

Automation & Robotics Fachschaft

Freshmen WS22' Orientation

Welcome

- The student councils at the TU Dortmund were set up by students for students.
- Funded and governed by the University and [AsTa](#) (University Student Organization)
- The members of the student council support their fellow students in a variety of ways:
 - They **organize** orientation events for first-year students,
 - They **advise** on planning their studies or help if there are difficulties in completing study formalities.
 - Senior students as **mentors** for the juniors and help them gain the most of their university experience.
 - Alumni network - The fachschaft is also a place to network and get develop meaningful relationships with your fellow colleagues.
- In addition, student councils represent the A&R students in various committees towards the University and Rectorate.
- Any complaints, issues or comments you have will be taken into consideration by us and conveyed to the university administration.

The Program

- Welcome to the Automation and Robotics program in TU Dortmund
 - The M.Sc. Automation & Robotics Program is interdisciplinary and covers the valuable contributions of many faculties, namely the Elektrotechnik und Informationstechnik (EIT), Maschinenbau (ME), Informatik (CS), Bio- und Chemieingenieurwesen (BCI), Mathematik (Math).
- In the following presentation we will take you through the **academic structure of the A&R program** and offer you some tips on how to successfully navigate through the program.
 - **There will be a brief Q&A session at the end** of the presentation so make sure you note down your questions and slide number.
- We will make sure to **give you a copy of all the information** in these slides.
 - Unfortunately we cannot guide you with Visa/Accommodation Issues, you can refer to our **“Freshmen’s Guide”** for tips on that.

Overview of the A&R Program

- Started in 2019 and course contents updated in 2020 (new courses are being added every year)
- The master's program Automation and Robotics is **research-oriented**. The goal of the degree course is to impart to students the necessary technical knowledge, skills and methods in the specialist field of robotics and automation, taking into account the demands of working life in such a way that successful students are enabled to carry out and evaluate complex engineering activities independently and with responsibility. In addition the degree course is laid out to form the scientific basis for a possible subsequent doctorate [from §2 of [Examination Regulations](#)].
- Read the [Examination Regulations](#) when you get the chance.
- **30 CP** Mandatory + **6 CP** General Education, **45 CP** Electives, **12 CP** Semester Project, **30 CP** Thesis
- You can find all the documents and information on the ETIT website:



Important Points of Contact

- Dipl.-Ing. Dipl.-Kfm. Ralf Burda - **Course Coordinator** for Automation & Robotics
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 - Tel.: +49 231 755 4514
 - Otto-Hahn-Straße 6, Room C1-04-102
 - Fax: +49 231 755 6136
- apl. Prof. Dr. Frank Hoffman - **Curriculum Coordinator** for Automation & Robotics
 - Lehrstuhl für Regelungssystemtechnik (RST)
 - Mail: frank.hoffmann@tu-dortmund.de
 - Tel.: +49 231 755 3998
 - Address: Otto-Hahn-Straße 8, Raum 211
- Prof. Dr. rer. nat. habil. Christian Wöhler - **Head of A&R Program** and **Chair** of the Board of Examinations
 - Arbeitsgebiet Bildsignalverarbeitung
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 - Address: Otto-Hahn-Straße 4, 44227 Dortmund, Physikgebäude 1, Raum P1-04-211
- Maja Schäfer - **Examinations Office Contact** for Automation & Robotics
 - TU Dortmund Administration
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 - Tel: +0231 755 -2079
 - Address: Emil-Figge-Strasse 61, room U03

Mandatory Courses

1. Semester
Advanced Engineering Mathematics Mandatory Course 6 Credits
Control Theory and Applications Mandatory Course 6 Credits
Computer Systems Mandatory Course 6 Credits
Modeling and Control of Robotic Manipulators Mandatory Course 6 Credits
Scientific Programming in Matlab Mandatory Course 3 Credits
General Education 1* 3 Credits

- 30 Credits total
- The busiest semester
- There is no requirement to finish all courses in the first semester, if you don't mind extending your studies
- General Education is Language Elective - German A1.1
- **Cannot** fail an exam more than **twice** [**\$14** [Examination Regulations](#)]

Elective Courses

2. Semester	3. Semester
Elective Classes in total 45 Credits, at least 30 Credits in the selected major field of study (Process Automation, Robotics, Cognitive Systems)	
Project Group* 12 Credits	
General Education 2* 3 Credits	

Overview

- 45 Credits total
- 30 credits has to be from the “Specialization”
- Depending on the courses, 5–9 elective modules have to be completed.
- There is no requirement for taking 30 credits every semester, the university recommends 20 credits per semester minimum.
- If you fail an exam **twice**, **rethink the next attempt** because you **cannot fail more than twice**. At this point talk to the professor on how to prepare better or change the elective(optimal strategy).

Specializations

- Each subject is part of a “Major Field of Study” or specialization and students have to take 30 credits in one of them.
- Major Field of Study include: **Robotics [R]**, **Cognitive Systems [CS]** or **Process Automation [PA]**
- Look at the [Exam Regulations](#) and the [Electives](#) page.

Faculty of Elective Subject	Subjects
Electrical & IT [ETIT]	Scheduling Problems and Solutions, 3D Computer Vision, Mobile Robots, Networked Mobile Robot Systems, Machine Learning in Robotics, Smart Grids, Hardware Software Codesign, Distributed and Networked Control, Practical Distributed Optimization in Julia, Remote Sensing, Optimal Power Flow Problems, Mobile Radio Networks I, Mobile Radio Networks II, Embedded Autonomy, Online Problems, Nonlinear Model Predictive Control, Mobile and Pervasive Computing, Machine Learning and optimal Control
Process Systems [BCI]	Process Automation, Data-Based Dynamic Modeling, Logic Control, Dynamic Models, Logistics of Chemical Production Processes, Single-Loop and Multi-Loop Controller Design, Machine Learning Methods for Engineers, Advanced Process Control, Batch Process Operation, Process Performance Optimization
Informatics [IF]	Computer Vision, Cyber-Physical System Fundamentals, Computational Intelligence, Real-Time Systems and Applications
Mathematic [MA]	Aspects of Mathematical Modeling, Mathematical Simulation Techniques,
Mechanical [MB]	Application of Robots
Statistics [ST]	Statistics for Researchers in Engineering Sciences

Semester Project

2. Semester

3. Semester

Elective Classes

in total 45 Credits,
at least 30 Credits in the selected major field of study
(Process Automation, Robotics, Cognitive Systems)

Project Group*

12 Credits

General Education 2*

3 Credits

- Semester project is offered both in Winter Semester & Summer Semester (from experience the variety of offers are less in summer)
 - Recommended officially to do in the 3rd semester
 - Requires you to work on a practical problem with team members and come up with a R&D solution.
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- Consider it a precursor to the Thesis, so if you enjoyed working with the chair or faculty you can continue your thesis with them.
 - Worth **12 CP** and **graded Pass or Fail** i.e. there is no grade and will not affect GPA.
 - Look at the [Exam Regulations](#) under §6 - §8

Thesis

4. Semester

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30 Credits

- Doing thesis is pretty much like being a cowboy in the wild west: anything goes.
 - Make sure to pay attention to what fields you enjoy/dislike since day 1 so you don't make the wrong choice in topic.
 - Don't let badly organized courses discourage you a particular field. A good engineer learns from everything and everyone around him/her.
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- The university recommends that you do a "Research Thesis" with the research groups at university. This is great if you want to do a Phd.
 - If you want to do a "Industrial Thesis", things are a bit trickier, start preparing for that a year before your thesis, Find a good thesis project and approach different professors and research groups to try to do an "Industrial Thesis" because it's always done in partnership with the TU.
 - Doing a job as a "werkstudent" or doing a "praktikum" (internship) during studies will boost your chances at an industrial thesis.

Overview of Systems

1. [LSF](#)(Lehre Studium Forschung): LSF stands for Lehre Studium Forschung ; this is the portal used to register for your classes.
2. [ZHB](#): The ZHB portal is used to register for the language courses. Automation and Robotics students have to complete a mandatory 6 credits of language courses and this portal can be used for that.
3. [Moodle](#): Moodle is used for classroom material management and assignment submissions.
4. [BOSS](#): Boss is used to manage and register for Exams, generate Transcript of records, etc.

You can find detailed information on our “[Freshmens Guide](#)” that we have created. You can download it by scanning this QR code.



SCAN ME

Specialization: Motion Planning & Control

- Me
- Courses
- Labs and groups
- Planning
- Control
- General Advices
- Questions



ShehabEldin Housein

Twitter



LinkedIn



Who Am I?

- Started in Winter Semester 2020
- Robotics Specialization
- Mobile robotics motion planning and controls
- Currently working on my thesis in learning with optimal control for mobile robots
- Past Projects and Internship
 - Multi-robot formation control (KAUST)
 - Cooperative planning and Control using Distributed MPC (IE3)
 - Dynamic path planning and control (Node Robotics)

Courses

- Easy 1.0 (Mobile and Pervasive Computing, Networked Mobile Robots,)
- Classes to memorize (Mobile Robots, MCRM, Computer Systems)
- Tough but good (NMPC, CTA, APC, MLOC)

Labs and research groups

- RST (Robotics Algorithms, Some controls)
- DYN (Controls)
- IE3 (Controls)

Planning

- Global and local
- Search based
- Sampling based
- Optimization based

Control

- How many layers of control
- Path tracking
- Path tracking and low-level local planner

General Advices

- Take courses about optimization theory
- Get into a HiWi or work related
- Don't over do it
- Try to choose an area early
- What companies usually look at?
- Where is the Robotics Industry at in Germany? And what do they work on?

Specialization: Perception & Machine Learning

- Started in Winter Semester 2020
- Robotics, Perception & Machine Learning Specialization
- Past Projects: SfM reconstruction of antique statues, Industrial bin-picking, UAV grasping, robot localization with LIDAR.
- Semester Project: Stereo Reconstruction of Mars using Images from Perseverance Rover.
- Currently working on a internship in preparation for Thesis in Vision for Industrial Bin-Picking.

Recommended Courses for Specialization

Faculty of Elective Subject	Subject	Specializations
Informatics [IF]	Computer Vision	R, CS
Electrical & IT [ETIT]	3D Computer Vision	R, CS
Electrical & IT [ETIT]	Remote Sensing	R, CS
Electrical & IT [ETIT]	Machine Learning in Robotics	R, CS
Process Systems [BCI]	Machine Learning Methods for Engineers	R, CS, PA
Electrical & IT [ETIT]	Mobile Robots	R, CS
Electrical & IT [ETIT]	Networked Mobile Robot Systems	R, CS
Process Systems [BCI]	Machine Learning and optimal Control	R, PA

Courses at RUHR
University



Note: You can also take courses from [RUHR university bochum](#).

You need to send an email to [Prof. Christian Wöhler](#) for pre approval and then, you can take the course, pass it and inform Prof. Wöhler and the exams office to have it in your transcript. Seats are limited so be fast to register for certain courses.

Research Groups

- **Signal Processing Chair** ([BV](#)) at ETIT Faculty
 - Remote sensing, 3D reconstruction, Pattern classification, Remote measurements & testing
- **Computer Vision Chair** at Computer Science Department
 - Computer vision, Pattern recognition, Human-Machine Interaction, Smart Environments
- **Chair of Computer Graphics** at Computer Science Department
 - Computer graphics, Geometry processing, Intelligent sensing, 3D scanning etc.
- **Chair for Material Flow and Logistics** ([FLW](#)) at Mechanical Faculty
 - Vision and deep learning for Bin picking, Automated robo-logistics, Warehouse activity detection etc.
- **Chair for Artificial Intelligence** at Computer Science Department
 - Statistical learning, Computational intelligence, Clustering algorithms, Distributed computing

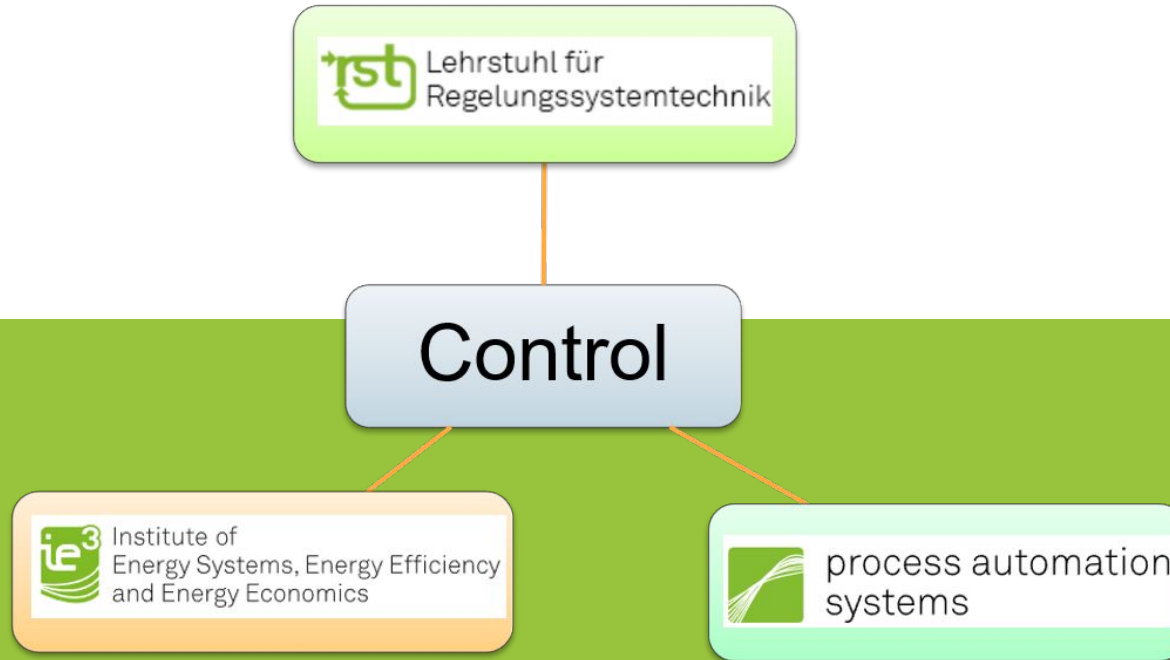
Job Outlook and General Advices

- Computer vision and Machine Learning is rapidly expanding field
 - Many different applications in multiple industrial areas: Logistics, Medical industry, Mobile Robotics, Autonomous Driving, Space exploration, Data analytics, Banking etc.
 - A lot of jobs in Dortmund and Germany but **mainly concentrated** in:
 - Stuttgart
 - Berlin
 - Munich
 - Hamburg
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- Machine Learning and Computer Vision engineers should have no problems finding a job in general, but it is always good to keep updated with the industry and see the trends.
 - AI and ML have become buzzwords, not everyone in the industry is implementing SOTA stuff.
 - **Always remember:** Good engineers learn at university, great engineers learn by building.

Specialization: Process Automation, Control & Optimization

- Started in Winter Semester 2020
 - Specialization: Robotics, Systems and control theory
 - 3 years professional experience in process automation
 - Model predictive control, optimization and distributed control
 - Currently working on my thesis in Data driven predictive control (DeePC)
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- Past projects:
 - Data driven modelling and controlling of flexible robotic link arm
 - Multi-stage model predictive control
 - Deep learning based control of double inverted pendulum

Specialization: Process Automation, Control & Optimization



Courses offered by PAS



process automation
systems

- Control theory and applications – Mandatory
- Logic control (3 ECTS) + Process automation lab (2 ECTS)
= Process automation (5 ECTS) (Mandatory for stream - PA)

- Dynamic models
- Data based dynamic modelling
- Single loop and multi-loop controller design
- Advanced process control
- Process performance optimization
- Machine learning methods for engineers
- Batch process operations
- Logistics of chemical production processes

Courses offered by ie3

- Distributed and network control systems
- Nonlinear model predictive control
- Practical distributed optimization by Julia
- Machine learning and optimal control
- Optimal flow problems
- Smart grids

Control concepts in *RST* offered courses

- Modelling and control of robotic manipulators (mandatory)
- Mobile robots

Research opportunities

PAS – Process automation systems

- Machine learning, control and optimization
- Robust MPC
- ML for data based modelling

ie3 – Optimization & control

- Data driven predictive control
- Stochastic predictive control
- Control of network systems
- Distributed optimization
- Nonlinear model predictive control

PAS – Process dynamics & operations

- State estimation
- Scheduling for chemical batch process
- Robust MPC – tube based

- HiWi jobs
- Oberseminar - small talk on a research paper

Job opportunities

- Automation jobs – related to PLC, DCS and SCADA in the field of robotic manipulators and process industries
- Ruhr region is surrounded by various process industries, chemical and pharmaceutical industries
- Machine learning and optimization based jobs
- Autonomous driving – MPC related control {research domain}
- MPC / ML based control related research jobs
- BCI department of TU Dortmund is famous in Germany and Europe, with various industry projects and European Union / German - govt research projects are being carried out by the respective chairs

Design Competition Kickoff

Sign up form



- We want to encourage creativity with a “Design Competition” by the Fachschaft
- The goal is to come up with sweatshirt and hoodie design ideas for the fachschaft as well as any other cool merchandise ideas you can think of (coffee mug, beer opener, keychain etc.)
- Send in your proposals by October 31st and 3 winners will be announced by November 15th.
- The winners will have prizes of course.

These are the rules for the designs:

- 1. The design of the merchandise should contain the Fachschaft logo**
- 2. The design has to be in the TU Dortmund-themed colours (2 shades of Green, White, and Black)**
- 3. It cannot contain the TU Dortmund logo or emblem due to copyright issues**

For simplicity's sake let's say we only want t-shirts/sweatshirts in the colour Black.

- You will receive an email with the detailed information

Fachschaft Contact

- You can contact us ([contact form](#)) if you have any **specific** questions:
 - [Instagram](#)
 - [Website](#)
 - [Email](#)
- Our website contains all the contact information you need.
- Most questions can be solved from our [FAQs](#), [Freshmen Guide](#) and the Faculty Websites.

Website



Joining Fachschaft

- It is recommended for Fachschaft members to complete at least 1 semester before joining but exceptions are welcome.
- You can participate by joining the student council chair and actively influencing the Fachschaft decisions.
- You can contact us directly by email or through our [Website](#) if you would like to join.