NEWS
SFB/Transregio 29
„Industrial Product-Service Systems“

Edition 3 / 2. Period

Change of Spokesperson in SFB/TR 29

The great cooperation of research partners in SFB/TR 29 has been lasting for more than six years now. We hope for a successful proceeding application in the midst of 2014 and thus six more years of shared research. This milestone of partnership between TU Berlin and Ruhr-Universität Bochum is marked by the change of the spokesperson and the substitutional spokesperson of TR 29, which has been planned for a long time. Prof. Dr. h. c. Dr.-Ing. Eckart Uhlmann (Institute for Machine Tools and Factory Operation, TU Berlin) has been the substitutional spokesperson of TR 29 and is the new spokesperson by now. The election of Prof. Dr. Mario Rese (Marketing Department, Ruhr-Universität Bochum) to be the new substitutional spokesperson does also reflect the interdisciplinarity of TR 29 through the structure of this scientific top management.

Book Publication of TR 29

In March 2012, the results of the first period of the Transregio 29 were published in the following book:


This book offers an overview on Industrial Product-Service Systems for an interested audience and presents methods and tools to develop products and services. The whole lifecycle of Industrial Product-Service Systems from development to use phase is considered.

Dear reader,

we are pleased to present you the latest issue of our TR 29 News in the middle of the second funding period.

In this issue, we would like to introduce the latest results of two subprojects. In particular, the IPS² assistance system and the demonstrator will be presented. Additionally, we want to inform you about the application of the results in two Transregio transfer projects. The transfer projects are meant for the evaluation of the results of the entire Transregio, but every subproject has its own main focus. At Trumpf GmbH + Co. KG, planning methods for service delivery are tested in practice, and an IT-based system for holistic support of processes in technical customer service is being tested at Schaudt Mikrosa GmbH.

In addition to the application of the results of our Transregio into industry, developed methods of two subprojects of the entire Transregio have been evaluated through workshops and adapted to the needs of the other subprojects.

Also this year, the Transregio 29 took part in many international conferences, for example the CIRP IPS² Conference in Tokyo, Japan, and the CIRP IPS² Spring School in Linköping, Schweden, to present the newest results and findings to international scientists. The Transregio 29 has the honor to organize the 5th CIRP IPS² Conference in Bochum and the 6th CIRP IPS² Spring School in Berlin in 2013.

We are also pleased to inform you about the new junior professorship (assistant professorship) for Product-Service Systems in the faculty of mechanical engineering at Ruhr-Universität Bochum which is now held by Jun.-Prof. Dr.-Ing. Katja Laurischkat, a former doctoral candidate within Transregio 29.

In order to strengthen the sustainability and the practical relevance, the research foundation for Industrial Product-Service Systems e.V. (FIPSS e.V.) was founded at Ruhr-Universität Bochum. Their goals and cooperation opportunities will be presented in more detail in this issue of the TR 29 News.

You can download our TR 29 News on the SFB/TR 29 homepage (www.tr29.de).

Enjoy reading!

Prof. Dr.-Ing. Horst Meier

News
Within the first transfer project of the Transregio 29 (TR 29), an agent-based IT system will be implemented to support the staff of maintenance departments in their daily work.

The Schaudt Mikrosa GmbH manufactures machine tools for centerless cylindrical grinding, cylindrical grinding between centers and non-circular grinding. All manufacturing facilities and the company headquarters are based in Leipzig. At the same time, Schaudt Mikrosa is part of the Schleifring Group. Products range from small nozzle needles to camshafts as well as heavy train axles. Customers of Schaudt Mikrosa can be found in automotive industry and its suppliers, ball bearing industry and general mechanical engineering.

Even before the delivery of the machine tool, customers get support by grinding trials and training courses. Schaudt Mikrosa offers a wide range of after-sales services. This primarily includes telephone consultancy, repair and maintenance but also remote diagnostics and overhaul of machines.

A typical case for the maintenance department starts with a customer calling the helpline. In first place, a Service Coordinator (SC) will try to help the customer with his problem (e. g. decreasing grinding quality) via telephone. For this purpose, the SC needs to access many sources of information to get a comprehensive overview of the specific machine. This includes the service history but also e. g. historical data of condition monitoring sensors. If all attempts to help the customer via telephone fail, scheduling in an on-site service with a Service Technician (ST) becomes necessary. Besides the procurement of needed spare parts, the SC prepares a folder that holds all necessary paper documents the ST will need for the on-site service. The most important document in this folder is the list of work steps for that specific service. Other included documents are e. g. protocols of previous services, product drawings, layout planes, miscellaneous circuit, fluid and pneumatic drawings. To gather all those documents, the SC has to access many sources of information that are distributed over different systems and places. The prepared folder is picked up together with necessary spare parts and tools by the ST in the maintenance department of the company headquarters.

In the first funding period of the TR 29, fundamental research concerning possibilities of automation and control of service delivery processes in Product-Service Systems (PSS) took place. Within the transfer project, those scientific findings will be further developed and evaluated in real industrial context. Collaboration and feedback of those findings is especially intended with subproject B6 ("Robust PSS – Intelligent control strategies for robust PSS-execution") of the second funding period of the TR 29.

The agent-based IT system will support SC as well as ST in their daily work. In the beginning, the SC will enter the serial number of a specific machine. The system will search all the heterogeneous sources of information, tailor everything it has found and provide the SC with this summary in a graphical user interface (GUI). New software functions will be implemented in the control of the machine tool. Those functions will support the ST via automation of selected work steps. E. g. all axes within the machine will be positioned in a way that makes the execution of a certain work step possible or more easy for the ST. Filling levels and axes backlashes will be measured automatically and displayed. The ST will be equipped with a tablet PC that will display the work steps in an own GUI. In comparison to the static list of work steps on paper, the tablet will be able to dynamically adapt the order of work steps using all available information (e. g. service history, new software functions in control of machine, current machine data). The tablet will also provide the ST with relevant information and documents in the context of the current work step. Data that are generated during the service will be saved in the database.

It is expected that the use of the described IT system will lead to an optimized service delivery process on-site. Significant time savings in the planning and execution of those services are also very likely. The comprehensive and to a large extent automatic information supply and assistance will increase the service quality even more.

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Transfer Project with TRUMPF Started
Optimization of the Delivery of Industrial Services by Means of Strategic and Operational IPS² Planning Methods

On January 1st in 2012, the transfer project T3 with TRUMPF Werkzeugmaschinen GmbH in Ditzingen started with the title „Optimization of the delivery of industrial services by means of strategic and operational IPS² planning methods“. During the funding period of three years, the methods for strategic capacity planning and operative resource scheduling, which were developed in the subprojects B1 and B2 in the first funding period of the Collaborative Research Center Transregio 29, will be adapted, applied and evaluated in the international service of TRUMPF Werkzeugmaschinen.

TRUMPF Werkzeugmaschinen GmbH + Co. KG produces machine tools for the flexible manufacturing of sheet metal. This includes machine tools for laser processing, punching, bending and combined punch and laser processing. The machines are sold worldwide. With the motto "Service like no other" and the department TruServices, the company is on the path to become a solution provider. Customers can benefit from a broad portfolio of lifecycle spanning services and a worldwide network of subsidiaries for sales and distribution and product support with more than 1000 service engineers.

For TRUMPF, a considerable challenge is to be seen in the long-term, strategic planning and buildup of capacity for service delivery in dynamic, globalized markets. In particular, the long planning horizon for hiring and training highly qualified service technicians makes strategic planning difficult. Furthermore, several direct and indirect factors influence the required quantitative and qualitative resource capacity for service delivery and lead to a planning problem of utmost complexity.

Once the required capacities in the strategic planning are determined and existent, the available resources need to be assigned to specific delivery processes, which need to be scheduled and controlled. This is the aim of the operative resource scheduling.

The partially conflicting aims of on-time delivery for a good machine availability and customer satisfaction and minimization of costs, combined with the objective of high-level utilization of service delivery resources, present the operative planner with a major challenge. The method for operative resource scheduling, which has been developed in the subproject B2 during the first funding period of TR 29, will be applied in this context in order to be able to provide high-quality planning solutions by making use of specific flexibilization potentials. However, the largest potential of Industrial Product-Service Systems (IPS²) in the operative planning is that decisions in situations with uncertain or missing information can be avoided. This enables the change from a foremost reactive to a proactive strategy of service delivery planning, enabling the scheduling of flexible delivery processes in times of low resource utilization and thus allowing for a more balanced workload. In order to realize this kind of planning optimization, it is necessary to have complete and secure information regarding the service processes which need to be delivered, including specific resource requirements. Prerequisite for this are highly standardized processes with determined process times and detailed information about the condition of the machine tools. To enable the planning of processes under conditions of complete certainty, the initiative for service delivery needs to be in the responsibility of the IPS² provider. This is only possible if new, innovative business models (e.g. availability- or result-oriented) can be realized.

A network approach is necessary in order to achieve the required flexibility in the organizational and operational structure. Existing capacities of adjacent subsidiaries and service companies as well as external service providers need to be considered in the planning, scheduling and control of service delivery processes. This is the only possibility to enable the leveling of capacity across the boundary of service regions and the optimization of resource scheduling regarding costs and quality of service delivery.

To be able to exploit the full potential of the IPS² planning methods, it is necessary to consolidate and manage the multitude of available planning data in the dynamic and heterogeneous provider and IPS² networks within an integrated planning approach. Due to the complexity of the planning problem, an IT-System, which supports the operative planning task, is necessary. In the subproject B1, an IPS² Execution System is currently being developed for this purpose. A first prototype of this IPS² Execution System is to be applied and tested in order to evaluate the operative planning methods in the context of the transfer project.

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The Technical Demonstrator is a central and highly integrative project of the CRC Transregio 29. All subprojects will present and evaluate their research results in this exemplary Industrial Product-Service System (IPS²). To develop IPS² for innovative, frequently changing and complex business models, the Demonstrator will be completed with further modules within the second funding period. Besides the developed micro milling machine tool, two robots for automation, a measurement station for quality assurance and a cleaning station were integrated. The application for this IPS² is the manufacturing of parts for mechanical watches.

The goal is to present customized IPS² business models for the Micro Production area. Therefore, flexibility and modularity of the individual components were focused during the development of the Technical Demonstrator. To ensure the fulfillment of specified functions in the function oriented business model, the components of the production will be activated separately via a software-based machine control. Therefore, the functions of micro milling, transporting, measuring and cleaning will be performed in a customized way.

Modules for ensuring the micro milling machine’s availability are integrated in an availability oriented IPS² business model. Thereby, a developed agent-based condition monitoring provides and processes information about the micro milling spindle’s condition. The determination of the spindle condition enables the proactive release of maintenance processes in the IPS² use phase. Furthermore, an intelligent tool case has been developed by the subproject B6, which interacts with the machine control via an agent system. The tool case is connected to the machine tool via Wireless LAN and guides the user during the maintenance processes. The service technician will be supported while performing maintenance processes in an appropriate manner. Therefore, measured values and data of operations are electronically structured and stored. This enables the documentation and verification of the performed work.

A further module to ensure the micro milling machine’s availability is a database for micro milling tools. This database has been developed to extend the availability guarantee for the used micro milling tools. The database files the tools condition and supports the development of optimized application parameters. Thereby, the factors availability, quality and efficiency of the key figure overall equipment effectiveness (OEE) are considered.

In the result oriented IPS² business model, the value will be generated in dependence of the defined manufacturing results of the Technical Demonstrator. Therefore, the configuration of the manufacturing system has to be considered and will be adapted to changing customer requirements. The micro milling machine tool has another option to increase its flexibility in addition to the already mentioned modularity. Therefore, the micro milling machine tool will be reconfigured and enables the performing of lathe operations. The production of rotationally symmetrical components is possible after the refitting of the axis of the milling machine. Thereby, the requirements for a high geometric flexibility were considered.

IPS² Spring School in Linköping, Sweden

The 5th IPS² Spring School (May 21st-25th, 2012) was hosted by the ManuServ (Centre for Service Research in Manufacturing Industry) at the Linköping University in Sweden.

Among 20 international PhD students were 5 PhD students of TR 29, who were welcomed by Prof. Sakao, Prof. Lindahl and Prof. Sundin.

29 scientists from five different countries shared their new ideas and experiences in the research area of IPS² during the interdisciplinary and international spring school. Scientific presentations were held by Prof. Sakao, Prof. Lindahl, Prof. Sundin, Prof. Kowalkowski, Prof. Roy and Prof. Meier.

Due to the focus on practice, the spring school was embedded to tours of the companies Toyota Material Handling, Siemens Industrial Turbomachinery and Atlas Copco Rock Drill.

Finally a case study of the company HTC was worked out in group work by the participants. On the last day, the results were discussed with a manager of the company.

We would like to thank the Linköping University for their hospitality. The next CIRP IPS² Spring School will be held by the TR 29 under the direction of Prof. Rötting at the Technical University in Berlin.

Contact IPS² Spring School 2013
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The IPS² paradigm has particular relevance for the integrated conceptual design process of products and services. Conceptual IPS² design is carried out in an interdisciplinary working process. Essential purposes are on the one hand the preparation of innovative solution principles and on the other hand the usage of synergies which occur by the cooperation of and communication between the different domains (engineering, marketing, controlling, etc.) involved in the process. In order to support conceptual IPS² design, two different aspects need to be focused: First of all, the assistance of creativity within the development process. Secondly, a knowledge transfer of the relevant IPS²-lifecycle domains has to be encouraged.

In order to meet these requirements, a new design approach based on the gamestorming theory has been developed by subproject A3. Gamestorming denotes a creativity technique, which is basically composed of the combination of the well-known brainstorming method and the integration of game mechanisms. In this context, the cross-domain collaboration is combined with team-oriented operating principles. The new design approach has been served as a central component of a TR 29 workshop. As an application scenario for the implementation and testing of the innovative design method, the micro-processing has been used.

The workshop participants have been divided into cross-sectional groups. Each group has dealt with the aforementioned application scenario. Observations during the workshop and final interviews with the workshop participants have revealed significant advantages of this method.

The discussions which were provoked by the game led also to some interesting insights and eureka effects. The workshop was a great deal of work, but also a lot of fun.

TR 29 Workshop: Conceptual Design Using Gamestorming

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TR 29 Project Conclave

In April 2012, during the milestone meeting in the middle of the second funding period, the principal investigators and research assistants of Transregio 29 came together in Cuxhaven Duhnen.

At the German North Sea coast, far away from the daily routines at the institutes, the researchers could fully attend to the current research questions of the second funding period. The focus of the project Conclave was on the consolidation and discussion of the integration of methods and results, which have been achieved within the project areas A, B, C and D. In workshops and in integration scenarios, the cooperation of the subprojects could be demonstrated and intensified. Fields of research for the pending two years of the second funding period, which ends in June 2014, were pointed out. Possible research questions for the third funding period were drafted and discussed. Last but not least, to the delight of the researchers of Transregio 29, subsequent to productive meetings, there was some time to enjoy the rough beauty of the North Sea and the national park Wadden Sea.
Industrial Product-Service Systems (IPS²) consist of interacting product and service elements. Based on the functional model, product-service modules (PSM) are developed to meet the IPS² requirement specifications. PSMs consist of variable elements of physical products and intangible services, which need to be developed simultaneously and jointly under permanent consideration of their interdependencies. Support tools are necessary in order to aid the IPS² developer in coping with the increased complexity of the integrated, multi-domain development. At present, IT support for this issue does not exist.

Consequently, an integrated product and service development during the drafting and design stages, which should be supported by an IT-based development support tool, is needed. Modeling and visualizing the interdependencies between the elements of the different product-service modules is the core task of this approach. Thus, a model of interactions and relations is created, which describes the integration of product and service elements in high detail. This information is modeled and maintained in one central database. The PSS-CAD support system provides the authoring tool for creating, visualizing and maintaining this model while the domain-specific IPS² elements are designed, and thus allows for an integrated product and service development for the drafting and design stages. As a software module within the IPS² assistance system, the PSS-CAD support system completes the IT support toolchain for the entire IPS² planning and development process.

Workshop for Computer-aided Service Design (CASD) has been successfully established in the TR 29.

The TR 29-team has been trained in Computer-aided Service Design (CASD) in March 2012. The software prototype has been successfully used by an interdisciplinary team of engineers, economists, computer scientists and work scientists. CASD is a research result of the TR 29 sub-project A5.

CASD is used to systematically consolidate, archive and reuse heterogeneous service information during the development of IPS². CASD offers interactive user assistance during the entire development of an IPS², plausibility checks with regard to service contents as well as a reduction of development time and costs. Required service knowledge is automatically generated during the concept development of an IPS² based on a complex system of rules. Heterogeneous service information is systematically consolidated and archived with the aid of CASD. Furthermore, the standardized modeling of manual and for the first time also remote-supported and automated services is made allowance for during an IPS²’s domain-specific detailing. In addition, service times and costs are automatically calculated based on a specific service process design.

The implemented assistant for the systematic input of data specifically enhances the systematic consolidation and archiving of heterogeneous service information. Thereby, different service information held by the TR 29-team members could efficiently and effectively be consolidated.

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Junior Professorship for Product-Service Systems

The junior professorship for Product-Service Systems has been established at the faculty of mechanical engineering at Ruhr-Universität Bochum.

Jun.-Prof. Dr.-Ing. Katja Laurischkat has been appointed as Junior Professor of Product-Service Systems (PSS) on the 22nd of August 2012.

The junior professorship Product-Service Systems has been established in order to further advance in the research on PSS. Furthermore, PSS-theory will be integrated into the studies of mechanical engineering at Ruhr-Universität Bochum. For detailed information, please visit www.product-service-systems.rub.de.

FIPSS e.V.

A new research community for Industrial Product-Service Systems has been founded.

The public charity supports applied research, transfers scientific discoveries into industry, initiates targeted research cooperations and raises not only the profitability of its members thereby.

FIPSS e.V. pointedly generates and transfers knowledge in the sector of industrial services. In the course of this, it is steadily oriented towards industry’s needs. The association facilitates cooperation projects between companies and between companies and research institutes, ensures a lively participation of partners and supports the realization of research results in companies.

The association detects and structures the need for research of its members and deduces the research priorities. It is the first contact point concerning the application for grants, as it offers its members information on current promotion programs, project announcements and projects. Furthermore, it assists them with their application from an application concept to searching appropriate partners to the coordination with relevant support institutions.

Due to the close interconnectedness of association, research and science, even small and average companies attain direct access to pathbreaking studies and projects. What is more, FIPSS e.V. cooperates interdisciplinarily with further networks, multipliers and other national partners. The active participation of companies and research institutes out of all engineering sectors, which constitute the association’s backup through their membership and commitment, is characteristic for the research community of Industrial Product-Service Systems.

The companies define their need for research and thus determine the relevant research priorities. In order to ensure a maximum application-relation, the research institutes gather the prevailing need for research and conduct the research projects with the companies’ direct participation.

Special Session at the International Colloquium on Relationship Marketing in Nottingham

At this year’s International Colloquium on Relationship Management, the Marketing Department held a special session on the issue of Solution Selling. In order to spread the current research topics of TR 29 further and to receive feedback from international researchers, the work of the Marketing Department was presented in three contributions.

First a depiction of the current situation as well as future challenges for the business-to-business markets have been offered, which will advance the development of Solution Selling. Against this background, Prof. Dr. Rese presented chances as well as limitations for Solution Selling. Afterwards, the individual impacts on supplier- and customer companies were illustrated. The long-run business relations between business partners resulting from Solution Selling and the changes that these entail for the customer company were especially emphasized. The presented contributions were positively assessed and animatedly discussed by the attending scientists.
In 2012, the „International CIRP Conference on Industrial Product-Service Systems” was held on the 8th and 9th of November in Tokyo, Japan. The conference was hosted in the premises of the National Institute of Advanced Industrial Science and Technology (AIST).

On the first day, after an introduction given by Prof. Yoshiki Shimomura, two very interesting keynote speeches were held. Prof. Hiroyuki Yoshikawa presented towards „Service Innovation in the Age of Sustainability”, followed by Dr. Botaro Hiroasaki, NEC Corporation, with his contribution „New Dynamism in the Manufacturing Industry: Value-Sharing ‘Monozukuri’”. After that, the first articles were presented in three parallel sessions. At the end of the conference day, an sophisticated conference dinner was arranged at the InterContinental Tokyo Bay Hotel with a spectacular view on the Tokyo Bay. A performance of Japanese Geishas completed the evening event.

The second day was opened with Prof. Horst Meiers keynote speech on „Planning and Development of Industrial Product-Service Systems”. After the presentation of more conference contributions, the conference was closed in the evening.

Among 108 conference participants from all over the world, 19 members of the projects of the CRC Transregio 29 were present. Further 11 German participants attended the conference, too, which made Germany to the second biggest attendee country in the conference, right after Japan with 48 participants. Further participants and contributions came from Sweden, Denmark, Italy, Brazil, Finland, France, Taiwan, United Kingdom, Belgium, Israel, Korea and Nigeria.

About 144 abstracts where handed in as proposals for presentation at the conference. In 22 of the 86 accepted papers, members of the CRC Transregio 29 were involved. One of the contributions was written by project C4 of the CRC Transregio 29 (Professor Mario Reese, Professor Horst Meier, Judith Gesing and Mario Boßlau) with the title „An Ontology of Business Models for Industrial Product-Service Systems“. From all accepted papers, this one was granted with the „Best Paper Award“, which was awarded at the conference dinner.

The „5th CIRP Conference on Industrial Product-Service Systems: IPS² 2013” will be held from 13th to 15th of March at Ruhr-Universität Bochum.

The following doctoral dissertations have been completed within Transregio 29 since the end of 2011:

Birgit Funke (2011): Adaptive Planungsmethode zur Terminierung der Erbringungsprozesse hybrider Leistungsbündel, Ruhr-Universität Bochum, Chair of Production Systems (Prof. Dr.-Ing. H. Meier)

Oliver Völker (2012): „Erbringungsorganisation hybrider Leistungsbündel“, Ruhr-Universität Bochum, Chair of Production Systems (Prof. Dr.-Ing. H. Meier)

We thank our former colleagues for the good cooperation and wish them good luck for their future careers!

Completed Doctorates

Announcements

23rd CIRP International Design Conference
11th-13th March 2013, Ruhr-Universität Bochum
(www.cirpdesign-2013.de)

5th CIRP International Conference on Industrial Product-Service Systems
13th-15th March 2013, Ruhr-Universität Bochum
(www.ips2-2013.de)

6th CIRP IPS² Spring School
21st-24th March 2013, TU Berlin
(www.mms.tu-berlin.de/menue/home/veranstaltungen/ipss_spring_school)