The Future of Production Engineering
WZL in Profile
The board of directors of the Laboratory for Machine Tools and Production Engineering (WZL) of RWTH Aachen University from left to right:

Prof. Dr.-Ing. Thomas Bergs, MBA
Chair of Manufacturing Technology

Prof. Dr.-Ing. Robert H. Schmitt
Chair of Production Metrology and Quality Management

Prof. Dr.-Ing. Dipl.-Wirt. Ing. Günther Schuh
Chair of Production Engineering

Prof. Dr.-Ing. Christian Brecher
Chair of Machine Tools
Editorial

Working Together, We Are Strong
Often, the whole is more than the sum of its parts – as we experience at the Laboratory for Machine Tools and Production Engineering (WZL) of RWTH Aachen University every day: The shared corporate culture of our four chairs combines the experiences, visions and goals to an efficient mixture of university teaching, basic research and practice-oriented development for industry.

You Will Benefit from Our Knowledge
Our scientific and non-scientific employees and student assistants work in project-oriented teams for your tasks. Through flat hierarchies, team spirit and the responsibility of everyone involved for the whole, all employees participate in the elaboration of your topics. They contribute experience, ideas and suggestions, weigh up alternatives and further develop new concepts. In this way, your goals become our goals. We rely on professional competence, the joy of work and the personalities of our employees. They are our crucial advantage in competition and in contact with our customers.

Progress through Technology
We attach particular importance to the constant exchange with industry and the further development of our machinery. In this way, we ensure that you and we are technologically up to date for a decisive advantage in production. Our laboratories and machine halls are equipped with the latest technology.

System Solutions for Production
We combine knowledge and experience in all areas of production technology. Our chairs Production Engineering, Machine Tools, Manufacturing Technology, Production Metrology and Quality Management provide the expertise to offer individual solutions to companies in the manufacturing industry.

We tighten the increasing complexity of your production processes and develop holistic solutions instead of looking at individual tasks in isolation. Cross-disciplinary cooperation enables us to develop new technologies and methods constantly. True to our motto «System Solutions for Production», we develop individual company and technology strategies from different perspectives and convert them into practicable results. In our working groups, we experience this systematic approach particularly clearly: aligned with the needs of selected industries and product areas, we offer bundled competence in almost all areas of production technology.
Our Institute
Modern Production Technology based on Practical Research

The Laboratory for Machine Tools and Production Engineering (WZL) of RWTH Aachen University is a worldwide known synonym for pioneering research in production technology. Led by the four professors Thomas Bergs, Christian Brecher, Robert H. Schmitt and Günther Schuh, a broad range of topics is addressed in six research areas: manufacturing technology, machine tools, production engineering, gear technology, production metrology and quality management. This involves carrying out both, basic research projects as well as research projects tailored to the requirements of industry and developing practical solutions to rationalize production.
From the aim of the WZL, to cover the entire field of production technology in one house, results a broad field of work, which is divided into the following company areas: development and construction, quality management, organization, work preparation, manufacturing and assembly as well as quality control and automation.

More than 850 employees have been demonstrating new concepts and strategies in production technology for over 100 years. They show off their current results and share their experiences at numerous events such as the Aachen Machine Tool Colloquium or contribute their knowledge to collaborations such as the Cluster of Excellence »Internet of Production (IoP)«. Our experts use their expertise to advise on issues in the field of digitalization and net-working in production technology and incorporate trends in the area of Industry 4.0 into their research.

**Aachen Machine Tool Colloquium (AWK)**
For 70 years, the AWK has been the most important knowledge hub for production technology. Current research results and new developments and trends in the field of production technology are being focused at the event that attracts more than 1,000 participants from all over the world every three years.

[www.awk-aachen.com](http://www.awk-aachen.com)

**Cluster of Excellence Internet of Production (IoP)**
The IoP paves the way into a new era of production. As a basis to transfer Aachen’s production technology into the age of the fourth industrial revolution, more than 25 institutes and research facilities, including the WZL, are connected in the IoP to create the next milestone in the foundation of application-oriented and innovative solutions.

[www.iop.rwth-aachen.de](http://www.iop.rwth-aachen.de)

**All Production Areas – One Institute**
The structure of the WZL was designed for handling all tasks that occur in modern production companies within the framework of competent project organization in a single institute. This includes the areas of organization, production management, production technology, means of production, quality management, measuring and assembly technology, except the sale of products.

A detailed overview of the organizational structure can be found on page 16.
Our Tasks

Teaching
As a university institute, WZL’s main task is to provide practice-oriented qualification and teaching of highly qualified young engineers. The results of the research projects findings are directly incorporated into the teaching, which is therefore always up-to-date. As one of the largest European universities, the RWTH offers an excellent environment for comprehensive and interdisciplinary studies.

Research
Research at the WZL is characterized by close cooperation between the various disciplines and a balanced mix of basic research and application-oriented development. In general, the research work and a wide variety of industrial companies perform jointly. This ensures that the research results are quickly transferred into operational practice.

Consulting
Together with industrial partners from various sectors, the WZL develops solutions for a wide range of production issues in publicly funded and bilateral research projects. These activities are consolidated on the RWTH Aachen Campus at the Production Engineering Cluster.

Advanced Training
The WZL promotes the innovative strength and competitiveness of industry with the essence of trend-setting basic research, applied research, and resulting consulting and implementation projects. With more than 7,000 visitor days a year at around 80 seminars, congresses and basic workshops, the WZL has developed into a hub for high-quality industrial exchange.
Our Skills
System Solutions for Production

The structure of the Laboratory for Machine Tools and Production Engineering (WZL) of RWTH Aachen University, with its numerous research groups, reflects the extraordinarily broad spectrum of work. The treatment of the entire field of production technology in one institute results in a broad scope of activities. They are oriented towards the areas of development and construction, quality management, organization, work preparation, manufacturing and assembly as well as quality control and automation. The WZL provides advice on questions and problems in all areas of production technology.
Production Metrology and Quality Management

Led by Prof. Dr.-Ing. Robert H. Schmitt, the Chair of Production Metrology and Quality Management researches and works on the industrialization of operational processes in production engineering. In this field, industrialization means the collection of relevant and objective data as well as their feedback and utilization in the operational context of control loops. The measurement data recorded in networked manufacturing and assembly processes are analyzed and processed in virtual models, while quality management is used to create suitable structures for the targeted use, resulting in the realization of capable processes with predictable results in defined time.
**Model-based Systems**

The support of manufacturing companies in the field of measurement and assembly technology through individual technology development, consulting and research, is one of the main tasks of this department. Thereby, the modeling through valid measurement data acquisition as a pioneer for Industry 4.0 is emphasized. Measurement technology researches the technologies and processes that enable the holistic integration of traceable measurement processes into the manufacturing process. Central research aspects are the modeling of complex manufacturing and measuring processes, the flexibility of the developed sensor technologies and the use of measurement data for process control. Assembly technology deals with the conception, realization and validation of integrated, innovative and metrologically monitored assembly systems as well as the quality assurance of assembly products. The use of intelligent sensor technology can initiate a new way of thinking and new types of assembly processes can be developed with the associated plant technology.

**Organizational Development**

In addition to the technical implementation of socio-technical systems, this department’s work also focuses on improving them. It is done by researching human beings in highly technical systems and by supporting organizational and procedural workflows with smart devices. The department also supports companies with the implementation of planned change initiatives in fields of action.

**Quality Intelligence**

The department Quality Intelligence focuses on the challenges and questions of data- and quality-driven product development in the Internet of Production. In addition, the recording and integration of relevant customer data collected and integrated in order to increase product quality. On the other hand, process-related control loops are modeled in order to make real-time quality forecasts and optimizations.
Production Engineering

The Chair of Production Engineering, led by Prof. Dr.-Ing. Dipl.-Wirt. Ing. Günther Schuh, addresses the issues of product and process planning in manufacturing companies in a special way: Core topics such as integrated product and process design, cooperative value creation, corporate development and Enterprise modeling are included. The chair is also significantly involved in the research activities on Industry 4.0. A particular strength is the close connection between engineering and business administration research.
Factory Planning
The Factory Planning Department researches topics of factory planning, plant structure planning and assembly planning and supports manufacturing companies in achieving their goals within the framework of consulting and planning projects.

Vehicle Production
The mobility shift, disruptive technologies, global production networks and shorter product life cycles present established and new vehicle manufacturers with increasing challenges. Facing these challenges, the Vehicle Production Department of the WZL uses approaches from the research fields of Production Engineering, Artificial Intelligence, and Industry 4.0.

Innovation Management
The department’s focus is on lean innovation to increase the effectiveness and efficiency of R&D. From variant management through modularization to product lifecycle management, a wide range of problems are addressed. In addition, manufacturing companies are supported in their innovation and complexity management.

Production Management
Overarching topics such as Industry 4.0 and Lean Production are involved in the development of solutions to design business processes. They also help to find solutions in the area of global production networks and in production planning and control for manufacturing companies.

Business Development
Various industrial and research projects in the fields of market intelligence, digitalization and toolmaking are the focus of the department’s work. For the manufacturing industry, solutions for the systematic selection of international sales and procurement markets, for the development of industrial applications and for the industrialization of tool manufacturing companies are developed.
The Chair of Manufacturing Technology, led by Prof. Dr.-Ing. Thomas Bergs, MBA, carries out research and teaching in the fields of fundamentals of manufacturing processes, investigations of manufacturing processes, gear technology, process monitoring and simulation as well as technology planning. Existing knowledge on the optimal use of production technologies is continuously questioned and deepened and new research approaches are developed. The chair also carries out publicly funded projects and projects planned with companies in direct cooperation or in the form of technology working groups. In this way, research results can be transferred to current problems in industrial manufacturing environments. For this purpose, the chair has access to an extensive, ultra-modern machine park, among other things at the Production Engineering Cluster.
EDM/ECM Processes
Research is carried out in the fields of spark erosion and electrochemical ablation: EDM (Electro Discharge Machining) and ECM (Electrochemical Machining) are key technologies when it comes to machining difficult-to-machine or high hardness, electrically conductive, metallic materials.

Digital Transformation
In the department of Digital Transformation, acquisition, modeling and exploitation strategies for manufacturing data and digital twins are developed and made usable in an industrial context.

Technology Planning and Grinding
The Technology Planning and Grinding Department combines the finishing of functional surfaces by grinding as well as the identification of optimal technology chains from the blank to the finished part.

Forming Technologies
With a focus on plasto-mechanics and tribological boundary conditions, the department investigates forming manufacturing processes supported by extensive process simulations (FEM) and industry-oriented experiments.

Cutting Technology
Cutting manufacturing processes with geometrically defined cutting edges form a large part of the department’s activities. In addition, basic research is performed on new and further developed materials for industrial use.

Gear Technology
The research area Gear Technology combines the fields of Machine Tools and Manufacturing Technology. Gear manufacturing and inspection as well as the simulation of gear drives and manufacturing processes are at the center of this research area, which is unique in Europe and offers comprehensive research and industrial solutions.
For decades, the Chair of Machine Tools, led by Prof. Dr.-Ing. Christian Brecher, has guaranteed successful, forward-looking research and innovation in the field of production technology worldwide. Four research areas focus on machine technology, automation technology, machine data analysis and gear technology. The aim is application-oriented research while considering the needs of manufacturers and users.
Automation and Control
Issues relating to digitization are addressed by the Automation and Control Department. The research aim, which is closely oriented to industrial needs, is to validate the results on real plants. The research work includes robotics, the design and realization of innovative MMI interfaces as well as system engineering approaches.

Machine Data Analytics and NC-Technology
Competences from the drive technology and CAD-CAM-NC chain are combined with the modeling of production plants in this department. The aim is the interdisciplinary development of concepts and solutions for the traceability and analysis of machine data in order to enable model-based optimization of machine components and production processes. The further development of the CAD-CAM-NC chain, the data analysis and evaluation of manufacturing processes, the design of the drive trains and the associated control system, the evaluation of measures for energy efficiency, and the FEM simulation of machine components are crucial.

Machine Technology
Machine Technology deals with the calculation and optimization of the static, dynamic and thermal behavior of machine tools, handling systems and their components. A further focus is on the metrological investigation and evaluation of machine tools.

Gear Technology
The research area Gear Technology combines the fields of Machine Tools and Manufacturing Technology. Gear manufacturing and inspection as well as the simulation of gear drives and manufacturing processes are at the center of this research area, which is unique in Europe and offers comprehensive research and industrial solutions.
Four Locations – One Mission
The Future of Production Engineering

Production Engineering Cluster on the RWTH Aachen Campus
Campus-Boulevard 30 | 52074 Aachen
The WZL is the initiator of the Production Engineering Cluster on the RWTH Aachen Campus. With its research focus on digitally integrated production, it aims to become one of the largest research laboratories in Europe for production technology and Industry 4.0. Business and science will experimentally open up the possibilities for product development processes linked to the Internet of Things (IoT) and cyber physically integrated production.
Manfred-Weck-Haus
Steinbachstraße 19 | 52074 Aachen
With 4000 m² net floor space and an equipment of more than 100 machines and test stands – with laboratories such as metallography and measuring room, several workshops as well as computer equipment always kept up to date – the Manfred-Weck-Haus provides us with the best conditions to work on complex production technology tasks in-house.

Explore and create the future of production together with us! We look forward to your visit and would be pleased to welcome you at the WZL!

Bogenhalle
Metzgerstraße 10 | 52070 Aachen
On 556 m² of total floor space, conference rooms and communication areas allow an intensive exchange of ideas on upcoming research projects and projects. In addition to the office space, the Bogenhalle also houses test stands focusing on the topics of perceived quality, social media, product value management and Industry 4.0.

Rotter Bruch
Rotter Bruch 10 & 12 | 52068 Aachen
On a total area of 1600 m² – divided into two halls of 1090 m² and 510 m² – the Rotter Bruch is home to a research center and training company at the same time: The areas of forming and cutting technology as well as the mechanical workshop and the training workshop are located here.
# Organizational Structure of the WZL

| Board of Directors | Prof. Robert H. Schmitt  
| | Prof. Günther Schuh  
| | Prof. Thomas Bergs  
| | Prof. Christian Brecher  |
| Managing Director | Prof. Dr.-Ing. Thomas Bergs, MBA  |
| Chair of Production Metrology and Quality Management | Prof. Dr.-Ing. Robert H. Schmitt  
| | · Model-based Systems  
| | · Organizational Development  
| | · Quality Intelligence  |
| Chair of Production Engineering | Prof. Dr.-Ing. Dipl.-Wirt. Ing. Günther Schuh  
| | · Factory Planning  
| | · Vehicle Production  
| | · Innovation Management  
| | · Production Management  
| | · Business Development  |
| Chair of Manufacturing Technology | Prof. Dr.-Ing. Thomas Bergs, MBA  
| | · EDM/ECM Processes  
| | · Digital Transformation  
| | · Technology Planning and Grinding  
| | · Forming Technologies  
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| | · Machine Data Analytics an NC-Technology  
| | · Machine Technology  
| | · Gear Technology  |

| Services | · Library  
| | · CNC Competence Center  
| | · EDP/Documentary  
| | · Electrical Workshop  
| | · Electronics Workshop  
| | · Finances  
| | · Training Workshop  
| | · Mechanical Workshop  
| | · Measurement Hall  
| | · Metallography  
| | · Press & Media  |

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The Laboratory for Machine Tools and Production Engineering (WZL) of RWTH Aachen University has chosen an environmentally friendly and climate-neutral print on 100% sustainable paper for this product.
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