



Research and development Campus Velbert/Heiligenhaus

Key activities and fields of interest



„NO PROGRESS WITHOUT INNOVATION“

PREFACE

Prof. Dr.-Ing. Markus Lemmen
Speaker of Campus Velbert/Heiligenhaus

Dear Reader,

Campus Velbert/Heiligenhaus (CVH) has been an innovative and active partner in the business community since its founding in 2009. The excellent interaction with our students and our cooperating companies shows us how much potential there is in cooperation projects with the economy and how much we can benefit from each other. Joint projects offer the opportunity for interesting and creative application-oriented development work at CVH to produce successful and competitive products. We would like to expand internationally the research and development work together with you. We contribute to this task with all our competences.

In this brochure, we have therefore put together the fields of interest of the professors on the campus to give you a quick overview. Feel free to contact us directly if you have ideas and are looking for challenges that you want to tackle together with us!

Sincerely yours

Markus Lemmen

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APPLIED ELECTRONICS & ENGINE CONTROL SYSTEMS



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FIELDS OF INTEREST

- **Control of Internal Combustion Engines**
 - * Air-/Fuel Ratio Control and Diagnostics
 - * Closed Loop Stochastic Control of Spark Advance
 - * Engine Control and Diagnostics for Combined Heat and Power Unit
 - * Oil Monitoring
 - * Fuel Ingress Monitoring in CI Engines
- **Applied Control Engineering and Stochastics**
 - * Concept Development and Validation
 - * Function Development and Software Engineering
 - * Analysis and Optimisation
- **Simulation and HIL-Systems**
- **Biomedical Engineering**
 - * Ultrasound based Imaging for Medical and Technical Applications
 - * Ultrasound Transmission Tomography
- **Signal and Image Processing**

APPLIED COMPUTER SCIENCE & MATHEMATICS



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FIELDS OF INTEREST

- application of data mining, especially on
 - * educational data bases and
 - * simulation data and in engineering,
- machine learning, especially in robotics and games



SELECTED PAPERS

- **Success Prediction System for Student Counseling Using Data Mining**, joint work with I. Bernst, published in the Proceedings of the 8th KDIR 2016, Nov. 2016 in Porto, Portugal, pages 181-189, INSTICC, ISBN 978-989-758-203-5
- **Simulation Data Mining for Supporting Bridge Design**, joint work with S. Burrows, B. Stein, D. Wiesner and K. Müller, published in AusDM 2011, Ballarat, Australia, p. 71-79, Dec. 2011, ACM, ISBN 978-1-921770-02-9
- **Learning Overlap Optimization for Domain Decomposition Methods**, joint work with S. Burrows, B. Stein, Michael Völske and Ana Belén Martínez Torres, published in the 7th PAKDD 2013, vol. 7818 of LNAI, pages 438-449, Gold Coast, Australia, April 2013. Springer.
- **Modelica Simulator Compatibility - Today and in Future**, Proceedings of the 8th International Modelica Conference, Dresden, March 2011, published in Linköping Electronic Conference Proceedings, Issue: 63, p. 812-818, ISBN:978-91-7393-096-3

AUTOMATION ENGINEERING



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FIELDS OF INTEREST

- Industrial Automation
- Industrial IT
- Smart Production

RESEARCH AND DEVELOPMENT TOPICS

- IOT, Cloud Systems and Cyber-Physical Production Systems
- Industrial Communication (Ethernet, OPC-UA, MQTT)
- IT systems in production (ERP, MES, simulation, PLM, etc.)

COOPERATION OFFERS

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

LAB EQUIPMENT

- Learning Factory with Industry 4.0 Production System
- Holistic industrial system approach from ERP to the sensor

AUTONOMOUS SYSTEMS AND HUMAN-MACHINE INTERACTION

N.N.

APPEAL PROCESS CURRENTLY UNDERWAY

PLANNED MAIN AREAS OF WORK:

AUTONOMOUS SYSTEMS

HUMAN-MACHINE-INTERACTION

ROBOTICS

ROBOTIK

COMPUTER TECHNOLOGY

ROBOT OPERATING SYSTEM (ROS)

INDUSTRY 4.0

BUSINESS INFORMATION SYSTEMS



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FIELDS OF INTEREST

- Industrial Project Management
 - * according to standards of International Project Management Association (IPMA)
 - * traditional, agile and hybrid management approaches
 - * socio-technical aspects as communication, stakeholder management, change management
 - * Risk management
 - * Project portfolio management
- Business Process Modelling & Optimization
- Integrated Industrial IT systems in Sales, Engineering, Logistics and Supply Chain Management
 - * Enterprise Resource Planning Systems
 - * Product Lifecycle Management Systems and variant configuration
 - * Supply Chain Management systems
 - * Integration of industry 4.0
 - * Integration of technical and organisational issues

CONSTRUCTION & CAE



**Prof. Dr.-Ing.
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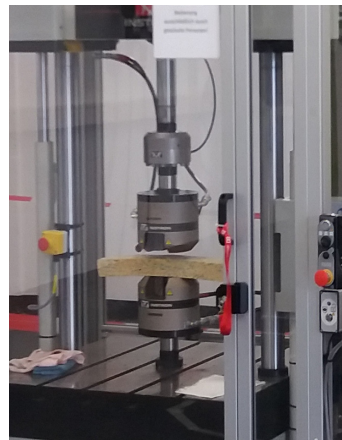
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RESEARCH

- Examination of the fatigue strength for finite life and infinite life of structural mechanical parts or material samples with dynamic testing devices

FIELDS OF INTEREST

- Dimensioning of gears and gearboxes
- Geardesign calculations, e. g. load carrying capacity etc. with state of the art tools
- Load distribution in gears



CONTROLS & AUTOMOTIVE SYSTEMS



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FIELDS OF INTEREST

- Controls
- (Nonlinear and linear) Systems Theory
- Vehicle Dynamics & Steering & Active Suspension
- Driver Assist Technologie & Automated Driving
- Subjective und objective Testing
- Hardware-In-the-Loop HIL / XIL
- Simulation
- Hydraulics



Foto: Blazy / Schlüsselregion e.V.

ELECTRONICS & SIGNAL PROCESSING



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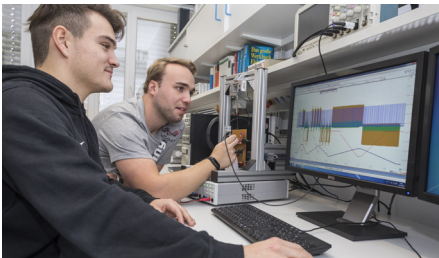
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FIELDS OF INTEREST

- Sensors and Measurement Systems
- Digital Signal Processing
- Pattern Recognition
- Analog and Digital Circuit Design

EXPERIMENTAL CAPABILITIES

- High resolution 3D measurement system et. al of testing sensors
- IDE for microcontrollers (Atmel Studio, PSoC Creator)
- FEM program for electrical and magnetic fields
- Fully equipped electronics laboratory



RESEARCH AND DEVELOPMENT

- Development of novel sensor and electrical measurement systems
- Methods of pattern recognition

RESEARCH PROJECTS (SELECTION)

- Methods of detecting surfaces (patented), 2018
- FEM simulation of a locking device (patented), 2015
- Development of a sensoric system of a punch (patented), 2012
- Energy measuring system of electrical lock systems, 2011

EMBEDDED SYSTEMS



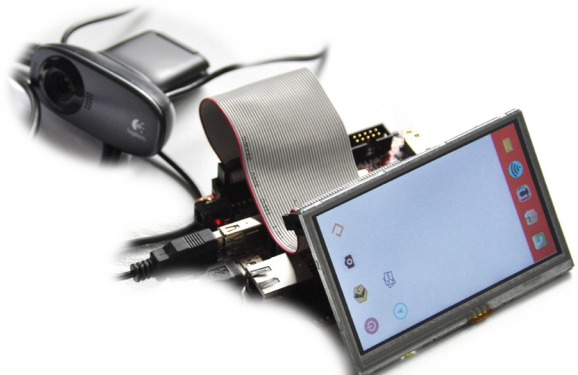
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FIELDS OF INTEREST

- Hardware Drivers
- Embedded Systems
- Microcontrollers
- Information Security
 - * Applied Cryptography
 - * Privacy
- Free Software / Open Source
 - * Open Interfaces
 - * Open Standards
 - * Embedded Linux



ENGINEERING MECHANICS & CONSTRUCTION



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FIELDS OF INTEREST

- Engineering Mechanics
- Vehicle Dynamics
- Commercial Vehicles
- Strain Gauge Measurement

PHYSICS & MATERIALS



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FIELDS OF INTEREST

- Selection, design and testing of linear drives
- Magnetic materials (selection, specification and characterization)
- Magnetic drives (solenoids, linear motors)
- Unconventional actuators (smart materials, smart actuators)

EXPERIMENTAL CAPABILITIES

Our laboratories are equipped for dynamic, contact-free recording of stroke vs. time characteristics:

- Modular laser vibrometer
- Velocity range: max. 10 m/s
- Displacement range: meters to nanometers

as well as for recording quasi-static force vs. stroke characteristics:

- Materials testing machine
- Force range: max. 20 kN (tensile and compressive loads)
- Accuracy of force measurement: 1 % of reading from 200 mN to 20 kN

In combination, the functional characteristics of linear drives may thoroughly be verified experimentally, and compared to design values.

RADIO & NETWORK ENGINEERING



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FIELDS OF INTEREST

- Digital Workplace
- Internet of Things
- Industry 4.0
- Networks and Protocols
- Traffic Engineering
- Mobile networks (2G, 3G, 4G, 5G)
- Professional Mobile Radio (PMR)
- Intelligent Networks
- Unified Communication & Collaboration
- Internet in Rural Regions
- IT-Services and Protocols
- Business Model Analysis ITC

SOFTWARE ENGINEERING



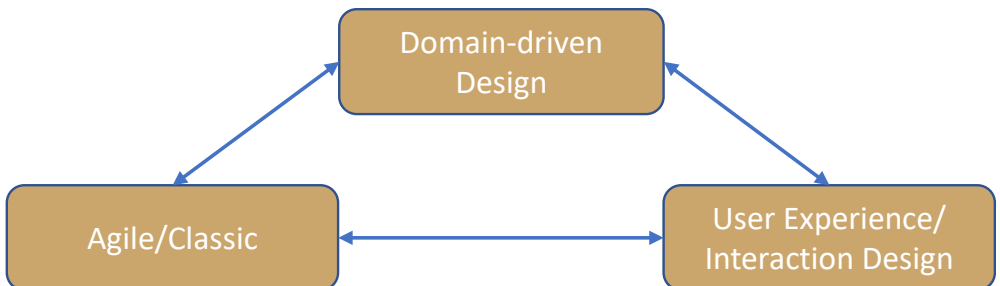
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FIELDS OF INTEREST

- Requirements Engineering
- Model-based Software Engineering
- Domain-driven Design (DDD)
- Usability Engineering
- CI/CD



CAMPUS VELBERT/HEILIGENHAUS



The Campus Velbert/Heiligenhaus (CVH) is part of the Bochum University of Applied Sciences (Hochschule Bochum). It was founded in 2009, receiving support from Schluesselregion e.V. (the Key Region – an association that comprises a cluster of companies, institutions and universities specialising in locks, security and door hardware), the cities of Velbert and Heiligenhaus, and the administrative district of Mettmann. There are around 300 places offered on technical courses of study and in computer science. Lots of these places are part of the German dual vocational education system, meaning that students graduate with both an academic degree and practical experience gained through an apprenticeship at a company.

The campus is part of department of Electrical Engineering and Computer Science at Bochum University of Applied Sciences and is also supported by the department of Mechatronics and Mechanical Engineering.



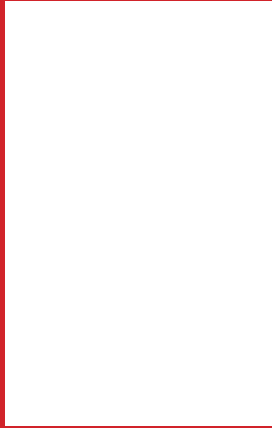
CAMPUS VELBERT HEILIGENHAUS: LEARNING AND RESEARCHING





IN A MODERN AND MOTIVATING ENVIRONMENT





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