methods are already applied in our department for predicting the quality of components from the automotive or household appliance industry. In addition, they are also suitable for the intelligent process control of manufacturing lines. These are characterized by a combination of several processes, i.e. increased complexity. The hot sheet metal forming process of press hardening is an example of a manufacturing line that produces ultra-high-strength and property-optimized car body components. Using comprehensive monitoring, a prediction of the expected component quality can be made during the press hardening process based on machine learning methods. If the predicted quality is outside a permitted range, machine learning algorithms can help to calculate adjustments of process parameters in following process steps in order to improve the final component quality.

Advantages

Identifying the influences of process parameters on component quality

Resource and material efficiency through reduction of defective components

Increase in productivity

Faster identification of defective parts; minimization of cycle time with guaranteed component quality


Maschine 4.0
Technologie
System
Digitalisierung
Standort Chemnitz
Infobox
Demomaschine 4.0
Prozessüberwachung
Condition Monitoring
Augmented Reality
Modellansichten
Augmented Reality
Gesamtansicht
Stößelansicht
Startansicht
DE
EN
Hubzahl [1/min]
10.000
0
1
5
10
Stößelverlagerung [mm]
Kraft [kN]
Wegsensor 1: 0.058
Ständer 1: 1.033
Wegsensor 2: -0.085
Ständer 2: 1.720
Wegsensor 3: -0.085
Ständer 3: 0.000
Wegsensor 4: 0.111
Ständer 4: 1.477
Sensor Kopfstück
Sensor Pleuel
Sensor Exzenter
Stößelkupplung
Wegsensor
Sensor Ständer
Sensor Tisch
Condition Monitoring
Prozessüberwachung

AUTOMATION AND MONITORING

Automation and control technology

When manufacturing processes are automated, electric and hydraulic axle drives are used with digital position control and force control in order to realize innovative machine concepts such as parallel kinematics, hydraulic die cushions or hybrid drive systems. In addition to creating concepts for drives and controls, our core competences mainly comprise simulation, programming, implementation and commissioning of new automation and control algorithms. We introduce new technologies by adding new NC-core applications or HMI applications to existing machine functions of industrial PLCs, MCs and CNCs (e.g. by Siemens, Rexroth, Andron, PA, Beckhoff, B&R) or by transferring new functions to specialized decentralized controls (microprocessors).

Inspection technology

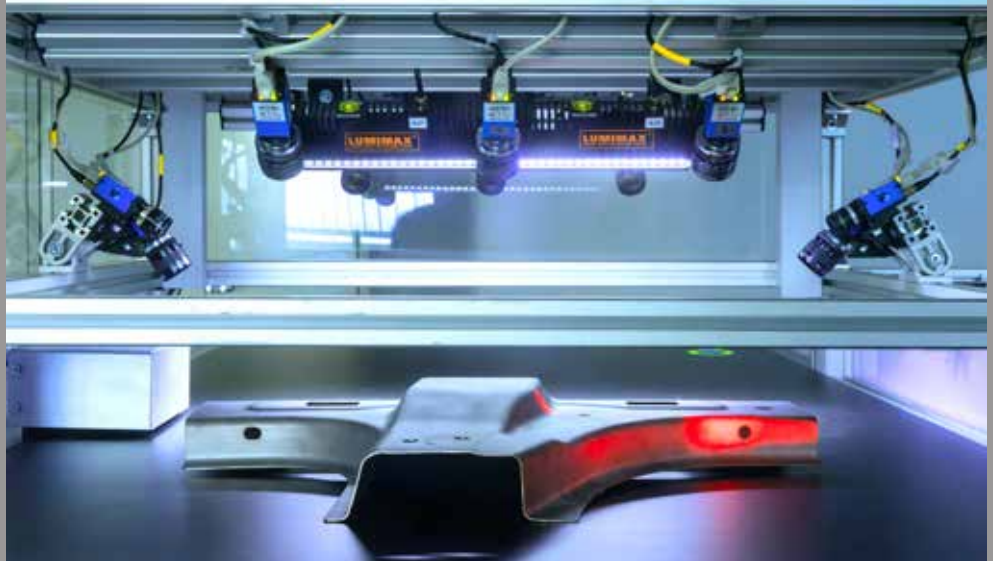
One challenge of industrial inline quality inspection often lies in the fact that component properties to be monitored are not or only partially accessible during production. Based on our long-term experience, we support you in selecting the required sensors to ensure continuous secure quality inspection. In this context, we apply solutions for multi-sensor processing (sensor fusion), thus increasing the spectrum of detectable defects and significantly raising the reliability of assessment. The implementation of inspection systems in industrial applications is executed by utilizing the Xeidana® software which we have developed.

Measurement technology

Experimental analyses of machines and production plants contribute to determining their static, dynamic, thermal and kinematic properties. On this basis we derive conclusions for the design as well as the comparison of calculation models and the operation of the machines. By applying smart sensors and by developing intelligent evaluation algorithms, we facilitate the calibration of machines as well as gapless process monitoring in order to guarantee the required quality of the manufactured workpieces.

Condition monitoring / Predictive maintenance

The availability of machines and production plants plays a significant role in the production process. In order to raise this availability, condition monitoring systems are increasingly used for accessing measurement data from controls, drives and additional sensors. By applying our modular condition monitoring system, essential machine assemblies can be monitored on the basis of measured values so that alerts can be sent when limiting values are exceeded, and suitable maintenance measures can be taken. Moreover, task-oriented intelligent algorithms are developed for identifying damage and prospectively for predicting lifetime as well. Therefore unexpected failures can be avoided, repairs can be planned better and in the end cost can be saved.



XEIDANA® – ONE SYSTEM FOR A LOT OF SENSORS

Advantages

Highest flexibility due to user-specific expandability

100% inspection possible

Time savings due to faster quality control

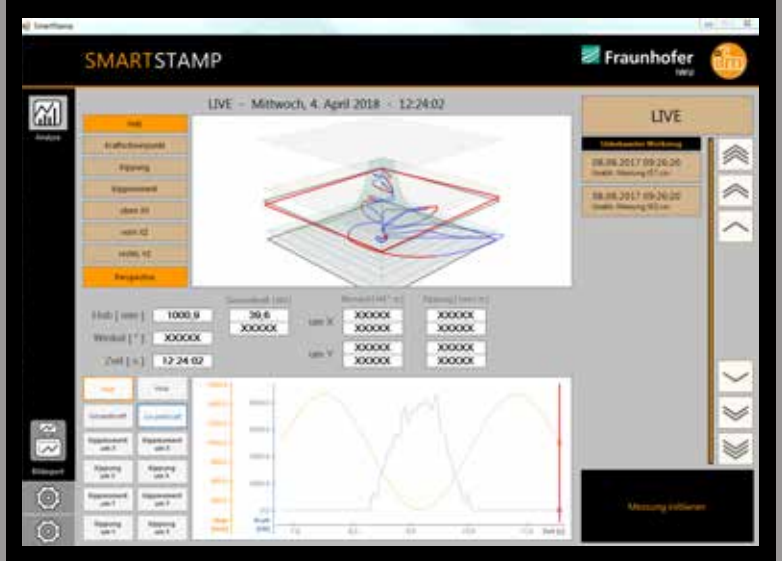
Often operatives in a press plant perform a visual inspection at the outfeed conveyor belt to check whether the quality of the pressed component is correct. This task is exhausting for the operative and the quality inspection is often not a hundred percent accurate. Using the XEIDANA® software, quality control can be conducted considerably more efficiently and precisely.

The program was developed at Fraunhofer IWU and can combine numerous inspections and measurements in one system, where they are evaluated automatically. It is based on various sensors with high resolutions, which control lengths, diameters or volumes. In addition, such sensors check whether assemblies are complete, whether surface damage can be detected; they can even check for internal defects. Large amounts of data flow during these processes.

XEIDANA® was developed particularly for fulfilling these requirements. The software detects and analyzes infrared images and optical live videos, e. g. together with information from ultrasound systems. The data can be evaluated live or archived for later analyses. The program works best with computer systems that have processors with several cores. This ensures that the required computing power is achieved.

Another characteristic of XEIDANA® is the extendable framework. It enables the user to independently add efficient extensions to the software. This allows access to numerous hardware components. At this point the human quality inspector is involved again. With this flexible framework measured results are provided to the quality inspector via tablet or a pair of data goggles. Thus, the tedious visual control at the press output can be eliminated. Moreover, 100% defect detection is accelerated.

A product of Fraunhofer IWU



SMART STAMP – CONDITION MONITORING FOR PRESSES

Maintenance has become increasingly important in machinery and plant engineering since the reliability of the production system is a crucial competitive advantage. Maintenance processes have to increase the availability and the service life of production systems. Therefore maintenance processes have to be integrated into business processes.

Condition-based maintenance aims to carry out maintenance and repair work only when required. Unexpected production losses can be avoided and the necessary spare parts can be produced specifically and in time.

If damage occurs in press lines in critical components such as the main drive, the hydraulics of the die cushion or the press transfer, the press comes to a standstill, which causes high cost due to repairs and loss of production. In order to avoid unscheduled standstills, systems of condition monitoring are increasingly applied. Using signals coming from sensors or measurements from the control unit and drives, they create damage predictions. Smart Stamp is one part of such a condition monitoring system for forming presses and performs monitoring of the main press drive in order to verify whether permissible values are being adhered to regarding press force, turning moment and tilting of the ram.

Today, modern press drives are mainly based on servo-electric drives. Several torque motors with eccentric crank gears generate the movement of the ram along the guides. The force transmission to the ram takes place via several pressure points of the drive. The eccentric distribution of the process forces in the forming tool depends on the stroke, leads to the turning moment in the ram and causes the ram to tilt.

Smart Stamp detects and visualizes these physical variables. Thus overload of the press can be avoided. It is possible to identify forming tools that load the press improperly, which causes increased wear. At the same time, Smart Stamp is a »fingerprint« of the forming process for the specific forming tool on this defined press. Changes in the press setup or wear in the forming tool can be detected as a tendency.

Advantages

Modular assembly and extension without difficulty

Machine and CM system work separately

Utilization on different machine types

Easy to retrofit on existing machines

VALUE BY PEOPLE IN PRODUCTION

Design of workplaces

Despite the increasing use of automated machines, humans will remain an integral part of production in the future. Under this premise we investigate innovative approaches for designing manual or partly automated workplaces and work processes. Already in the planning stage we use methods and software like the editor of human work (ema) to think ahead for creating ergonomic, economic and humane working conditions. We integrate intuitive, manageable IT solutions into our approaches in order to provide an optimum supply of information for the employees of production facilities. Our interdisciplinary team, the certified training of our experts in MTM and REFA and our insight into various companies allow us to create progressive ideas for our clients and to develop them to application maturity.

Process organization

Successful management systems are characterized by clear structures and process orientation. They enable businesses to validate and continuously increase their competences regarding quality, environmental impact, energy consumption, etc. Applying our profound methodical knowledge, we support our clients with analyses, concept development and implementation of measures for optimum employee involvement while considering current standards.

Workload and order planning

Adequate dimensioning of the production capacities and control of orders are imperative for successful production operations. Based on our extensive practical experience, we design individualized planning solutions for the spatial structure of factories and process organization. We include our clients in this planning process. Thus, we apply established methods of factory planning, lean management and production planning and control.

Production assistance

Information editing and information provision have been become more and more important in addition to data analysis and the generation of information relevant for production. Context-based concepts ensure that employees receive all the information required to fulfill their tasks. Both in data analysis and in providing information it is required to possess knowledge regarding the respective process. Therefore it remains imperative to actively involve humans as creative problem solvers and to adequately consider their natural compentences such as intelligence and flexibility. In order to accomplish this, we work with advanced web technologies and platform-independent solutions that can be integrated optimally into existing business networks.

REFERENCES AND SERVICES

REFERENCES

SynErgie

The joint research project SynErgie, funded by the Federal Ministry for Education and Research (BMBF), develops solutions for enabling energy-intensive key production processes to operate with a more and more volatile energy supply. Using modern approaches of information and communication technology, the energy distribution between various sectors shall be controlled to consider the fluctuating supply of renewable energies.

REEMAIN

In REEMAIN, a project of a European network of partners, funded by the European Commission, we investigated implementable solutions for the energy-efficient operation of factories. The results comprise innovative solutions in the field of renewable energies. Moreover, Fraunhofer IWU developed tools and methods for identifying, quantifying, virtually securing and also implementing potentials of energy efficiency in companies.
www.reemain.eu

WindNode

The project WindNode deals with the development of transferable, scalable and industry-oriented solutions for synchronizing energy producers and industrial loads. In order to apply these partial solutions, a software-based energy management system for synchronizing energy supply and energy demand is implemented as a flexibly expandeable hardware and software solution. The E³-Forschungsfabrik [E³-research factory] at Fraunhofer IWU demonstrates solutions of industrial production for supporting the energy turnaround. The focus lies on direct utilization of renewable energies, active energy and load management and on applying energy storage systems in production processes.
www.windnode.de

Leichtbauatlas
Atlas of lightweight construction

Germany is the world-wide leader for production and production technologies of innovative materials. In order to illustrate the potential of this position, Fraunhofer IWU designed and developed the Leichtbauatlas [atlas of lightweight construction] as an innovative system for researching competences. The interactive portal can be used by organizations to present their processes and activities. Furthermore, companies and research institutions can utilize it to look for customized competences in lightweight construction in local areas. Thus, this portal supports the networking of companies and research institutions.
www.leichtbauatlas.de

CyProAssist

This project has the objective of implementing the modular system of production assistance, called »FriendlyImprover«, for the acquisition, analysis and interaction of data. An open concept of architecture and interfaces is developed for integrating modules of diverse solutions providers. On this basis the assistance system can provide required data and functions from ERP, SCADA or MES solutions to stationary or mobile terminals by using an adaptive user interface for novel human-machine interaction. A modular system is developed that facilitates the implementation of new assistance solutions considerably and ensures the transferability to various application cases and sectors due to its open interface concept.
www.cyproassist.de

SmARPro

SmARPro
SmARt Assistance for Humans in Production Systems

The joint research project, which is funded by the Federal Ministry for Education and Research (BMBF), aims at developing mobile assistance systems based on augmented reality for setting up and operating intelligent production and logistics systems. These assistance systems shall improve the integration of humans as intelligent problem solvers into production systems.
www.smarpro.de

RANGE OF SERVICES

We offer numerous types of collaboration:
– Directly and exclusive contract research
– Engineering services
– Joint research/initial research
– Consultations, studies and workshops

Our main competences are reflected in the following topics:

Resource-Efficient Factory
– Simulation of material flow and analyses of value streams
– Planning of logistics/production/assembly systems
– Energy-flexible and resource-efficient production
– Design of energy-efficient processes and development of energy supply concepts
– Studies on ergonomics and time management (MTM, REFA)

Digitization in Production
– Digital models and data
– Data science
– Virtual and augmented reality
– Human-machine interaction and assistance
– Software engineering and development

Automation and Monitoring
– Concept development for controls and drives
– Development of inline inspection systems (Xeidana®)
– Property analyses for production machines
– Condition monitoring systems
– Development of assistance systems for production machines
– Software development of postprocessors (CAM) for NCs

Editorial notes
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Photo acknowledgments
Titel, page16: photothek.com
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All other photos: Fraunhofer IWU