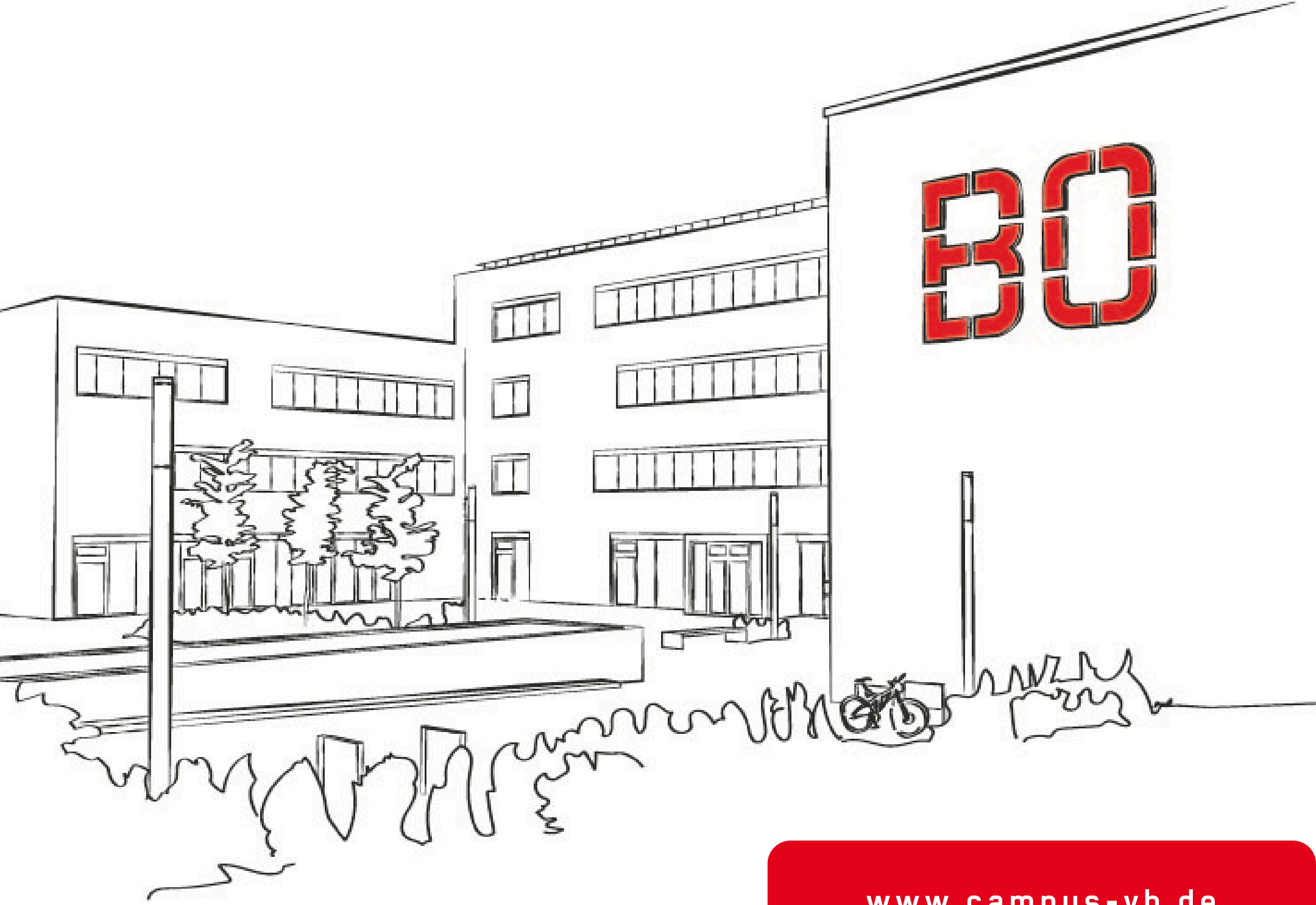

www.campus-vh.de

Research & Development

Campus Velbert/Heiligenhaus

Key activities and fields of interest

Bochum University of Applied Sciences
TECHNOLOGY BUSINESS HEALTH

“No progress without innovation”

PREFACE

Prof. Dr.-Ing. Markus Lemmen

Campus Spokesperson

Campus Velbert/Heiligenhaus (CVH)

Dear Reader,

Since its founding in 2009, the Velbert/Heiligenhaus Campus has been an innovative and committed partner to the local business community. The strong collaboration with our students and partner companies demonstrates the immense potential of cooperative projects with the regional economy and how much we can mutually benefit from one another. Joint projects provide the opportunity to transform interesting, application-oriented development work at CVH into successful and competitive products. We would love to further expand our research and development work with you, strengthening the region as a hub for research and business together. We bring all of our expertise to this mission.

In this brochure, we have compiled the research and work areas of the campus professors to give you a quick overview. Please feel free to contact us directly if you have ideas or see challenges you would like to tackle together with us!

Sincerely yours

Markus Lemmen

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Applied Computer Science & Mathematics

Prof. Dr. rer. nat.
JÖRG FROCHTE

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MAIN AREAS OF WORK AND INTEREST

- Applied AI and machine learning
- Green AI and continual learning
- Responsible and trustworthy AI
- Educational data mining and learning analytics

RESEARCH GROUP NETWORK (EXCERPT)

- Member of the Doctoral School for Applied Research in North Rhine-Westphalia, Department of Computer and Data Science
- Member of the steering committee and founding member of the Interdisciplinary Institute for Applied Artificial Intelligence and Data Science Ruhr
- Associate member of the Interdisciplinary Center for Machine Learning and Data Analytics at the University of Wuppertal

PROJECTS (EXCERPT)

- 2024–2027: CoFill, AI-based solutions for a sustainable and efficient circular economy;
  partner: Zolitron
- 2024–2027: JetsKI, AI-based modelling for waterjet milling of difficult-to-machine materials;
  partners: HydroMill and AixPath

Applied Electronics & Electrical Engineering

Prof. Dr.-Ing.
MOHAMMAD ASHFAQ

Tel: +49 (0)2056 5848 7726
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MAIN AREAS OF WORK AND INTEREST

- Stochastic signal processing
- Applied control engineering
- Electric drives
- Drive train control and diagnostics
- Modeling of technical systems
- Simulation and HiL
- Applied signal and image processing
- Ultrasound signal and image processing

Autonomous Systems

Prof.
MICHAEL DANNER, Ph.D.

Tel: +49 (0)2056 5848 7724
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hs-bochum.de/en/cvh/autonomous-systems

MAIN AREAS OF WORK AND INTEREST

- Mobile Robotics and Autonomous Systems
- Sensors & Perception (RGB/depth cameras, LiDAR, point clouds)
- Machine Learning and Artificial Intelligence for Robotics
- Navigation, Mapping, and Localization (SLAM, multisensor fusion)
- Human-Machine Interaction and Collaborative Robotics
- Robot Operating System (ROS/ROS 2)
- Intelligent Technical Systems and Industry 4.0

RESEARCH AND DEVELOPMENT TOPICS

- Development of methods for safe human-robot interaction
- Autonomous mobile systems for logistics, healthcare, and manufacturing
- AI-based object recognition and environmental modeling
- Adaptive control and planning methods for dynamic environments
- Integration of robotics into smart factory & Industry 4.0 concepts

COLLABORATION OPPORTUNITIES

- R&D Projects in the fields of robotics, AI and automation
- Support for the implementation of autonomous systems in business processes
- Theses and project work with practical relevance

Business Informatics

Prof. Dr.
OLIVER SCHNEIDER

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MAIN AREAS OF WORK AND INTEREST

Enabling business through IT systems

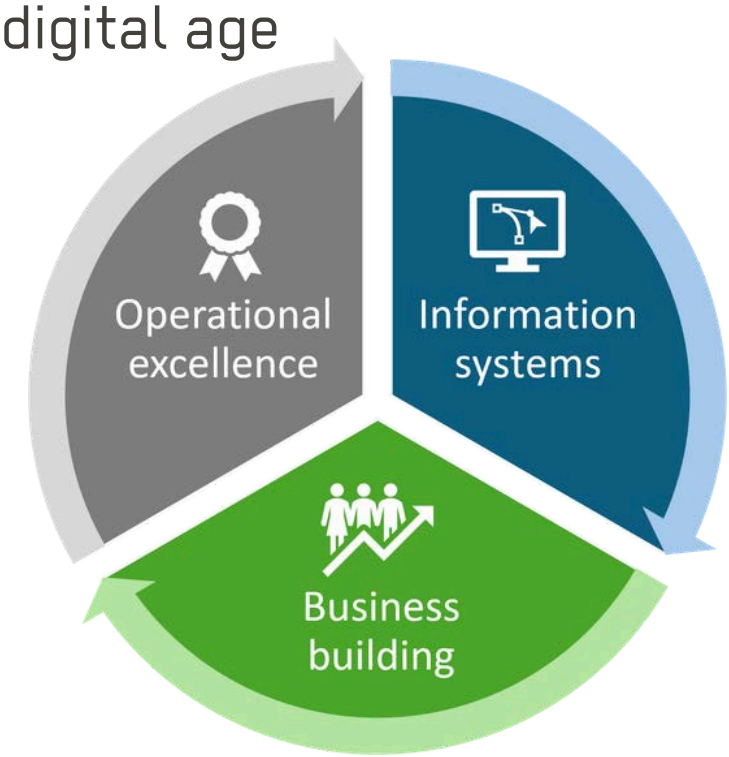
- ERP systems: backbone of integrated business operations
- BI & analytics: insight-driven decision making
- Smart automation: AI and workflow optimization

Building the (digital) businesses of tomorrow

- Corporate entrepreneurship & internal ventures
- Launching and scaling (digital) startups
- Design thinking, ideation & prototyping

Driving operational excellence in the digital age

- (Agile) project & portfolio management
- Change & transformation management
- Leadership sparring & strategic problem solving



Construction and CAE

Prof. Dr.-Ing.
GREGOR STEINBERGER

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MAIN AREAS OF WORK AND INTEREST

- Computer-Aided Analyses
- Gearbox Design
- Strength Analysis of Gear Stages
- Load Distribution Analysis in Gear Meshing
- Gear Optimization
- Service Life Calculations for Bearings, etc.

COLLABORATION OPPORTUNITIES

- Vibration resistance testing of components
  using a hydropulsator
  up to +- 250 kN (frame)/+- 50 kN (piston) dynamic rated load,
  up to 150 mm (+- 75 mm) piston stroke
- Consulting services in the field of gears and gearboxes

Controls and Automotive Systems

Prof. Dr.-Ing.
MARKUS LEMMEN

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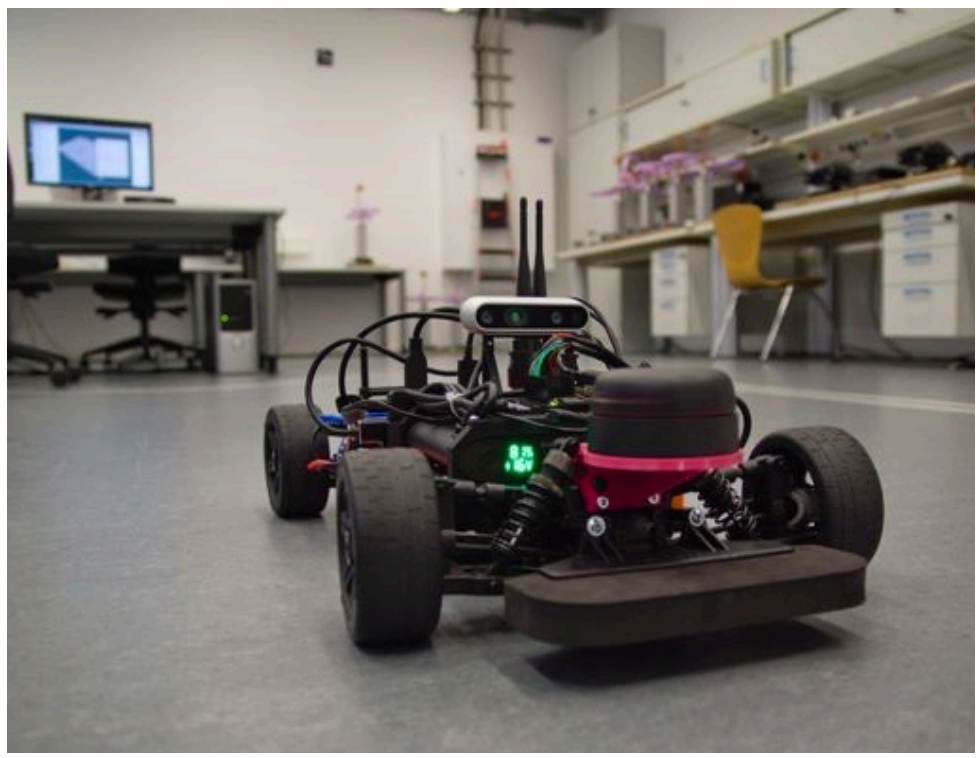
MAIN AREAS OF WORK AND INTEREST

- Control engineering & (non-linear and linear) system theory
- Vehicle dynamics & steering
- Automated driving & driver assistance technology
- Active chassis components & vehicle systems
- Subjective and objective driving tests
- Hardware-In-the-Loop HIL / XIL
- Modelling & Simulation
- (hydraulics)



Electronics and Signal Processing

Prof. Dr.-Ing.
DIETMAR GERHARDT

Tel: +49 (0)2056 5848 7719
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hs-bochum.de/en/cvh/electronics-signal-processing

MAIN AREAS OF RESEARCH AND INTEREST

- Development of novel sensor technology and measurement systems, capacitive sensors
- Digital image processing and object recognition (AI)
- Analog and digital circuit development

EQUIPMENT (Excerpt)

- High-resolution 3D measurement system, including for sensor measurement
- Cameras (thermal imaging, time-lapse, time-of-flight, stereo)
- Spectrometers
- Programming environments for microcontrollers (including Microchip Studio, PSoC Creator, MPLAB X IDE)
- FEM simulation for electric and magnetic fields

COLLABORATION OPPORTUNITIES

- R&D projects in the fields of image processing, sensor technology, robotics and AI
- Support for product development
- Optimization of production facilities
- Theses and project work with practical relevance

Embedded Systems

Prof. Dr. rer. nat.
PETER GERWINSKI

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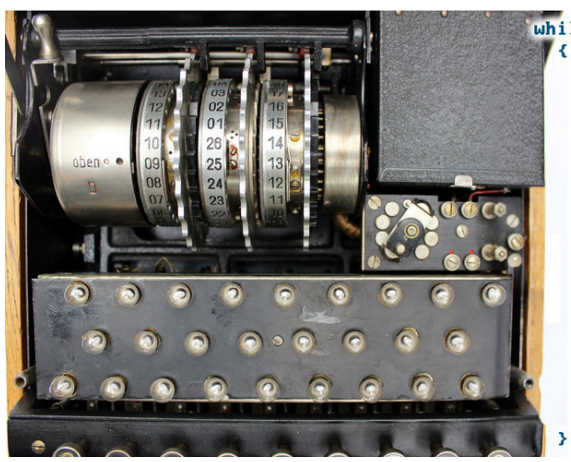
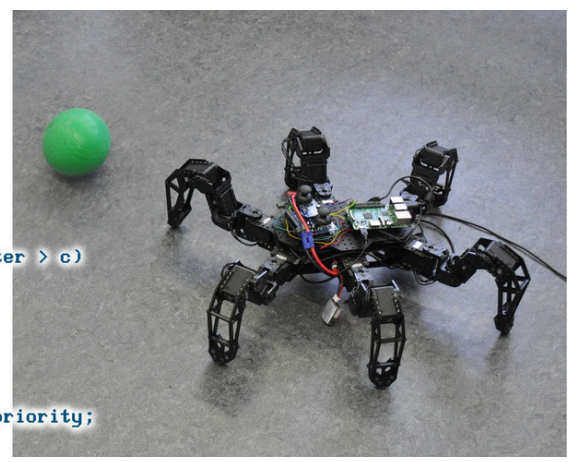
hs-bochum.de/en/cvh/embedded-systems

MAIN AREAS OF WORK AND INTEREST

- Hardware control
- Embedded systems
- Microcontrollers
- Computer security
- Encryption
- Data protection
- Free Software / Open Source
- Open interfaces
- Open standards
- Embedded Linux



```
while (1)
{
  c = -1;
  next = 0;
  i = NR_TASKS;
  p = &task[NR_TASKS];
  while (--i)
    {
      if (!*--p)
        continue;
      if ((*p)->state == TASK_RUNNING && (*p)->counter > c)
        c = (*p)->counter, next = i;
    }
  if (c)
    break;
  for (p = &LAST_TASK; p > &FIRST_TASK; --p)
    if (*p)
      (*p)->counter = ((*p)->counter >> 1) + (*p)->priority;
}
```



ICT Infrastructures and Services

Prof. Dr.-Ing.
SIMON RÜSCHE

Tel: +49 (0)2056 5848 7725
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hs-bochum.de/en/cvh/ict-infrastructures

MAIN AREAS OF WORK AND INTEREST

- Internet of Things
- Industry 4.0
- Networks and Protocols
- Network Quality Analysis / Traffic Engineering
- Mobile Communications (2G, 3G, 4G)
- Specialized Wireless Networks (Wi-Fi, RFID, NFC, TETRA, DECT, GSM-R)
- Smart Networks (Energy, Transportation, Healthcare, Logistics/Manufacturing)
- Unified Communications & Collaboration
- Contact Centers
- Internet in Rural Areas
- IT Service and Process Management
- ICT Business Model Analysis
- IT Risk Management
- Project Management
- Change Management

Industrial Automation and Smart Manufacturing

Prof. Dr.-Ing.
CLEMENS FALLER

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hs-bochum.de/en/cvh/automation-engineering

MAIN AREAS OF WORK AND INTEREST

- Intelligent automation
- Industrial IT
- Smart manufacturing
- IoT, cloud and digital twins
- Industrial communication (OPC UA, MQTT)
- Manufacturing IT (ERP, MES, AI assistance)
- Sustainable and inclusive manufacturing

COOPERATION OFFERS

- Research and development projects
- Consulting and workshops
- Training & Continuing Education

LAB EQUIPMENT

- CVH Learning Factory for Industry 4.0
- End-to-end connectivity from ERP to sensor

Mechanics and Vehicle Dynamics

Prof. Dr.-Ing.
STEFAN BREUER

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MAIN AREAS OF WORK AND INTEREST

Engineering Mechanics

- Structural Analysis
- Vibrations and Acoustics
- Functional Analysis and Optimization
- Expert Reports

Vehicle Dynamics

- Force and Motion Simulation
- Fuel Consumption Analysis
- Powertrain
- Expert Reports

Commercial Vehicle Engineering

- Structural Design
- Vehicle Dynamics
- Fuel Consumption Prediction
- Expert Reports

Physics and Materials

Prof. Dr.
HERBERT SCHMIDT

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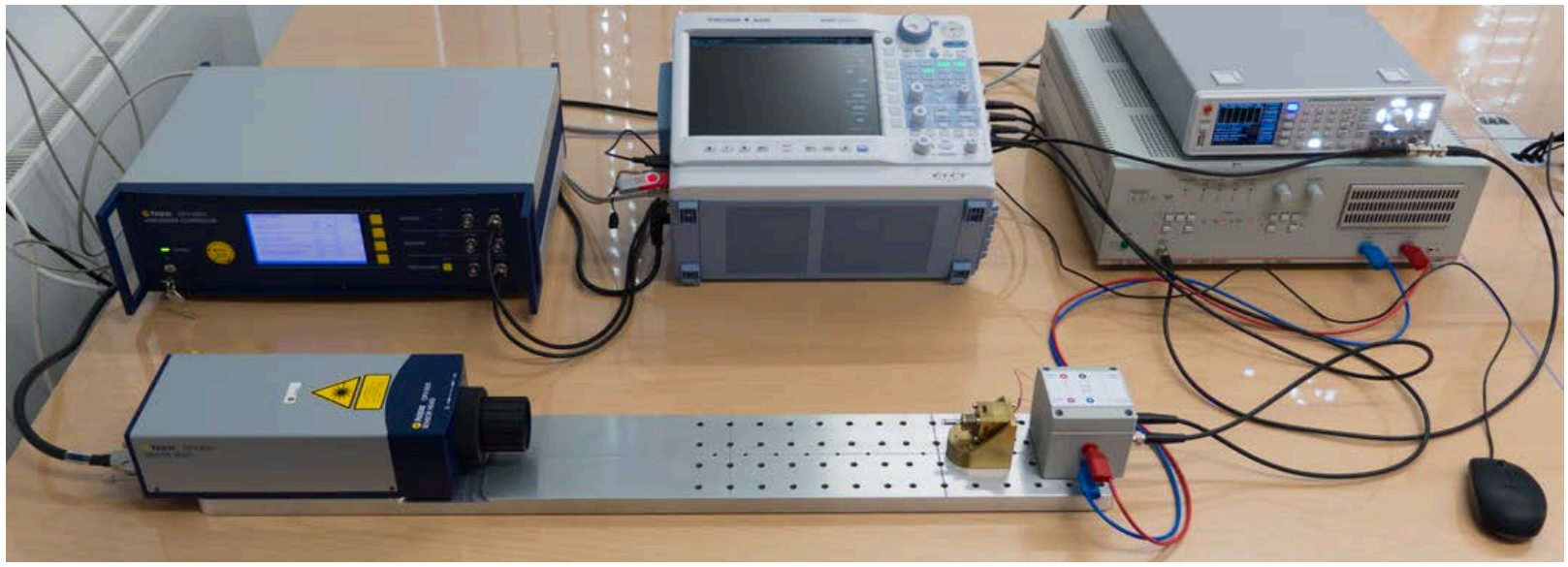
MAIN AREAS OF WORK AND INTEREST

- Magnetic system simulation (Modelica, FEMM)
- Selection, design and testing of linear actuators
- Magnetic materials (selection, specification and characterisation)
- Magnetic linear drives (solenoids, linear motors)
- Unconventional actuators (smart materials)



Software Engineering

Prof. Dr.-Ing.
CHRISTIAN WEIDAUER

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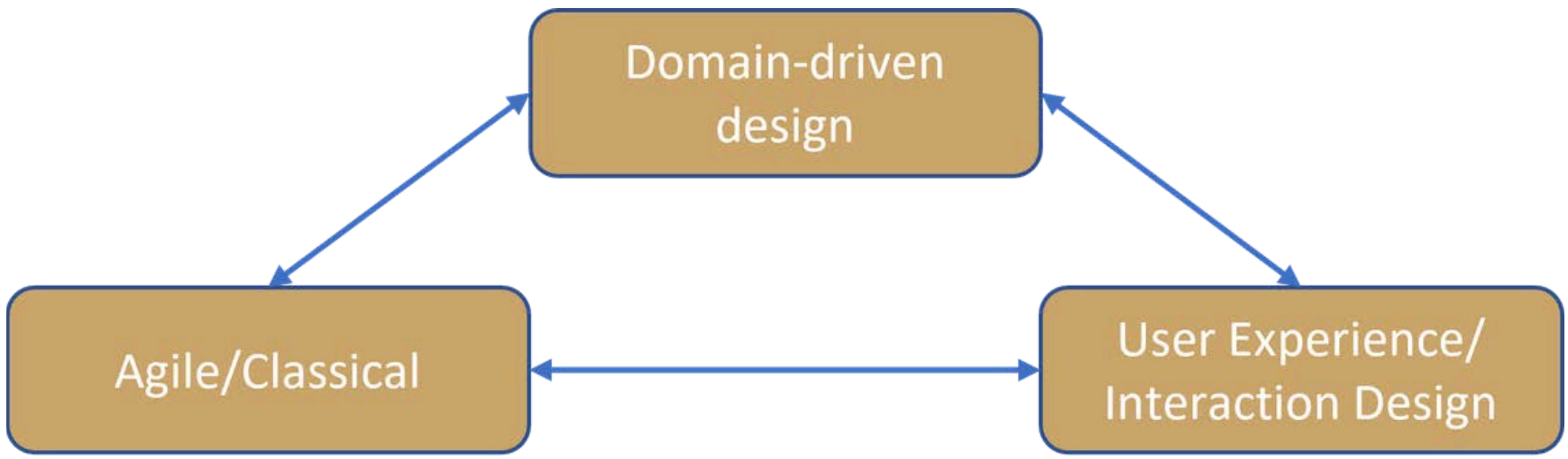
MAIN AREAS OF WORK AND INTEREST

- Requirements Engineering
- Model-based software development
- Domain-driven design (DDD)
- Usability Engineering
- CI/CD



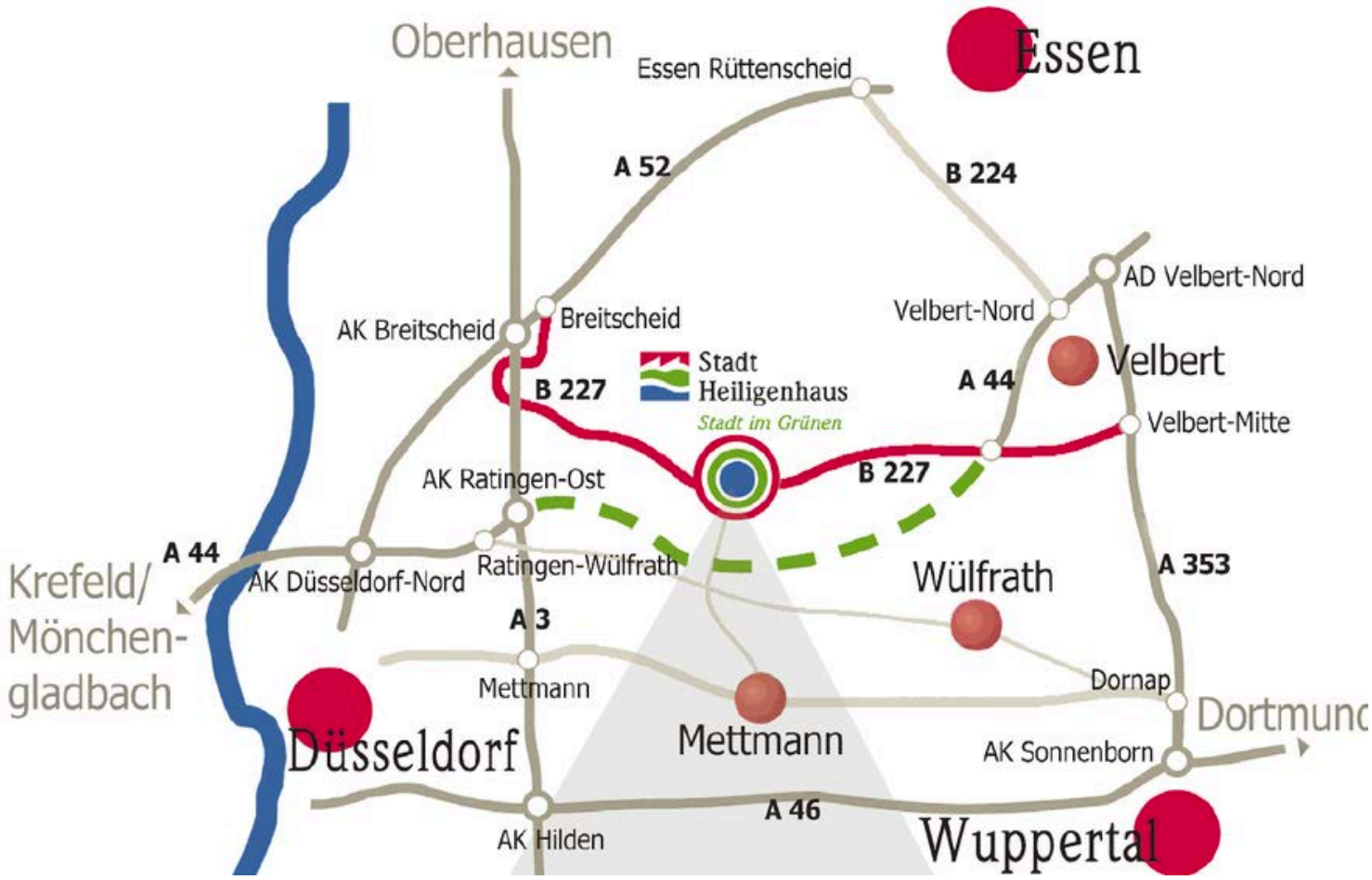
Campus Velbert/Heiligenhaus (CVH)

The CVH is part of Bochum University of Applied Sciences (Hochschule Bochum) and is located in Heiligenhaus. The campus maintains close ties with local businesses in the region, both in teaching and in research.

Around 300 study places are available across our engineering and computer science degree programmes. Many of these are offered as dual study programmes, combining an academic degree with practical, paid work experience at a partner company. Students can earn bachelor's and master's degrees. The languages of instruction are English and German.

https://www.hochschule-bochum.de/en/cvh

Learning and Researching in a modern and motivating environment



Hochschule Bochum
Campus Velbert/Heiligenhaus
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www.hochschule-bochum.de/en/cvh

Bochum University
of Applied Sciences
TECHNOLOGY BUSINESS HEALTH