Excellent Further Education
for Professionals and Companies
Dear Ladies and Gentlemen,

as the official training provider of RWTH Aachen University, we are constantly striving to bring innovative research content closer to industry, form networks and grow with our customers. For three years now, we have been offering our part-time certificate courses and customized programs. On the following pages you will discover our wide range of courses, learn how we can help you to increase your competitiveness through continuing education and what an RWTH Executive Certificate is all about.

We will briefly review the past years with you. With more course participants than ever before, we are very proud that our programs have generated a consistently positive response in the market. The area of our customized courses, as well as international cooperation is also growing steadily and once again confirms the trend: sustainable training strategies are important for the success of your company. Returning customers, satisfied participants and committed lecturers allow us to start the next year with a feeling of strong motivation.

The forthcoming year will be marked by a growing course portfolio, which, in addition to production technology, quality management and engineering courses, now also includes an extensive range of new workshops in the field of robotics. In addition, topics such as biolubricants or the latest developments in design methodology will be offered for the first time from 2020.

If you have any further requests, please do not hesitate to contact us.

We look forward to welcome you at RWTH International Academy!

Yours

Dr. Helmut Dinger
Managing Director
RWTH International Academy

Preface
The In-service Training Courses Offered by the RWTH International Academy in 2020
### PRODUCTION TECHNOLOGY

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The RWTH International Academy

The RWTH International Academy is the official continuing education provider of RWTH Aachen University and serves three different learning groups with different programme types: Young Professionals, Mid Career and Senior Career.

In cooperation with the institutes, researchers and experts of RWTH Aachen University, the training programmes are developed for specific target groups and offered in a customer-oriented manner. All educational formats make use of innovative topics as well as new types of programme and teaching structures. The focus here is always on continuously increasing the academic value of the educational offers available. Therefore, all courses are accredited and certified for quality assurance purposes. They are 3-fold certified according to ISO 9001:2008, the international standard DIN ISO 29990. The certificate is certified by TÜV SÜD and according to AZAV - approval of institutions and measures of employment promotion according to SGB III.

In the area of Senior Career, working specialists and managers are trained in short learning units on subject-specific topics. Whether it’s a brush up on previously acquired content, a reorientation of personal skills or a company-driven further training measure - the certificate courses, seminars and workshops offered by the RWTH International Academy enable professionals to use new knowledge to realize their goals and develop methods and applications that shape the future.

www.academy.rwth-aachen.de/en

The RWTH Aachen

The Elite University RWTH Aachen with its more than 260 institutes is one of the leading scientific and research institutions in Europe. The University of Excellence has long been synonymous with an internationally recognized hotspot where innovative answers to global challenges are developed.

The RWTH Aachen University also offers tailored in-service training formats dedicated to research and practical application which find resonance in business and industrial practice. Specialist knowledge from the entire range of topics and qualifications at the university can thus be taught in application-oriented learning units tailored to the needs of industry and business. RWTH Aachen University is an innovation site where numerous developments are patented and exploited. Its unbeatable research network helps to devise market-driven solutions.

It is indispensable to integrate the practical application directly into the learning process. In addition to the methodical input of the individual lectures, the laboratories of the university offer the unique opportunity to apply the newly acquired knowledge directly and under expert supervision. Participants can use test benches, machines and systems in a protected area in order to find out what it means to implement new approaches of automated production technology in the company. Individual support in small groups also makes it possible to respond quickly to special demands. These practical insights and experiences increase the learning success and can be easily transferred into the daily routine of the company.

www.rwth-aachen.de
What are the implications of Industry 4.0 for me and my company? Is there a way to both optimize and automate my processes? Exactly which technological fundamentals are required for digital transformation?

The RWTH Aachen University has devoted considerable attention to this topic in recent years. The factory of the future is being conceived and implemented at numerous institutes. After all, the advancing digitalization and the widespread networking of devices and systems open up completely new possibilities for companies.

In order to successfully implement Industry 4.0 in existing production environments, the work and competence profiles of employees must be continuously expanded both on a specialist and management level. They must be empowered and motivated to understand cyber-physical systems and intelligent robotics, to recognize their benefits and to integrate these profitably into everyday working life.

In practical learning units, they develop company-specific solutions, expand special knowledge for complex problem solutions, learn to recognize unconventional interrelationships and make decisions beyond the norm. Participants apply their newly acquired knowledge directly in the university’s laboratories and use it profitably in their day-to-day work.

As the official training provider of RWTH Aachen University, the International Academy offers various training formats in the categories of Technology & Innovation Management, Automation & Control Technology, Digitisation, Industrial Data Processing and Production Networking in order to bring today’s research into tomorrow’s companies.
Chief Technology Manager: Course Schedule (subject to change)

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<td>Technology Scouting and Monitoring</td>
<td>Integrated Technology Planning I</td>
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| Wednesday | Thursday | Friday |
| Interaction of Innovation & Technology Management | Development of a Technology Strategy I & II | Integrated Technology Planning II |
| Understanding Your Own Business Model | Agile Technology Development | Awarding of Certificates |

| Social Event | Social Event |

Chief Technology Manager

Successfully Designing Strategic Technology and Innovation Management

Identify successful approaches to technology and innovation management for the effective identification, evaluation and development of new technologies. On this basis, design a consistent strategy and derive your future fields of action. Test the knowledge gained in practical exercises to develop innovative business models for your individual market success on this basis.

In Focus
- Field-tested methods for the systematic design of a strategic technology and innovation management
- Interfaces to business model innovations and agile technology development
- Solidification of newly-acquired knowledge in practical exercises on the basis of a continuous case study
- Best practices from industrial practice

Building and maintaining a successful market position entails selecting the right technologies. Ever shorter technology and product life cycles, increasing global competition and increasing individualization of products require companies to understand or anticipate the needs of their customers. Well-conceived technology management is therefore no longer a luxury, but a must!

You are a specialist or executive in a technology-oriented company, particularly in the fields of research and development, technology and innovation management, new business development and strategy, production and technical purchasing and management.
Digitization for Industry 4.0: Course Schedule (subject to change)

Day 1                               Day 2                               Day 3

- Communication for Industry 4.0
- Communication in industrial networks – From Bits to the exchange of information

- The Internet of Things and Basics of Communication in Distributed Networks
- The Industrial Internet of Things (IIoT) for modern production systems

- Information integration in modern factories using OPC Unified Architecture
- Information Modeling of heterogeneous Automation Systems based on OPC UA

Lunch

- Networking in traditional Automation Systems and Brown Fields, Programmable Logic Controller Programming
- Communication in Modern Automation Systems with Publish Subscribe – DDS/MQTT

- Modeling of Complex Automation Systems with Topic-based approaches
- Development of a Smart Factory Dashboard based on distributed information source and MQTT

- Using distributed information sources to enable Data Analytics in production
- Advanced Analytics use-case: The Knowledge Discovery in Databases (KDD) process

Networking-Tip: Social Event

Digitization for Industry 4.0
Transforming Machine-to-Machine Communication Into a Networked Factory

Develop an understanding for the challenges of heterogeneous production environments and discover basic technologies for digital networking. In addition, you will acquire the basics of information modeling and will be able to apply them in production using interface technologies.

In Focus
- Communication for the Internet of Things
- Interface standards for machine-to-machine communication
- Information modeling and information management in production networks
- Case study: Integration of Data and Real-Time Optimization

Networked production creates interoperability between formerly proprietary encapsulated systems. By means of continuous communication between the components of a production network, intelligent, self-learning and self-regulating systems are created that autonomously optimize themselves based on current sensor technology. By efficiently processing and analyzing data, companies can react to changing conditions almost in real time and adaptively re-adjust their production processes.

You are an engineer from the fields of mechanical and/or electrical engineering with basic knowledge of communication in computer networks.
### Data Scientist: Course Schedule (subject to change)

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<td>Data Acquisition and Storage</td>
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<td>Reinforcement Learning and artificial Neural Networks</td>
<td>Presentation of the Results Building a Solution for the Use Case</td>
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<td>Real-world Data from CPS and industrial Robots</td>
<td>Introduction to heuristics and rule-based Programming</td>
<td>Introduction to Artificial Intelligence and Machine Learning</td>
<td>Introduction to Use Case Scenario</td>
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<tr>
<td>Lunch</td>
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<tr>
<td>Pre-processing of Data (e.g. dimensionality reduction)</td>
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<td>Coping with real world Data in CPS and robotic Environments</td>
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<td>Processing Information from Production</td>
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<tr>
<td>Introduction to Expert Systems and Business Intelligence (BS)</td>
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<tr>
<td>Data Mining and Knowledge Discovery in Databases (KDD)</td>
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<td>Supervised Learning</td>
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<td>Building a first Solution for the Use Case</td>
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<tr>
<td>Unsupervised Learning</td>
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<td>Development of solutions and prediction model</td>
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<tr>
<td>Lunch</td>
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<tr>
<td>Introduction to Expert Systems and Business Intelligence (BS)</td>
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<tr>
<td>Data Mining and Knowledge Discovery in Databases (KDD)</td>
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<td>Unsupervised Learning</td>
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<tr>
<td>Lunch</td>
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**In Focus**
- Preprocessing and providing data for analysis
- Data Mining & Knowledge Discovery in Databases
- Artificial Intelligence and Deep Learning
- Machine learning with data from industrial practice
- Case Study: Optimizing Industrial Applications with Machine Learning

**In the context of industrial manufacturing**, continuous improvement of running processes is increasingly important, e.g. for predictive maintenance of machines or sustainable improvement of production processes.

**You are** an engineer, decision-maker or head of department from the fields of production, manufacturing technology, automation, process technology, maintenance and quality management. The course particularly appeals to executives and (middle) management to acquire a basic understanding of terms such as „digital transformation“, „machine learning“ and „Industrial Big Data“.

### Data Scientist

**Sustainable Implementation of Machine Learning in Production**

**Discover what** Data Science is all about. You will learn basic methods of preprocessing data and will be able to evaluate them using artificial intelligence approaches. You will develop an understanding for the application of machine learning and master practical applications in production successfully.

**In Focus**
- Preprocessing and providing data for analysis
- Data Mining & Knowledge Discovery in Databases
- Artificial Intelligence and Deep Learning
- Machine learning with data from industrial practice
- Case Study: Optimizing Industrial Applications with Machine Learning

**Contact:** further-education@academy.rwth-aachen.de | +49 241 8097865
Big Data in Production
Successfully Mastering Large Data Volumes

Experience the difference between „Big Data“ and „Industrial Big Data“ in the production context. You will gain insight into the integration tools and structures required for highly distributed data analysis. In addition, you will learn the basic structures of Big Data ecosystems and Big Data in the cloud.

In Focus
- Data integration, analysis, and data mining: Big Data and machine learning
- Big Data ecosystems: from isolated solution to Industrial Data Lake
- Integration of heterogeneous source systems of industrial data
- Data-driven procedures and machine learning

Data is the oil of the 21st century, and data analysis is the engine! Despite the multi-faceted collection of production data, the targeted usage of these data is often lacking since data integration and comparative observation are often fraught with difficulties. With the correct analysis, however, data reveal hidden patterns and connections assisting in process optimization and continuous improvement.

You are an engineer from the fields of mechanical and/or electrical engineering with a basic understanding of data concepts.
Industry 4.0 for Management: Course Schedule (subject to change)

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<td>• The Internet of Things in production</td>
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<tr>
<td>• Cyber-Physical Systems (CPS) and Digital Twins</td>
<td>• Lightweight Networking Strategies for the Internet of Production</td>
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<tr>
<td>Lunch</td>
<td>Models for digital networking in companies</td>
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<tr>
<td>• Interoperability and Communication in the Factory of the Future</td>
<td>• Scalable information integration based on generic tool chains</td>
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<tr>
<td>• Generic interfaces and interoperability</td>
<td>In Focus</td>
</tr>
<tr>
<td></td>
<td>• Communication in modern production facilities</td>
</tr>
<tr>
<td></td>
<td>• Data-driven process optimization using interoperability and machine learning</td>
</tr>
<tr>
<td></td>
<td>• Overview of the technologies of Industry 4.0 and its practical applications</td>
</tr>
<tr>
<td></td>
<td>• Reference Architectures and Standards in Industry 4.0</td>
</tr>
</tbody>
</table>

Discover the technologies behind terms such as Industry 4.0, Digital Shadow or Reference Architecture RAMI4.0. You will be able to navigate safely through the conceptual worlds of digital transformation. You are aware of the central challenges associated with establishing cyber-physical systems and a digital twin in production.

In Focus

The keyword Industry 4.0 describes a collection of technologies leading the way to the factory of the future. In order to understand, classify and successfully apply the theoretical foundation, i.e. the technological foundations for digital transformation, a fundamentally new understanding is required.

You are an engineer from the fields of mechanical and electrical engineering and are familiar with the basics of production engineering.
Robot Operating System (ROS): Course Schedule (subject to change)

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<td>• Why ROS?</td>
<td>• ROS basics - action services</td>
<td>• Gazebo basics – models, worlds</td>
<td>• ROS theory – sensor drivers</td>
<td>• ROS theory – localisation</td>
</tr>
<tr>
<td>• Demonstration of our ROS based systems</td>
<td>• Practical session ROS</td>
<td>• Practical session Gazebo</td>
<td>• Practical session</td>
<td>• ROS theory – localisation and mapping</td>
</tr>
<tr>
<td>• Linux + ROS Filesystem</td>
<td>• ROS basics – logging</td>
<td>• Gazebo with ROS – URDF</td>
<td>• ROS theory – hardware drivers</td>
<td>• ROS theory – motion planning</td>
</tr>
<tr>
<td>• ROS basics – debugging</td>
<td>• Practical session – URDF</td>
<td>• Gazebo with ROS – connect ROS and Gazebo</td>
<td>• Practical session</td>
<td>• Q&amp;A</td>
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<tr>
<td>• Practical session ROS</td>
<td>• Exam</td>
<td></td>
<td></td>
<td>• Awarding of Certificates</td>
</tr>
</tbody>
</table>

Lunch

• ROS basics – packages, nodes, topics
• ROS basics – publishing, subscribing, services

Networking-Tip: Social Event

Robot Operating System (ROS)

Fundamentals of Industrial Robot Navigation

Learn the basics of robot motion and the Robot Operating System (ROS). Based on fundamental communication concepts with robots, you will understand how they can be localized and navigated autonomously in a logistics scenario.

In Focus
- Localization, mapping and motion planning with ROS
- Integration of ROS into industrial application fields
- Application of local and global path planning and collision avoidance
- Utilization in flexible material flow systems with the Robot Operating System (ROS)
- Environmental perception of mobile robotic systems with various sensor technologies

The Robot Operating System (ROS) has gained considerable influence in research and product development. It contains many open source implementations of common robotic functionalities and algorithms in areas such as perception, knowledge representation, planning and control. With applications ranging from mobile and stationary robotics to underwater robotics and flying drones, there are virtually no limits to the software’s range of applications.

You are an engineer and/or computer scientist from the fields of mechanical engineering, electrical engineering and computer science.
Mobile Robotic Systems in Intralogistics: Course Schedule (subject to change)

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<td>Theory &amp; Practical</td>
<td>Theory &amp; Practical</td>
<td>Theory &amp; Practical</td>
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<td>Linux</td>
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<td>Introduction to</td>
<td>Applying local path</td>
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Mobile Robotic Systems in Intralogistics

Architecture and Implementation

Learn how to control mobile robotics systems in the intralogistic environment. You will work directly with the software architecture allowing robots to freely navigate a room and to autonomously execute material flow tasks. You will also get to know the open source project Robot Operating System (ROS).

In Focus

- Hardware and software concepts of mobile robotics including planning of movement
- Application of local and global path planning and collision avoidance
- Application in flexible material flow systems with the Robot Operating System (ROS)
- Environmental perception of mobile robotics systems with various sensor technologies

The increasing variety and short-lived nature of products are two key drivers of using flexible material flow systems in the production area. Aside from fixed transport systems, the past ten years have seen ever more automated guided vehicles (AGV) come into use. Further development towards autonomous mobile robotics systems thus allows free and autonomous decision-making.

You are an engineer or computer scientist from the areas of mechanical engineering, electrical engineering, and computer science with programming knowledge in C++ and Python.

Certificate Facts

- Dates available upon request
- 5 days of attendance
- Prices available upon request
- German
- 2 ECTS (50 h. Workload)
- RWTH Executive Certificate

Registration

www.academy.rwth-aachen.de/en/mobile-robotic-systems

Course Leader

Dr. Pia Benmoussa
Smart Engineering for Smart Factories

Successfully Using the Digital Value Chain

Become acquainted with the potentials of „Front Loading“ in addition to classic topics of Product Lifecycle Management (PLM). Learn the basics of digitized production and focus on the integration of modern information technologies into technical processes. You will be able to successfully implement (engineering) technical approaches and concepts independently.

In Focus
- Machine-2-Machine-Communication / Human-Machine-Interfaces
- Key Performance Indicators (KPI) and Dashboards for Information Visualization
- Enterprise Resource Planning (ERP) and Manufacturing Execution System (MES) for industrial robotics
- Workshop: Integrated, collaborative robots and PLM-based Robot Assembly
- Case Study: Optimization of an industry 4.0 production site

The Smart Factory connects and automates machines and systems in order to synchronize work steps autonomously. Product families with many variants and ever shorter product life cycles require a shift of effort into engineering science development (“front loading”). New product variants can be efficiently produced by means of a continuously available digital planning chain.

You are an engineer in the fields of mechanical and/or electrical engineering.

Smart Engineering for Smart Factories: Course Schedule (subject to change)

<table>
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<th>Monday</th>
<th>Tuesday</th>
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<tbody>
<tr>
<td>Introduction to Industry 4.0</td>
<td>PLM-based Robot Assembly</td>
<td>Challenge of Consistent Information Flows</td>
<td>Introduction to Communication Networks in</td>
<td>Enterprise Resource Planning (ERP) and</td>
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<tr>
<td>Enabling Technologies for Industry 4.0</td>
<td>New Control Paradigms for Future Production</td>
<td>From Engineering to Production</td>
<td>Modern Production Systems</td>
<td>Manufacturing Execution System (MES)</td>
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<td>Systems</td>
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<td>Software Architectures and Development</td>
<td>Machine-2-Machine Communication</td>
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<td>Data Modeling and Database Systems</td>
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</table>

Lunch

- Introduction to Product Lifecycle Management (PLM)
- Integrated, Collaborative Robotics
- Lab Tour: Smart Automation Lab
- Case Study: Industry 4.0 Optimization of Exemplary Production Site
- Data Analytics for Industrial Production and Modern Manufacturing
- Innovative Human-Machine-Interfaces
- From Intra-Device to Inter-Machine Communication Using DDS
- Modern Robotics Using Microservices in ROS
- Final Discussion
- Exam and Awarding of Certificates

Networking-Tip: Social Event

Course Characteristics

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## Automation: Course Schedule (subject to change)

<table>
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<tr>
<th>Day 1</th>
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<tbody>
<tr>
<td><strong>Welcome and introduction to WZL</strong>&lt;br&gt;Introduction to industrial automation&lt;br&gt;Fields of application&lt;br&gt;Heterogeneous control architectures&lt;br&gt;Industry 4.0&lt;br&gt;Enabling Technologies for Industry 4.0&lt;br&gt;Methodology and functioning&lt;br&gt;Practical application&lt;br&gt;Lunch</td>
<td><strong>PLM-based robotic applications</strong>&lt;br&gt;New control paradigms for future production plants&lt;br&gt;Integrated Engineering&lt;br&gt;Product Lifecycle Management (PLM)&lt;br&gt;Simulation of mechatronic systems&lt;br&gt;Practical application&lt;br&gt;Industrial and collaborative robotics&lt;br&gt;Basics and technology overview&lt;br&gt;Application examples&lt;br&gt;Lab-Tour through the Smart Automation Lab&lt;br&gt;Innovative technologies for human-technology interaction on the shop floor&lt;br&gt;Practical exercise</td>
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## Automation

**Introduction to Modern Automation Solutions for Machines and Plants**

**Experience** current and future trends in automated production and learn the basics of all levels of automation technology. You will be introduced to applied technologies as well as their functionality, requirements and framework conditions in the planning and implementation of automated systems.

**In Focus**
- Basics of model-based applications in automation
- Application examples and theoretical foundation of industrial robotics
- Practice example: application of new control paradigms
- Lab visit: Smart Automation Lab

**Automated production** today represents an important branch of the German mechanical and plant engineering industry. Product-centered control, CPS, networking of virtual and real worlds, individualized production and human-robot cooperation open up numerous potentials: from increasing efficiency to the basis for new business models.

**You are** an executive or a decision-maker in the areas of manufacturing and production.

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**Course Characteristics**

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**WHERE?** RWTH Aachen University

**WWW** [academy.rwth-aachen.de/en/automation](http://academy.rwth-aachen.de/en/automation)

**Contact** further-education@academy.rwth-aachen.de | +49 241 8097865

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**In Focus**
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**You are** an executive or a decision-maker in the areas of manufacturing and production.
Smart Automation Expert

Practical Approaches to Modern Automated Solutions for Machines and Plants

Use practical examples and your own implementation of a robot-supported application to familiarize yourself with the ideas and concepts of the networked factory. You will gain a fundamental understanding of current topics, changes and trends in production automation.

In Focus
- Intelligent control and information supply in automation
- Fields of application and theoretical basics of industrial robotics
- Practical example: Application of new control paradigms
- Visit of the Smart Automation Lab

Automated production today represents an important branch of the German mechanical and plant engineering industry. Product-centered control, CPS, networking of virtual and real worlds, individualized production and human-robot cooperation open up numerous potentials from increasing efficiency to the basis for new business models.

You are a specialist or manager in the fields of manufacturing, production or mechanical engineering.

Quick Facts
- Certificate Course
  - Dates available upon request
  - 5 days of attendance
  - Prices available upon request
  - German or English
  - 2 ECTS (50 h. workload)
  - RWTH Executive Certificate

Registration
www.academy.rwth-aachen.de/en/smart-automation-expert

Scientific Lead
Prof. Christian Brecher

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**Course Characteristics**

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**Smart Automation Expert: Course Schedule (subject to change)**

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<th>Monday</th>
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<tbody>
<tr>
<td>History of Industry 4.0 and current developments in production technology</td>
<td>Challenges of a Data-Continuous Automation Pyramid, Potentials and Challenges of Cloud Computing</td>
<td>Internet of Production for robot-based systems</td>
<td>Processing the application task I</td>
<td>Processing the application task III</td>
</tr>
<tr>
<td>Integrative production technology</td>
<td>Linking of production plants</td>
<td>Assembly Robotics and Smart Automation</td>
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</table>

**Lunch**
- Flexibilisation of production facilities
- Enabling Technologies for 4.0 – OPC UA, Funk, etc.
- Lab-Tour through the Smart Automation Lab Case-Study
- Introduction to the practical application task
- Processing the application task
- Presentation of the results
- Expert panel
- Awarding of Certificates

**Network Tip: Social Event**
### Digital Solutions in Production: Course Schedule (subject to change)

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
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<tbody>
<tr>
<td>- Basic training in Industry 4.0</td>
<td>- Data-based Value stream mapping</td>
</tr>
<tr>
<td>- Digital Waste Walk (Lab-Tour Lean Production)</td>
<td>- Data processing and programmable logic controller</td>
</tr>
<tr>
<td><strong>Lunch</strong></td>
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<tr>
<td>- Elaboration of solution approaches</td>
<td>- Digital business models in practice</td>
</tr>
<tr>
<td>- Economic advantages</td>
<td>- Transfer knowledge to own companies</td>
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<tr>
<td>- Digital application in production</td>
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### Course Characteristics

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### In Focus

- Application and elaboration of digital solutions
- Uncovering waste in production and generating Industry 4.0-based solutions
- Practical visualization via individual application
- Interactive exchange and lab tour in small groups

### Reveal

-waste and inefficient processes in various areas of production and learn about the importance of Industry 4.0. You will acquire the ability to identify procedural weaknesses and generate digital applications and proposed solutions along the value chain.

### Industry 4.0

- is considered a tremendous opportunity to strengthen competitiveness. Optimizing and automating processes, networking systems and implementing new technologies pose new challenges for companies. Digital transformation makes it possible to increase productivity, reduce the need for servicing and maintenance costs and reduce the time-to-market.

### You are

-an engineer, technician, manager and/or executive from the fields of mechanical engineering, manufacturing, electrical engineering, IT, digitisation, HR, operational and strategic management.

### Free Fact

- Dates available upon request
- 2 days of attendance
- Prices available upon request
- German or English
- Certificate of Attendance

**Registration**


**Scientific Lead**

Prof. Thomas Gries

**McKinsey & Company**
### Course Schedule (subject to change)

<table>
<thead>
<tr>
<th>Day 1</th>
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<tbody>
<tr>
<td>* Introduction and Advantages of AR/VR</td>
<td>* Creation of a 3D Augmented Reality Assistance System for Maintenance Work in Production</td>
</tr>
<tr>
<td>* Theoretical and practical Requirements</td>
<td>* Positioning 3D Models in the real World</td>
</tr>
<tr>
<td>* Demonstration of AR/VR Solutions in the Model Factory</td>
<td>* Display of Sensor Data with simple Dependencies</td>
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<tr>
<td>* Simplified editing, fine-tuning and Publishing of AR</td>
<td>* Releasing of Methods such as ordering Processes in Source Systems</td>
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<td>Content in a user-friendly web-based Environment</td>
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<tr>
<td><strong>Lunch</strong></td>
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<tr>
<td>* Creation of an AR-based Assistance System for Employees in Production with Vuforia Expert Capture</td>
<td>* Displaying Animations from expert Systems (Creo Illustrate)</td>
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<tr>
<td>* Gathering of Expertise for the Creation of Step-by-step Instructions for practical Training and task Management</td>
<td>* Creation and Release of Animations via Java-Script</td>
</tr>
<tr>
<td>* Programming, optimization, and Management</td>
<td>* Manipulation of the Models via TML/JS</td>
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<td>* Competency in methodology</td>
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#### Experience

Create AR/VR Applications for Your Company

- **Experience** the difference between augmented and virtual reality applications and learn more about the different application areas. Whether for learning platforms or for maintenance work in production: By programming augmented reality applications using CAD models, you will learn how to use these technologies independently.

#### In Focus

- Augmented and virtual reality in the production context
- Insight into different augmented reality assistance systems in production
- Lab tour in a model factory 4.0
- Programming AR and VR applications

#### Augmented and virtual reality

Applications are crucial in the advancing digitalization of companies in order to realistically depict production processes and products. The use of these technologies in production can lead to increases in efficiency and productivity. They serve to reduce machine downtimes and thus render remote maintenance systems obsolete.

#### You are

an engineer, technician, manager in the fields of mechanical engineering, manufacturing, production and communication.

### Quick Facts

- **Seminar**
  - Dates available upon request
  - 2 days of attendance
  - Prices available upon request
  - German or English
  - Certificate of Attendance

- **Registration**

- **Scientific Lead**
  - Prof. Thomas Gries

- **Digital Capability Center Aachen**

- **McKinsey & Company**
From Sensor to App: Course Schedule (subject to change)

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
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<tbody>
<tr>
<td>• Introduction of Production Data Acquisition Systems in the ongoing Operation</td>
<td>• Reference Architecture Theory for Industry 4.0 Landscapes</td>
</tr>
<tr>
<td>• Introduction to Sensor Technology, Measurement Technology, Data Processing</td>
<td>• Theory about the predictive Power of current Processes based on real-time Data</td>
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<tr>
<td>• Practical Inspection of the Machinery, Introduction into the Software and Hardware used</td>
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Lunch

• Commissioning of sample Sensor Systems and Extraction of the Data with a Measuring System
• Introduction to PTC Thingworx for Data Acquisition and Visualization of Data on the Dashboard in the Model Factory
• Theory for Evaluating the Industry 4.0 Maturity level of your Company with Focus on the Technical Realization
• Commissioning of sample Sensor Systems and Extraction of the Data with a Measuring System
• Creation of an Operating Data Acquisition System and Dashboards with PTC ThingWorx

Learn the basics of sensor technology, control technology, data processing and visualization and use them on real machines. You will be enabled to independently generate production data acquisition systems during operation in order to increase the efficiency of your processes. You develop your own app to visualize real-time machine data.

In Focus

• Individual visualizations for your own company
• Various possibilities of further processing of data
• Practical work on sensors and machines in a model factory
• Extracting and evaluating data

In the field of Industry 4.0, data play a key role. Merely collecting large amounts of data on the road to digital transformation is hardly efficient since a suitable cross-company strategy for the further processing of the data is rarely in place. Generating economic usefulness from typical Industry 4.0 technologies therefore is only possible as part of a suitable, company-specific strategy of data processing.

You are a manager, engineer, technician, electrician, IT employee from the fields of mechanical engineering, electrical engineering, production/ manufacturing.
**Course Schedule (subject to change)**

**Monday**
- Innovation workshop part 1: Application of programming tools for 5G, artificial intelligence, networking and sensors
- Practice of algorithmic thinking
- Interaction of distributed 5G systems through blueprints and their technical implementation

**Tuesday**
- Introduction to mobile radio systems
- Overview of the mobile radio generations 1G-5G
- Technologies of 5G: new radio multiplex technologies, use of spectrum and energy saving mechanisms

**Wednesday**
- Introduction to modern communication technology
- Guidelines and requirements

**Thursday**
- Algorithmic artificial intelligence
- Modeling technical problems as optimisation problems
- Presentation of the most important optimisation problem classes
- Basic algorithms for the efficient solution of 5G optimisation problems
- Machine learning as an optimisation problem

**Friday**
- Basics of the Internet of Things
- Machine-to-Machine communication
- Social and economic significance

**Lunch**
- Innovation workshop part 2: use of a newly developed IoT-board within a team
- Rapid prototyping and design thinking

**Networking Tip: Social Event**

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**5G Communication and the Internet of Things**

**Real Time Capability and High Data Rates - LTE as a Pioneer**

Acquire the principles and technologies of future 5G wireless communication systems. In the areas of system design, communication technology, optimization of LTE systems, RF systems and IoT platform, you will be introduced to methods and tools to create the basis for new products and to succeed in the market.

**In Focus**
- Holistic concept: from system design over the basics of signal processing to the platform
- Optimization and machine learning in 5G LTE
- Practical planning game as part of an innovation workshop
- Graphical development environment for IoT platforms

5G has the potential to support key industries such as healthcare, transportation, revolutionizes infrastructure, media and production. This entails important tasks and big challenges: extremely low latency times of 1 millisecond, 100 times higher data rates than today’s networks, 100 billion end devices worldwide and low power consumption. The Internet of Things and intelligent networking are important components of 5G. Methods and approaches of this technology open up many new opportunities for small and medium-sized enterprises.

You are an engineer and/or manager with a technical degree in electrical engineering, manufacturing or mechanical engineering.

---

**Quick Facts**
- Certificate Course
  - Dates available upon request
  - 5 days of attendance
  - Prices available upon request
  - German
  - 2 ECTS (50 h. Workload)
  - RWTH Executive Certificate

**Registration**
www.academy.rwth-aachen.de/en/5G-communication

**Scientific Lead**
Prof. Anke Schmeink
Intelligent machines constantly permeate every aspect of professional and private life. Experts anticipate an exponential increase in the influence of such machines on everyday life in the coming years. The extent of the impact will strongly influence the way organisations and individuals do their daily work. While robotic automation is increasingly finding its way into large, modern production facilities, small and medium-sized enterprises are in particular need of the right strategies to exploit the advantages of machine intelligence and automation and integrate them into existing processes.

Competences for robotics beginners, technical experts as well as executives are trained with seminars such as Roadmap2Automation, introduction to sensor technology up to Smart Cognition. The focus lies always on the individual plans and motivations of the course participants, enabling competencies to be maximized in line with requirements.

The seminars are conducted by employees of the Institute of Mechanism Theory, Machine Dynamics and Robotics at RWTH Aachen University. Depending on the focus of the seminar, basics, tools and concepts are taught. The acquired knowledge is deepened through practice-oriented individual and group exercises as well as practical robotics applications.
Roadmap2Automation
Robotic Handling - Your Way to Automation for Production/Logistics

**QUICK FACTS**
- Seminar
  - Dates available upon request
  - 2 days of attendance
  - Prices available upon request
  - German
  - Certificate of Attendance
- Registration
- Scientific Lead
  - Prof. Burkhard Corves and Prof. Mathias Hüsing

**Benefit** from this introductory course in robotic automation in order to follow the path towards automated processes using robots with the right tools and the necessary specialist knowledge in a safe and focused manner. Try out different industrial robots and mobile platforms and gain a first insight into robot programming.

**In Focus**
- Application-specific introduction to robotic automation
- Process planning in automation technology
- Hands-on Robotics - practical workshop with industry and mobile robots
- Individualized adaptation of automation concepts and creation of a roadmap

**Intelligent machines** and robots constantly permeate every aspect of professional and private life. While automation via robotic systems is increasingly used in large production enterprises, small and medium-sized companies in particular need the appropriate strategies to take advantage of machine intelligence and integrate it into their processes.

You are an engineer, manager or technical specialist from the fields of automation technology, mechanical engineering, electrical engineering, manufacturing or production.

**Selection of a Driverless Transport System (DTS)**
Systematic Analysis of Automation Solutions

**QUICK FACTS**
- Seminar
  - Dates available upon request
  - 2 days of attendance
  - Prices available upon request
  - German
  - Certificate of Attendance
- Registration
  - [www.academy.rwth-aachen.de/en/dts](http://www.academy.rwth-aachen.de/en/dts)
- Scientific Lead
  - Prof. Burkhard Corves and Prof. Mathias Hüsing

**Gain** an overview of the driverless transport systems (DTS) available on the market and their specific areas of application. Taking into account the structural changes that the integration of driverless transport systems entails in the current production process, you will learn methods for the appropriate selection of robots and present different DTS in an interactive simulation.

**In Focus**
- Overview of the driverless transport systems (DTS) available on the market and their distinguishing feature
- Individual selection and application analysis for DTS
- Practical illustration via use cases
- Behind the scenes: Interactive simulations

**Robots are assuming** a growing number of tasks in production and logistics. In logistics, for example, the transport of goods is increasingly covered by driverless transport systems. This increases productivity and eases the workload of employees.

You are an engineer, technician, manager or executive from the fields of mechanical engineering, manufacturing, electrical engineering, IT, digitisation, HR, operational and strategic management. You will particularly benefit from this course if you want to introduce or expand driverless transport systems in the field of production, assembly or packaging technology.
Introduction to Sensor Technology
Project-specific Selection of a Sensor Network for Mobile Robot Applications

Gain an overview of the field of sensor technology and the project-specific composition of a sensor network. Risks and characteristics of local and global sensor systems can be assessed and applied in a targeted manner.

In Focus
- Overview of sensor technology in an industrial context
- Requirement analysis and risk assessment
- Clear visualization of the sensor data on the real system
- Practical examples from Industry 4.0

Sensor systems are of great importance when using networked systems and in Industry 4.0. In plant design, these systems can only be used in a targeted manner with a certain methodological competence. An improved overview in the field of sensor technology makes budget savings and efficient plant design possible.

You are a new professional, a specialist, an engineer from the fields of mechanical engineering, robotics, automotive engineering or plant planning.

Scrum
Agile Approaches in Technical Product Development

Learn to apply the agile process model Scrum onto the technical development process. In addition, you will learn to master the steps from the creation of the backlog, the estimation of effort up to the execution of the sprints and make your success measurable.

In Focus
- Introduction to the agile procedure model Scrum
- Application of Scrum using the example of automation technology
- Memorable case studies
- Interactive team simulations for day-to-day technical development

The development of modern technical products increasingly requires the cooperation of specialists from different disciplines. At the same time, worldwide competition in globalized markets demands a dynamic and equally high-quality development process. In order to meet these requirements, Scrum offers an agile process model that supports the necessary flexibility and speed.

You are an employee of a technical profession or work in the engineering sector at related departments.
Interconnection of Robot Systems

Cooperation in Collaborative Robotics

QUICK FACTS

Seminar
- Dates available upon request
- 2 days of attendance
- Prices available upon request
- German
- Certificate of Attendance

Registration
www.academy.rwth-aachen.de/en/interconnection-of-robot-systems

Scientific Lead
Prof. Burkhard Corves and Prof. Mathias Hüsing

Gain an insight into the networking possibilities of robots in a production line. Learn how robotic perception of other robots within the production line as well as environmental changes can be achieved through appropriate networking (in cloud systems) and how this influences human-involved production lines or changes at workplaces.

In Focus
- Configuring and deploying a cloud system for the control of a robot team
- Global and local sensor systems
- Development of individual application possibilities
- Connecting several robot systems in a demo scenario

Agile, freely networked assembly systems can be characterized by the sensor-supported cooperation of several robots - the foundation of Industry 4.0. In order to develop such a cooperation system, the basics of communication between robot systems and the necessary structure for a central control system are introduced.

You are an automation technician, engineer, computer scientist, manager from the fields of computer science, electrical engineering, mechanical engineering, logistics or production.

Smart Cognition

Robot-assisted Environmental Perception in the Plant 4.0

QUICK FACTS

Seminar
- Dates available upon request
- 2 days of attendance
- Prices available upon request
- German
- Certificate of Attendance

Registration

Scientific Lead
Prof. Burkhard Corves and Prof. Mathias Hüsing

Strengthen your skills in efficient plant and production planning by gaining a basic understanding of environmental perception and how robotic units move around. This enables you to design an efficient and safe plant layout.

In Focus
- Sensor-based path finding and mapping with robotic units
- Optimization of layout and robot sensor systems in plant 4.0
- Hands-on exercises with different sensors in 2D and 3D
- Case studies from the networked factory

Driverless transport systems are gaining increasing popularity in modern facilities. Not only do they enable the autonomous transport of goods, they also extend the manipulability of objects. They are regarded as the basic technology for systems that will become increasingly flexible in the future. Even at the design stage, a basic understanding of the robot system can optimize the layout and thus increase the productivity and efficiency of the system.

You are a technical expert in the fields of factory planning, logistics or robotics.
Quality Management

As one of the most widespread concepts in the field of quality management, Six Sigma offers a framework for systematic planning and effective implementation of sustainable improvement projects along structured project management lines. The combination of consistent customer orientation and measurable success is the success factor for planning and implementing sustainable optimizations in companies. The Six Sigma training courses make use of the DMAIC cycle, a continuous control loop with which the relevant improvement measures can be identified and quantified. The embedded methods enable companies to identify core causes of process problems and to develop solutions based on systematic analyses.

Together with the Chair of Metrology and Quality Management of the WZL Laboratory for Machine Tools and Production Engineering, the RWTH International Academy offers various qualification opportunities within the framework of Six Sigma: From the introductory seminar Six Sigma Yellow Belt to the basic certificate course Six Sigma Green Belt to the expert course Six Sigma Black Belt. The Six Sigma Green Belt Hybrid, which perfectly combines e-learning and attendance times, also focuses on flexibility and personal learning needs. The Quality Management Expert provides a comprehensive overview of current quality management concepts and methods throughout the company.

The RWTH trainers are qualified Six Sigma Black Belts. They convey the methodology of Six Sigma and illustrate the tools for the direct transfer into the company by means of practical examples. A special focus lies on the application of the attained knowledge in single and group exercises, as well as usually in one’s individual project work.

Six Sigma in practice

99 % good (3.8 Sigma)

- 20,000 lost letters per hour
- about 15 minutes per day of unsafe drinking water
- 5,000 failed surgeries a week
- 200,000 false prescription medications per year
- almost 7 hours of blackouts per month

99.99966 % good (6 sigma)

- 7 lost letters per hour
- every 7 months 1 minute unsafe drinking water
- 1.7 botched surgical surgeries per week
- 68 wrong medication prescriptions per year
- every 34 years 1 hour of power failure
Six Sigma Yellow Belt

Achieve Statistical Quality Goals

Work on your first improvement projects using the Six Sigma philosophy, deepen your basic statistical knowledge and learn how to apply problem-solving methods by means of a case study.

In Focus
- Tools and methods for implementing the DMAIC cycle
- Process visualization
- Practical planning games and case studies
- Group work & interactive learning room

The widespread quality management concept Six Sigma provides a framework for systematic planning and effective implementation of sustainable improvement projects along structured project management lines. It helps organizations to pursue a disciplined and data-driven approach and provides them with a method for error reduction. The Six Sigma Yellow Belt is the first step in Six Sigma training: Participants become experts for process optimization and waste reduction using statistical and analytical methods.

You are an engineer, computer scientist or specialist from the fields of mechanical engineering, electrical engineering, manufacturing, production or civil engineering.

Six Sigma Yellow Belt: Course Schedule (subject to change)

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction Six Sigma und DMAIC cycle</td>
<td>Data collection and data quality</td>
</tr>
<tr>
<td>Introduction Define Phase</td>
<td>Process stability &amp; capability</td>
</tr>
<tr>
<td>Voice of the Customer (VoC), Kano model and decision trees</td>
<td>Conclusion Measure Phase</td>
</tr>
<tr>
<td>SIPOC and stakeholder analysis</td>
<td>Introduction Analyze Phase</td>
</tr>
<tr>
<td>Project charter and conclusion Define Phase</td>
<td>Pareto-Analysis</td>
</tr>
<tr>
<td>Basics of statistics</td>
<td>Conclusion Analyze Phase</td>
</tr>
<tr>
<td>Excursion: Minitab</td>
<td>Introduction Improve Phase</td>
</tr>
<tr>
<td>Introduction Measure Phase</td>
<td>Creativity techniques</td>
</tr>
<tr>
<td>Process recording</td>
<td>Conclusion Improve Phase</td>
</tr>
</tbody>
</table>

Course Characteristics

<table>
<thead>
<tr>
<th>Math/statistics</th>
<th>Process analysis</th>
<th>Production optimization</th>
<th>Projectmanagement</th>
<th>Competency in methodology</th>
<th>Practical application</th>
</tr>
</thead>
<tbody>
<tr>
<td>little</td>
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<td>little</td>
<td>a lot</td>
<td>little</td>
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</tbody>
</table>
Quality Management Expert: Course Schedule (subject to change)

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality Perception</td>
<td>Process Management</td>
<td>Quality Planning</td>
<td>Quality Assurance</td>
<td>Outlook</td>
</tr>
<tr>
<td>Quality as a success factor</td>
<td>Interaction of QM and processes</td>
<td>Maturity assurance and APQP</td>
<td>Measurement System Analysis (MSA)</td>
<td>Quality 4.0</td>
</tr>
<tr>
<td>Quality Perception</td>
<td>Systematic approaches to process management</td>
<td>Special features</td>
<td>Statistical Process Control (SPC)</td>
<td>Wrap-up of the course</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Error and complaint management (JID)</td>
<td>Multiple choice exam</td>
</tr>
</tbody>
</table>

Lunch

Quality Management Systems
- Entrepreneurial quality concepts
- Normative QM systems
- The Aachen QM Model

Quality Characteristics
- Understanding of markets and customers
- Identifying and describing quality characteristics

Quality Control
- Risk hedging (FMEA, FTA)
- Plan inspection & production control (CP, PLP)
- Release procedures (PP, PPAP)

Quality Improvement (Six Sigma)
- Six Sigma Methodology
- The DMAIC project cycle
- The Six Sigma Toolbox

Conclusion
- Certificate ceremony
- Feedback round

Networking-Tip: Social Event

Quality Requires Qualification

You will gain a comprehensive overview of current concepts and methods of quality management applicable throughout the entire company and receive targeted training in the use of key tools. In addition, you will receive a Six Sigma Yellow Belt qualification, which will enable you to carry out systematic improvement projects in various process areas.

In Focus
- Field-proven concepts, methods and tools for planning, control and assurance of product and process quality
- Consolidation of the acquired contents with practical exercises and on the basis of case studies
- Systematic improvement of processes on the basis of the Six Sigma methodology
- Including Six Sigma Yellow Belt Training

Quality is a growing distinguishing feature in international competition: Only those companies with consistently high quality products and processes can successfully establish a long-term position on the market. To achieve this, today’s quality managers need to be familiar with modern concepts and methods and be capable of applying central quality management tools in all areas of the company.

You are a specialist or manager in the field of quality management in manufacturing companies.
### Six Sigma Green Belt

**Achieving Sustainable Improvements in Companies**

**Improve** business processes and identify hidden potential. Six Sigma’s control loop (DMAIC) allows you to filter out decisive improvement measures, make them quantifiable, implement them and, if necessary, transfer them to other business areas.

**In Focus**
- Methods for structuring problems, tests of hypotheses and creativity techniques
- Statistical tools for process and problem analysis
- Management and elaboration of quality improvement projects with Minitab
- Practical application: innovative case studies and company-specific project

Six Sigma offers a framework for action in the systematic planning and effective execution of sustainable improvement projects based on the DMAIC cycle. With the embedded methods, it is possible to identify core causes of difficult problems in processes and to develop sustainable solutions on the basis of statistical analyses. Above all, measurable results are achieved in the areas of process cost and waste reduction as well as in the reduction of throughput times.

**You are** a project manager, quality manager, specialist or manager from the service or manufacturing industry with at least one year of professional experience.

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**Course Schedule Module 1 (subject to change)**

<table>
<thead>
<tr>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
</table>
| - Introduction Six Sigma and DMAIC cycle  
- Project charter and conclusion Define Phase  
- Voice of the Customer (VoC), Kano model and decision trees  
- SIPOC and stakeholder analysis  
- Project selection and benefit analysis  
- Fundamentals of project management | - Review and recap day 1  
- Data collection and data quality  
- Process stability & capability  
- Indices of effectiveness and efficiency  
- Process recording  
- Process analysis | - Review and recap day 2  
- Introduction Analyze Phase  
- 8-MUDA  
- Techniques for problem structuring ( Ishikawa diagram, 5 - Times-Why, cause-effect matrix etc. )  
- Process structure matrix  
- System, function and decision tree analysis  
- Pareto - Analysis | - Review and recap day 3  
- Introduction Improve Phase  
- Systematic application of Minitab  
- Practical application: innovative case studies and company - specific project |

Networking-Tip: Social Event

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**Course Characteristics**

<table>
<thead>
<tr>
<th>Math/statistics</th>
<th>Process analysis</th>
<th>Production optimization</th>
<th>Projectmanagement</th>
<th>Competency in methodology</th>
<th>Practical application</th>
</tr>
</thead>
<tbody>
<tr>
<td>little</td>
<td>a lot</td>
<td>little</td>
<td>a lot</td>
<td>little</td>
<td>a lot</td>
</tr>
</tbody>
</table>

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**Participants appreciated the convenient toolbox of methods and the pleasant working atmosphere.**

**Detailed information with regard to the second course module can be found on our homepage:**


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**QUICK FACTS**

- **Certificate Course**
  - Dates available upon request
  - 2x 4 days of attendance
  - Prices available upon request
  - German
  - 4 ECTS (100 h. Workload)
  - RWTH Executive Certificate

- **Registration**

- **Scientific Lead**
  - Prof. Robert Schmitt

---

**Quality Management**

52 53

Contact: further-education@academy.rwth-aachen.de  |  +49 241 8097865

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**Quality Management**
Six Sigma Green Belt Hybrid: Course Schedule Module 1 (subject to change)

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welcome and introduction round</td>
<td>Presentation of company-specific project plan</td>
</tr>
<tr>
<td>Goal and set-up of the attendance phase</td>
<td>Introduction Analyze</td>
</tr>
<tr>
<td>Introduction to the case studies</td>
<td>Sprint planning Analyze</td>
</tr>
<tr>
<td>Sprint planning, sprint and sprint review Define</td>
<td>Analyze sprint (I/II)</td>
</tr>
<tr>
<td>Sprint planning and sprint Measure</td>
<td>Analyze sprint (III)</td>
</tr>
<tr>
<td>Sprint review Measure</td>
<td>Sprint review Analyze</td>
</tr>
<tr>
<td>Conclusion and feedback day 1</td>
<td>Conclusion and feedback day 2</td>
</tr>
</tbody>
</table>

Detailed information with regard to the second course module can be found on our homepage: www.academy.rwth-aachen.de/en/ssgb-hybrid

Six Sigma Green Belt Hybrid Certificate

Implement decisive improvement measures using innovative case studies, learn how to improve business processes using the Six Sigma methodology and identify hidden potential. Acquire course content flexibly and at your own pace, reducing absence time at work.

In Focus
- Methods for problem structuring, hypothesis testing and creativity techniques
- Process optimization based on the DMAIC cycle
- Easy online learning: quality management theories
- Practical relevance: innovative case studies and company-specific project

In the e-learning sector, videos and online-seminars are ideal for taking part in training courses in a time- and cost-efficient manner, while simultaneously benefiting from high-quality knowledge. Applying the acquired knowledge remains an important component in order to maintain skills: In our classroom trainings you can therefore apply the acquired theory in close contact with other participants and the lecturers using case studies.

You are a project manager, quality manager, specialist or manager in the service or manufacturing sector with at least one year of professional experience.

Six Sigma Green Belt Hybrid

Smartly Combining Flexibility and Quality

Implement
decisive improvement measures using innovative case studies,
learn how to improve business processes using the Six Sigma methodology and identify hidden potential. Acquire course content flexibly and at your own pace, reducing absence time at work.

In Focus
- Methods for problem structuring, hypothesis testing and creativity techniques
- Process optimization based on the DMAIC cycle
- Easy online learning: quality management theories
- Practical relevance: innovative case studies and company-specific project

In the e-learning sector, videos and online-seminars are ideal for taking part in training courses in a time- and cost-efficient manner, while simultaneously benefiting from high-quality knowledge. Applying the acquired knowledge remains an important component in order to maintain skills: In our classroom trainings you can therefore apply the acquired theory in close contact with other participants and the lecturers using case studies.

You are a project manager, quality manager, specialist or manager in the service or manufacturing sector with at least one year of professional experience.
Six Sigma Black Belt: Course Schedule Module 1 (subject to change)

<table>
<thead>
<tr>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction Six Sigma Black Belt and DMAIC cycle</td>
<td>Factors for successful Six Sigma projects and definition of “lighthouse projects”</td>
<td>Presentation case study</td>
<td>Visualization forms in Minitab</td>
</tr>
<tr>
<td>Presentation of individual Green Belt projects</td>
<td>Project selection and evaluation</td>
<td>Introduction Define Phase</td>
<td>Introduction Measure Phase</td>
</tr>
<tr>
<td>Integration of Six Sigma into organizational structures</td>
<td>Basics and advanced methods of project management</td>
<td>Consolidation and reflection of known methods (VOC/CTQ, SIPOC, project charter)</td>
<td>Consolidation and reflection of known methods (Measurement system analysis for variable data, data collection and quality)</td>
</tr>
<tr>
<td>Definition of corporate framework conditions</td>
<td>Stakeholder, Pestle and SWOT analysis</td>
<td>Conclusion Define Phase</td>
<td>Measurement system analysis for attributive data</td>
</tr>
<tr>
<td>Six Sigma organization (Roles and tasks)</td>
<td>Summary of basic knowledge of statistics</td>
<td>Measurement system analysis for attributive data</td>
<td>Sample selection and planning methods</td>
</tr>
<tr>
<td>Definition of requirement profiles for future Belts</td>
<td>Characteristic values of distributions (asymmetry, curvature)</td>
<td>Distribution forms (t, x², binomial, Poisson, Weibull, etc.)</td>
<td>Distribution tests and data transformation</td>
</tr>
</tbody>
</table>

Networking-Tip: Social Event

Detailed information with regard to the second course module can be found on our homepage: www.academy.rwth-aachen.de/en/black-belt

Six Sigma Black Belt

The Expert Level

Enhance your Six Sigma Green Belt skills to independently manage improvement projects and identify root causes of complex problems in processes. You will be able to take over project management in your Six Sigma team, coach employees and implement effective reports for management.

In Focus

- Consolidation of Six Sigma Green Belt skills
- Managing larger, more complex improvement projects in one’s own company
- Project work phase: individual coaching by experienced course instructors
- Extensive participation documents including workbook with form sheets and templates

Six Sigma Black Belt introduces quality management approaches as a holistic set of methods and as a philosophy which can be used to achieve measurable results such as the reduction of process costs and the shortening of lead times for companies. This course builds on Green Belt knowledge, deepens the methods along the DMAIC phase model for leading project teams, expands statistical knowledge and offers approaches for establishing Six Sigma in the company.

You are a project manager, quality manager, specialist or manager from the service or manufacturing industry and you have a Six Sigma Green Belt degree as well as relevant work experience.
The excellent reputation of RWTH Aachen University for research and teaching in the fields of technology and engineering is also documented by the current QS ranking by subject: RWTH Aachen University is ranked second in Germany in the „Engineering & Technology“ category and 44th in the world. In the category „Natural Sciences“ RWTH Aachen University is ranked fourth among German universities and 51st in the world. The certificate courses and seminars in the field of engineering are developed in close cooperation with renowned chairs of RWTH Aachen University, which stand for the outstanding quality of the teaching content.

# Fundamentals of Life Cycle Assessments (LCA) for Industrial Products

**LCA as a Holistic Environmental Inspection Method**

Learn to represent and quantify material and energy flows relevant to the process as input or output variables in the various life phases of the product, process or service. In addition, you will be able to use the Life Cycle Assessment tool for process optimisation decisions that focus on added value.

**In Focus**
- Various phases of LCA and their areas of application
- Autonomous implementation of life cycle assessments
- Development of standardized methods for account balancing according to DIN norm
- Interpretation of LCA analyses and evaluation of improvement potentials

Achieving a leading role in environmental protection and thus remaining competitive in the climate policy environment requires many industrial companies to implement decisive measures to reduce environmental impacts. In order to identify suitable activities, a detailed environmental assessment is required: the so-called „Life Cycle Assessment“ offers a widely approved and highly effective method for this purpose.

You are an engineer and/or project manager from the fields of production, environmental management, research and development or strategic management with at least one year of relevant professional experience.

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**Course Schedule** (subject to change)

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
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<tbody>
<tr>
<td><strong>Introduction</strong></td>
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<tr>
<td>- Introduction &amp; expectations</td>
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<tr>
<td>- Life Cycle Assessment: introduction &amp; application fields</td>
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</tr>
<tr>
<td><strong>Phase 1 &amp; 2 of LCA</strong></td>
<td><strong>Introduction to a LCA Software</strong></td>
<td><strong>Examination Case Study</strong></td>
<td><strong>Prospects of LCA</strong></td>
<td></td>
</tr>
<tr>
<td>- Phase 1: Goal &amp; Scope Definition</td>
<td>- Modelling course: LCI</td>
<td>- Independent LCA study based on the data obtained during the company visit</td>
<td>- Prospects of LCA</td>
<td></td>
</tr>
<tr>
<td>- Phase 2: Life Cycle Inventory (LCI)</td>
<td>- Modelling course: Allocation</td>
<td></td>
<td>- Wrap-up LCA</td>
<td></td>
</tr>
<tr>
<td>- Theoretical background for data collection, building of an LCI model, software tools &amp; databases</td>
<td>- Modelling course: Life Cycle Impact Assessment</td>
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<tr>
<td><strong>Lunch</strong></td>
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<tr>
<td><strong>Phase 3 &amp; 4 of LCA</strong></td>
<td><strong>Modelling Course: Case Study</strong></td>
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<tr>
<td>- Phase 3: Life Cycle Impact Assessment Overview on and computation of environmental impacts based on LCI results</td>
<td>- Conducting an industry-related LCA case study</td>
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<tr>
<td>- Phase 4: Interpretation and Sensitivity</td>
<td>- Example industries: - Recycling</td>
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<tr>
<td>- Interpretation and communication of Life Cycle Assessment results</td>
<td>- Petro - Food - Transport - Energy</td>
<td></td>
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<tr>
<td><strong>Exursion Company Visit</strong></td>
<td><strong>CO₂ avoidance cost curves as decision-making tool</strong></td>
<td><strong>Examination and Awarding of Certificates</strong></td>
<td></td>
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<tr>
<td>- Specific industrial production process in the field of carbon capture and utilisation</td>
<td>- Comprehensive communication of LCA results both within the company and towards stakeholders</td>
<td>- Examination (group presentations)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Portrayal and implementation of LCA in industrial processes of decision-making and introduction to the case study</td>
<td>- group work: preparation for final presentation</td>
<td>- Feedback and Awarding of Certificates</td>
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</tbody>
</table>

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**Course Characteristics**

<table>
<thead>
<tr>
<th>Math/statistics</th>
<th>Process technology</th>
<th>Production optimization</th>
<th>Competency in methodology</th>
<th>Practical application</th>
</tr>
</thead>
<tbody>
<tr>
<td>little</td>
<td>a lot</td>
<td>little</td>
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<td>little</td>
</tr>
</tbody>
</table>

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**Certificate Course**
- Dates available upon request
- 5 days of attendance
- Prices available upon request
- German or English
- 2 ECTS (50 h. workload)
- RWTH Executive Certificate

**Registration**

**Scientific Lead**
Prof. André Bardow

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Participants praise the high level of practical relevance
Participants appreciate the focus on applications and research.

### Course Characteristics

<table>
<thead>
<tr>
<th>Category</th>
<th>Little</th>
<th>A Lot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math/statistics</td>
<td></td>
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<tr>
<td>Production optimization</td>
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<tr>
<td>Competency in methodology</td>
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<tr>
<td>Practical application</td>
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</tbody>
</table>

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**Fine Blanking**

Best Practice Approaches for Toolmaking, Press and Plant Engineering and Tribology

**Master** fineblanking trends such as the application of environmentally friendly lubricants or agile process changes on your own. You will understand the interplay of process, tool, press, plant peripherals and tribology. Furthermore, you will be able to identify process anomalies in good time using statistical analysis (Six Sigma) or numerical methods (FEM).

**In Focus**

- Process technology and basics of metallurgy
- FE simulation and modeling, tribology
- Practical application on a Feintool XFT2500
- Industry 4.0-supported process control in the machine hall

**Due to the high quality** of the blanking edge and the resulting energy and resource efficiency, fineblanking is of considerable importance for production technology. Economy and precision are the two essential characteristics of this technology. In an effort to extend this advantage compared to alternative technologies, fineblanking companies must serve current trends: These include high-strength steel sheet materials as well as the digitalization of the value chain.

**You are** a specialist, manager or lateral entrant with at least one year of relevant professional experience in fineblanking technology, stamping and bending technology or toolmaking.

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**Fine Blanking: Course Schedule (subject to change)**

<table>
<thead>
<tr>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greeting and introduction of the machine tool lab</td>
<td>Summary day 1</td>
<td>Summary day 2</td>
<td>Summary days 1-3</td>
</tr>
<tr>
<td>Introduction Fine Blanking</td>
<td>Metallurgical basics</td>
<td>Specialization contents tool construction</td>
<td>Exam</td>
</tr>
<tr>
<td>Introduction plant technology</td>
<td>Basics of sheet metal forming</td>
<td>Specialization contents statistical analysis and measuring technology</td>
<td></td>
</tr>
<tr>
<td>Lunch</td>
<td>Practical part I</td>
<td>Specialization contents FE simulation and modeling, tribology</td>
<td>Awarding of certificates</td>
</tr>
<tr>
<td></td>
<td>Practical part II</td>
<td>Specialization contents precision cutting 4.0</td>
<td></td>
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<tr>
<td></td>
<td>Discussion of the previous seminar contents</td>
<td>Exam preparation</td>
<td></td>
</tr>
</tbody>
</table>

**Networking-Tip: Social Event**

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**Quick Facts**

- Certificate Course
  - Dates available upon request
  - 4 days of attendance
  - Prices available upon request
  - German
  - RWTH Executive Certificate

- Registration
  - [www.academy.rwth-aachen.de/en/fine-blanking](http://www.academy.rwth-aachen.de/en/fine-blanking)

- Scientific Lead
  - Prof. Thomas Bergs
Vehicle Acoustics – Noise, Vibration, Harshness

Targeted Design of the Vibration and Acoustics Behaviour of Vehicles

Acquire a special understanding of vehicle-specific acoustic mechanisms and acquire the knowledge to implement the appropriate remedial measures for existing problems.

In Focus
- Comprehensive and holistic understanding of the entire vehicle system
- Vehicle-specific acoustic effect mechanisms and remedies for existing problems
- Practical transfer of knowledge with numerous application examples
- Applying the learned knowledge in your own case study

The field of acoustics is of central importance in the development of vehicles in order to achieve high quality standards. Noise, vibration and harshness are essential elements in the targeted design of vibration and acoustic behaviour.

You are an engineer or technician in the automotive and supplier industry with at least one year of relevant professional experience.
Participants appreciate the comprehensive insight into innovations in the aluminium processing industry and the mixture of theory and practice.

Course Characteristics

<table>
<thead>
<tr>
<th>Basics</th>
<th>Process technology</th>
<th>Production and processing</th>
<th>Research approaches</th>
<th>Competency in methodology</th>
<th>Practical application</th>
</tr>
</thead>
<tbody>
<tr>
<td>little</td>
<td>a lot</td>
<td>little</td>
<td>little</td>
<td>a lot</td>
<td>little</td>
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</table>

Introduction to Aluminum Technology: Course Schedule (subject to change)

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
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</thead>
<tbody>
<tr>
<td>Lecture and practical training</td>
<td>Casting technique – metalurgy and processing</td>
<td>Joining technology for aluminium alloys</td>
<td>Lecture: Use of aluminum in automotive</td>
</tr>
<tr>
<td>training Metalurgic basics of</td>
<td>Permanent mold process – chill casting</td>
<td>Welding procedures for aluminium alloys</td>
<td>Practical training</td>
</tr>
<tr>
<td>aluminum materials</td>
<td></td>
<td></td>
<td>Aluminum in automotive</td>
</tr>
<tr>
<td>Lunch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lecture and practical training</td>
<td>Design of cyclically stressed elements from</td>
<td>Construction and calculation of Al</td>
<td>Process chain modeling</td>
</tr>
<tr>
<td>Aluminum recycling from mixed</td>
<td>aluminium materials</td>
<td>constructions</td>
<td>for automotive strip</td>
</tr>
<tr>
<td>waste</td>
<td></td>
<td></td>
<td>Forming technologies for</td>
</tr>
<tr>
<td>Lecture and practical training</td>
<td>Stress tests of Al</td>
<td>Lecture and practical</td>
<td>AL semi-finished products and molded parts</td>
</tr>
<tr>
<td>Extraction and recycling of</td>
<td></td>
<td>training Wear and corrosion protection of Al</td>
<td>Plastic forming of</td>
</tr>
<tr>
<td>aluminium</td>
<td></td>
<td>elements</td>
<td>aluminium alloys</td>
</tr>
<tr>
<td>Networking-Tip: Social Event</td>
<td></td>
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</tbody>
</table>

Familiarise yourself with the material aluminum or deepen your knowledge in the areas of further processing and possible applications. In addition to the basics of metallurgy, you will also receive a broad knowledge of the individual process steps in manufacturing and processing aluminium products.

In Focus

- Use of aluminium in automotive engineering
- Forming technologies and welding processes
- Casting Technology: Metallurgy and Processing
- Insight into the research work of various institutes at RWTH Aachen University

Aluminium is one of the most versatile metals in use: low weight, high strength and formability make it a universal material that is used in the manufacture and further processing of high-quality products. As an interdisciplinary research and development partner for industrial applications, the aluminium engineering center Aachen (aec) offers a pool of highly qualified material technicians and engineers for future projects.

You are a specialist or newcomer from an aluminium processing company.
Systematic Innovation Methodology
Promote Product Innovation Through Strategically Applied Design Methodology

**QUICK FACTS**

**Workshop**
- Dates available upon request
- 1 day of attendance
- Prices available upon request
- German
- Certificate of Attendance

**Registration**
www.academy.rwth-aachen.de/en/systematic-innovation-methodology

**Scientific Lead**
Prof. Georg Jacobs

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**Learn** to view product solutions in an abstract way by means of a systematic, solution-neutral and function-driven approach. This enables you to develop new solution concepts and promote product innovations in a targeted manner.

**In Focus**
- Product- and industry-neutral methods for the targeted identification of technical solutions
- Optimization of new product generations via systematic variations of current solutions
- Universally applicable methods illustrated by practical examples
- Testing of the application in interactive workshops

**Increasing cost** and competitive pressure in almost all industries and branches makes it necessary to optimize and update product portfolios. A significant step in this process is the identification of new technical solutions which are detached from familiar concepts and the apparent limitations of the existing portfolio.

**You are** a designer, product manager, product developer or designer from the fields of mechanical engineering, product development or product design.

---

Load-Compatible Component Design
Performance Enhancement and Sustainability via Application-optimized Design

**QUICK FACTS**

**Workshop**
- Dates available upon request
- 1 day of attendance
- Prices available upon request
- German
- Certificate of Attendance

**Registration**
www.academy.rwth-aachen.de/en/component-design

**Scientific Lead**
Prof. Georg Jacobs

---

**Acquire** the basics of load-compliant component definition, both in terms of shape and material selection. You will then be able to analyze existing products with regard to optimization potential and to develop load-optimized components. You will gain insight into target properties, systematic material selection and computer-aided shape optimization.

**In Focus**
- Methods for a load-compatible initial shape
- Systematic material selection and computer-aided shape optimization
- Methods and tools for load-compatible generation and optimization of component designs in practice
- Direct, independent practical application of workshop contents on the computer

The main potential for load-compatible component design is increased sustainability through reduced use of materials, cost and weight savings, and improved performance of mechanically stressed components. The essential component parameters are often determined purely on the basis of experience, since the ideal shape is complexly related to the utilized materials. Yet the addressing of technically and economically optimized components must take place differently!

**You are** a mechanical engineer, product manager, developer or product designer in the fields of mechanical engineering, mechatronics, product development or product design.
Reverse Engineering Step by Step
Successful Benchmarking and Targeted Optimization Using Effective Product Analysis

Discover tools and methods for capturing and analyzing complex products and product systems. You will be able to evaluate existing products, their subcomponents and solutions, identify effective and constructive optimization measures and successfully implement the same.

In Focus
- Practical, product- and industry-neutral analysis of products, their working principles and implemented functions
- Digitisation techniques and CAD modelling of existing component geometries
- Reverse Engineering for every abstraction level: Universally applicable methods, demonstrated with example products
- Supplementation of classical methods through the use of various digitization techniques

The combination of modern digitization tools and classical analysis methods offers optimal conditions for continuously optimizing the existing product portfolio, for understanding, abstracting and quantifying existing solutions.

You are a designer, product manager or product developer in the fields of mechanical engineering, mechatronics or product development.

Targeted Component Design for 3D Printing
The Path to Successful FDM Prototypes and Small Series

Familiarize yourself with design guidelines for creating FDM-compliant 3D print parts. You will then be able to adapt the design of components specifically to the manufacturing constraints of FDM printing. You are familiar with design strategies for minimizing distortion, joining techniques with materials from classic series production and approaches for the integration of standard parts. You can exploit the maximum potential of this technology and develop mechanically resilient and economically optimized FDM components.

In Focus
- Practical design rules and guidelines for successful FDM-3D printing
- Production-oriented component design, avoidance of printing errors, versatile joining techniques
- Practical instructions for the design of functional components, joining technologies, combination strategies with conventional manufacturing processes and much more
- Sample projects & hands-on testing of your own design

New manufacturing technologies require a shift in the design of injection-molded components. Relevant design guidelines make it possible to exploit the potential of 3D printing and successfully develop and produce functional prototypes or small series.

You are a designer, product manager, product developer or product designer from the fields of mechanical engineering, mechatronics, product development or product design. You will particularly benefit from this course if you work in the plastics-processing consumer goods industry (automotive, household appliances, tools), in assembly and production planning (jig and fixture construction) or if you require mechanical prototypes for a start-up.

QUICK FACTS
Workshop
- Dates available upon request
- 1 day of attendance
- Prices available upon request
- German
- Certificate of Attendance
Registration
www.academy.rwth-aachen.de/en/reverse-engineering
Scientific Lead
Prof. Georg Jacobs

QUICK FACTS
Workshop
- Dates available upon request
- 1 day of attendance
- Prices available upon request
- German
- Certificate of Attendance
Registration
www.academy.rwth-aachen.de/en/reverse-engineering
Scientific Lead
Prof. Georg Jacobs
Biohydraulic Oils - Becoming a Sustainable Company

Competitive Advantages via Pioneering Fluids in Mobile Hydraulics

**Quick Facts**
- **Workshop**
  - Dates available upon request
  - 1 day of attendance
  - Prices available upon request
  - German
  - Certificate of Attendance
- **Registration**
- **Scientific Lead**
  - Prof. Katharina Schmitz

**In Focus**
- Characteristics and challenges of biohydraulic oils
- Preparing for changes in legislation on climate and environmental protection
- Lubrication of mobile hydraulic working machines
- Certification EU Ecolabel and Blue Angel

**Quick Facts**
- **Workshop**
  - Dates available upon request
  - 1 day of attendance
  - Prices available upon request
  - German
  - Certificate of Attendance
- **Registration**
- **Scientific Lead**
  - Prof. Burkhard Corves and Prof. Mathias Hüsing

**Strengthen** your competence in the field of biolubricants and familiarize yourself with various biohydraulic oils, their applications and properties. You will learn which measures are necessary to convert to bio-oil and become acquainted with the corresponding certification possibilities in order to shape the future of your mobile machines in a sustainable way.

**In Focus**
- Characteristics and challenges of biohydraulic oils
- Preparing for changes in legislation on climate and environmental protection
- Lubrication of mobile hydraulic working machines
- Certification EU Ecolabel and Blue Angel

**Companies are increasingly obliged** to introduce measures aimed at implementing sustainable processes and products. Legislation, for example, stipulates the use of environmentally compatible lubricants in public construction projects. In order to maintain competitiveness, the conversion of mobile hydraulic machines to bio-oil is an inevitable step.

**You are** an engineer, practitioner, manager or supplier in the fields of mobile hydraulics, fluid production or in the construction industry.

Introduction to Simulating Mechatronic Systems

Design of Complex Motion Systems by MathWorks Simulink

**Quick Facts**
- **Seminar**
  - Dates available upon request
  - 2 days of attendance
  - Prices available upon request
  - German
  - Certificate of Attendance
- **Registration**
- **Scientific Lead**
  - Prof. Burkhard Corves and Prof. Mathias Hüsing

**Simulate** mechatronic motion systems, i.e. mechanics, sensors, drives and controls. You will gain basic simulation knowledge, be able to use MathWorks Simulink and structure simulation models. In addition, you will be able to design and optimize systems using simulations.

**In Focus**
- Model-based design of a system with motor, mechanics, sensors and control system
- Structuring simulation models
- Practical case studies for simulation skills
- Interactive exercises with Simulink

**The modelling of technical systems** offers many advantages. Good simulation models accelerate development and enable system design without existing hardware. They can also be used during operation for control or process monitoring. Simulink’s structuring options are used for decentralized development of individual modules in different departments.

**You are** a developer or engineer in the field of mechanical engineering with a basic knowledge in programming and mechanics. Basic knowledge of Matlab or Simulink is useful, but not a prerequisite.
Take a look at the following pages to find out more about the institutes of the RWTH Aachen University that guarantee the excellent teaching quality of your next further education course. In addition to the regular seminars, our customized courses offer directly applicable practical knowledge that is tailored to your company. With the RWTH International Academy, you are opting for the finest academic quality and excellent learning conditions, which are certified by official university certificates in every course.

To ensure the academic quality standard, these courses undergo an integrated quality assurance process. The quality management system of the RWTH International Academy is certified according to DIN EN ISO 9001 and DIN EN ISO 29990 (“Learning Services for Education and Training - Basic Requirements for Service Providers”). The consistently upheld quality standards of the RWTH Aachen are documented by the seal stamp, which is applied manually upon each certificate.

Another partner for the certification of quality management systems in system accreditation is ASIN e.V. This accreditation agency for trainings sets standards in the fields of engineering sciences, computer science, natural sciences, mathematics and teaching qualification. The ASIN system seal certifies the guarantee of quality teaching and successful learning. This accreditation is updated at regular intervals of five years to ensure a continuous quality which is passed on to participants.

All credits achieved are marked by the European Credit Transfer Systems (ECTS): It is possible to apply these credits to other certified courses or even to subsequent university studies.

If you have any questions, please consult the useful knowledge category on pages 102-103 or contact us directly. We look forward to hearing from you!
Institutes

Excellent Teaching Quality For Your Professional Development

Chair of Technical Thermodynamics and Institute of Thermodynamics

The chair deals with the development and evaluation of energy and process systems at all levels, from single molecules to complex process systems. Projects are carried out in the following groups: Energy system technology, sorption system technology, model-based fuel design, measurement system technology, laser diagnostics in thermofluid dynamics and molecular system technology. For many years, the Group for Energy System Technology has been involved in the development of a variety of methods in the field of sustainable engineering.

Chair of Manufacturing Technology of the Laboratory for Machine Tools and Production Engineering (WZL)

At the Chair of Manufacturing Process Technology of the Machine Tool Laboratory WZL, new technologies are researched, existing manufacturing processes further developed and new inventions developed are put into practice. The focus is on process reliability and robustness as well as economic factors. The research area covers topics like basic principles of manufacturing processes, process investigations of individual manufacturing processes, process monitoring, process simulation and environmentally friendly technologies.

Chair for Machine Tools of the Laboratory for Machine Tools and Production Engineering (WZL)

Research and teaching cover the calculation and optimization of machine tools and handling systems, and their components. They further include metrological testing and evaluation of production systems, drive technology, NC, RC and SPS controls, process monitoring and machine diagnosis, human-machine interaction, control technology and automation. This is complemented by gear technology and gear cutting machines. In the Smart Automation Lab, a complex demonstrator, new control methods are validated on real systems and a wide range of features of Industry 4.0 shown.

Chair of Mechanism Theory, Machine Dynamics and Robotics

Gear technology deals with the generation of desired movements and their kinematics. Machine dynamics includes the avoidance of unwanted movements as part of vibration technology (e.g. rotor dynamics and balancing technology). In robotics and mechatronics development, analysis, control and application of robotic systems are covered. In addition to industrial, collaborative and mobile robots, navigation, software and sensor integration are covered since 1959.

Institute for Metallurgical Process Technology and Metal Recycling

The Institute under the direction of Professor Dr.-Ing. Dr. h.c. Bernd Friedrich deals with applied research and teaching in the fields of extractive metallurgy (pyrometallurgy and hydrometallurgy), metal refinement and electrolysis as well as the recycling of metals from various waste streams. Processes are designed and further developed with optimised use of resources and under consideration of critical waste flows (circular economy). Other important fields of research are vacuum metallurgy on a small to demo scale and the synthesis of nanopowders.

Chair of Textile Engineering and Institute of Textile Technology, Digital Capability Center

In cooperation with the Chair as well as McKinsey, the Digital Capability Center assists companies to approach the topic of Industry 4.0 in a targeted manner. In a realistic factory environment course participants receive the tools needed in order to advance digital transformation in their own companies. They will learn where and how to use the latest technologies along the entire value chain: from the first customer inquiry, its development, production and marketing up to the service business.

Chair and Institute for Machine Elements and Systems Engineering

The ikt Aachen GmbH & Co. KG is a spin-off from the Chair and Institute for Machine Elements and System Engineering (MSE). It offers a wide range of services in the field of design methodology, from the concrete concept solution to the systematic weak-point analysis and the parameter-based product configuration. Years of project experience as well as the scientific management by Prof. Dr.-Ing. Georg Jacobs guarantee the quality of the results: Customer satisfaction and an individual customization of the project to the respective needs are guaranteed.

Chair and Research Field Information Theory and Systematic Design of Communication Systems (ISEK)

The teaching and research area of the Faculty of Electrical Engineering and Information Technology (ISEK) focuses on information theory, the optimization of networks (5G, sensor networks, relay systems) and biomedical problems as well as the analysis of the resulting data. Optimization methods, machine learning and stochastic simulation are especially important. The teaching and research area ISEK has many years of experience in carrying out DFG projects, EU subprojects, industrial projects and projects with Forschungszentrum Jülich.
Chair of Production Metrology and Quality Management at the Laboratory of Machine Tools (WZL)

The chair focuses on the industrialization of operational processes in production engineering. In this context, industrialisation refers to the collection of relevant and objective data and their traceability and exploitation in the operational context of control loops. The first problem is solved by measurement technology, while quality management is concerned with the creation of suitable structures. The objective is to create capable processes with predictable results in a defined period of time. In this way, a multitude of tools and methods are made available to support companies at all levels.

Institute for Fluid Power Drives and Systems

As one of the world’s largest and best-known scientific institutions, the institute deals with all aspects of fluid technology. In addition to mechanical engineering, current research includes information technology and control engineering. Environmental and safety regulations as well as increasing industrial consumer requirements require the continuous development of sustainable and efficient fluid technology. Emerging technologies such as mechatronic systems, preventive maintenance and additive manufacturing also open up new areas of application for fluid power systems.

Chair of Production Engineering at the Machine Tool Laboratory (WZL) and Technology Management at the Fraunhofer IPT

On behalf of its customers, the Fraunhofer IPT develops and optimizes new and existing solutions for modern production. The objective is application- and industry-oriented research and development for companies from the entire manufacturing industry. The work results obtained are directly implemented in the business practice of the customers. The industry focus ranges from automotive engineering and its suppliers, especially tool and mold making, to the aerospace industry as well as precision mechanics and optical industry up to machine tool construction.
In close cooperation with you, we develop holistic and operational teaching concepts that do justice to your strategic business processes: Whether on site or in the research centres of RWTH Aachen University, be it a short seminar or a complete certificate course - we will adapt to your needs. Renowned RWTH lecturers train your teams in production technology, quality management, robotics and engineering.

If you have any further requests, please do not hesitate to contact us - we will certainly be able to help.

Your Benefit
- Innovative contents
- Certified degrees
- Solution-oriented practical application
- Sustainable learning effects
- Effective transfer of knowledge into the company

We will also be happy to advise you on further details and send you a non-binding offer.

Team Business Development
- business-development@academy.rwth-aachen.de
- https://www.academy.rwth-aachen.de/de/customized-courses

Value Proposition
Professional Development at the RWTH International Academy

You can rely on the RWTH International Academy's high academic standard of part-time continuing education as reflected in the following three characteristics:

1. Excellent Teaching Quality
Course participants are supported by a large number of scientists and visionaries of the renowned RWTH Aachen University. Some 80 percent of its professors have a business background. They pass on their practical experience directly to our course participants and allow academic and vocational training to merge.

2. First Class Learning Conditions
Small groups enable the joint development of effective solutions. The RWTH International Academy’s further education courses are deliberately user-oriented and manufacturer-neutral, and are focused on the professional reality of the individual participants and their companies.

3. Enthusiastic Graduates
The positive feedback of our graduates confirms our quality motto, to only be successful if they are after our training. Graduates confirm the targeted development of competences and appreciate the fact that the RWTH Aachen University’s final certificate qualifies them comprehensively and visibly.

They benefit sustainably from the career-promoting networks and the lively exchange with lecturers and participants.
**Useful Knowledge**

**Login and Registration**
You can register easily using our online registration portal [www.academy.rwth-aachen.de/en/certificate-courses]. The registration is legally binding upon our written confirmation. Every legally binding registration is subject to general terms and conditions. Should you have any questions in advance, we will be happy to assist you at any time.

**Payment**
After successful registration you will receive the invoice via e-mail, payable by bank transfer. If payment has not been made, we reserve the right to cancel and reallocate the space. Should you be in default of payment, we are entitled to charge interest on default at a rate of 6% p.a. above the base rate (§ 247 para. 1 BGB).

**Venue**
We are happy to welcome you - to the majority of the courses - at the RWTH International Academy at Campus-Boulevard 30 in Aachen. A virtual tour will give you a first impression of our modern facilities at [www.campusraum.de]. In some courses you will also be given the opportunity to visit laboratories or participate in excursions. About two weeks before the start of the course you will receive detailed information about the venue and the course programme via e-mail.

**Food and Catering**
If you use one of our hotel recommendations, breakfast will be included in the room price. During seminar times we take care of your meals: depending on the course, breakfast or lunch as well as drinks are included. You are responsible for all other meals, but we will gladly provide you with some suggestions as to where you can eat well in Aachen.

**Accommodation**
To help you find accommodation, we are happy to recommend hotels. We provide you with reserved hotel contingents which can be booked up to four weeks before the start of the course. You are responsible for the costs arising here. Please do not hesitate to contact us.

**Arrival and Departure**
You organize the arrival and departure yourself, as it is not included in the course costs. You will receive directions to the event location approx. 2 weeks before the start of the course. We will be happy to provide you with a parking permit if required. This will allow you to arrive with ease and concentrate fully on your professional development.

**Course Materials**
To support and consolidate your newly acquired knowledge, you will receive high-quality course materials.

**Number of Participants**
In order to encourage the individual learning process and lively discussions between participants and speakers, we limit the maximum number of participants to 15-20. The minimum number of participants is usually 8.

**Networking**
For most courses, we look forward to invite you to our evening event. Discover the imperial city of Aachen and seize the opportunity to exchange ideas with other participants and lecturers in a relaxed atmosphere.

**Expenses**
Please refer to the respective course descriptions in this brochure for the costs of the individual courses. Each course fee is exempt from VAT according to § 4 Nr. 21a) b) UStG. Course documents and the supporting programme are included, however, expenses for overnight accommodation and for arrival and departure are not.

**Cancellation Policy**
Should your plans change and you have to cancel your registration, you will have to declare your withdrawal in writing. Cancellations up to 8 weeks before the start of the event will not result in any cancellation fees. Cancellations up to 4 weeks prior to the start of the event will entail a cancellation fee of 50% of the participation fee. Cancellation after this date and non-appearance without cancellation will incur the full course fee. In the event of cancellation due to illness or a premature departure from the course, there will be no reimbursement of event fees already paid in part or in full. If too few participants are expected to register for a course, we reserve the right to cancel the course. In this case, any fees already paid will be refunded in full. Further claims, in particular for reimbursement of travel and accommodation costs as well as compensation for loss of working hours, are excluded.

**Further Information**
The course descriptions in this brochure outline the main aspects of each course. If you have any further questions, please do not hesitate to call us at +49 (0)241 8097865 or write to us at further-education@academy.rwth-aachen.de or visit [www.academy.rwth-aachen.de/en/certificate-courses].

**Data Protection**
Information about our privacy policy can be found on our website: [https://www.academy.rwth-aachen.de/en/index/privacy](https://www.academy.rwth-aachen.de/en/index/privacy).

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**Further information and registration**
Are you interested in our courses and would like further information? We are happy to discuss further questions and your personal requirements. We also look forward to your inquiry for our customized programs.

Contact Us
We will be happy to advise you

Are you interested in our courses and would like further information? We are happy to discuss further questions and your personal requirements. We also look forward to your inquiry for our customized programs.

Tanja Lux
Head of Business Development

Sven Lingens
Business Development Career Manager

Kim Schönberg
Program Manager

Carmen Scharf
Program Manager

+ 49 241 80-97865
further-education@academy.rwth-aachen.de

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Jörg Hempel, www.medien.aachen.de/Peter Hirschläger; mauritius, Werkzeugmaschinenlabor der RWTH Aachen (WZL), Institut für Getriebetechnik, Maschinendynamik
und Robotic (IGMR), Institut für Allgemeine Konstruktionstechnik des Maschinenbaus (ikt), Sarah Thelen

Facts
& Figures

>1,000
students

>100
Programs

>200
experts

>130
involved institutes

>3,000
applicants

>10
M.Sc. programs

>1,500 m²
Event space

>35
extra-occupational courses
Registration Form

☐ Hereby, I bindingly register for the course:

The participation fee includes the course documents, catering during the course and the framework program. The course is exempt from V.A.T. taxation according to Art. 4 Para 21a and b UStG. Please find our terms and conditions under: www.academy.rwth-aachen.de/en/terms-and-conditions

Please send this registration form via post, fax or e-mail to:

RWTH International Academy gGmbH
Business Development | Campus-Boulevard 30 | Cluster Produktionstechnik | 52074 Aachen (Germany)
Fax: +49 241 8092525 | further-education@academy.rwth-aachen.de

Title/Surname*/First name*
Company*/Position
Street*
ZIP code*/City*/Country*
Telephone*/e-Mail*
Date*/Signature*

*These data are required.

Registration
You can register via mail, fax or the electronic registration portal on the RWTH International Academy website. Registration becomes legally binding upon written confirmation by the RWTH International Academy. Each legally binding registration is based on general terms and conditions. The participation fee due upon receipt of the invoice and must be paid by bank transfer. If payment is not made, the RWTH International Academy reserves the right to cancel and transfer the place. If the participant is in default of payment, the RWTH International Academy is entitled to charge interest on arrears in the amount of 5% above the base interest rate (§ 247 para. 1 BGB) p. a. to demand.

Cancelation
Should your plans change and you have to cancel your registration, you must declare your withdrawal in writing. Cancellations up to 3 weeks before the start of the event will not incur any cancellation fees. Cancellations up to 1 week prior to the start of the event will incur a cancellation fee of 50% of the participation fee. In the event of non-appearance without cancellation, the full participation fee must be paid. There is no entitlement to partial or full reimbursement of event fees already paid in the event of cancellation due to illness or early departure from the course. In the event of non-appearance, this fee will not be refunded. If, contrary to expectations, too few participants register for an event, we reserve the right to cancel the event. Any fees already paid will be refunded in full. Further claims, in particular for reimbursement of travel and accommodation expenses as well as loss of working hours, are excluded.

Data Protection
By registering, you agree that your name and business address will be included in the list of participants and electronically processed and stored for the purposes of event organisation.

Check out our website and learn more about our further education courses and customized programs. With our online registration form you can register directly and comfortably for your professional training.

www.academy.rwth-aachen.de/en/certificate-courses