Stephan **Düsterhaupt**

Graduated Mechatronics Engineer · Project Developer · Mentor

Institute for Process Technology, Process Automation and Measurement Technology | Theodor-Körner-Allee 16 | 02763 Zittau, Germany

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"Wow! It's technology."

Education & Work

Hochschule Zittau/Görlitz - University of Applied Sciences
Zittau, Germany

LECTURER | MENTOR · *July 2013 - present*

- Comprehensive instruction in specialist knowledge and practical experience
  in the lecture series Magnetic Bearing Technology, Sensor Technology and Fundamentals of Mechatronics.
- My credo: An engineer relies on four guiding forces – the mind (knowledge), the heart (passion), the gut (experience) and the thumb (intuition).
- Active recruitment of young talents for student thesis projects and my preliminary research initiatives.

Supervisor | Prof. Dr.-Ing. Frank Worlitz

Institute of Process Technology, Process Automation and Measurement Technology (IPM)
Zittau, Germany

MEMBER OF SCIENTIFIC STAFF · *April 2007 - present*

- Department Mechatronic Systems
- Design, modeling and dynamic simulation of mechatronic systems, especially active magnetic bearings
- Development of (international) projects with industry and public research institutions;
  Presentation of research results at international conferences (ISMB13/ISMB14/ISMB15)
- Design, construction and commissioning of a large-scale test facility for the testing of active magnetic bearings
  and backup bearings (Active Magnetic and Backup Bearing Test Facility MFLP)
- Technical project coordination (project volume 250,000 to 2.5 million euros, duration 1 to 3 years) as team leader

Supervisor | Prof. Dr.-Ing. Frank Worlitz

University of Technology Chemnitz
Chemnitz, Germany

GRADUATE STUDENT · *April 2010 - April 2015*

- Study of traction technology and magnetic bearing technology
- Study of power electronics

Institute of Surface Technology (IOT)
Zittau, Germany

MEMBER OF SCIENTIFIC STAFF · *June 2006 - March 2007*

- Preparation of a project outline and project description for a research project between the industry
  and the Zittau/Görlitz University of Applied Sciences
- Project was applied in the Central Innovation Program for Medium-sized Companies (ZIM);
  R&D subject was a device for the controlled incremental coating of test substrates for post-process analysis (CoatingWatch)
- Collaboration in the development of substrate layer composite systems using PVD technology

Supervisor | Prof. Dr.-Ing. habil. Rudolf Förster

Institute of Process Technology, Process Automation and Measurement Technology
Zittau, Germany

GRADUATE STUDENT (DIPLOMA) · *March 2005 - August 2005*

- Topic: Investigations concerning the Optimization of the Active Radial Magnetic Bearings for a Flywheel Storage System
- FEM analysis of the rotor dynamics with the determination of the bending shapes
- Investigation of the influence of the magnetic pull of the motor/generator unit on the operating behavior
- Optimization of the arrangement of the active radial magnetic bearings
- Optimization of the controller parameters and verification of the function of the active magnetic bearing
  using the dynamic rigidity method with the MLDyn simulation system

Supervisor | Prof. Dr.-Ing. Frank Worlitz

Institute of Process Technology, Process Automation and Measurement Technology *Zittau, Germany*

Internship

September 2003 - April 2004

- Topic: Creation of a Concept for the Alternating Operation of Two Kinetic Energy Recovering Systems
- Investigation of the potential of kinetic energy recovery systems (KERS) to homogenize the power performance duration curve and increase the reliability of the power supply
- Use of the KERS to support primary power sources in isolated energy grids
- Integration of a KERS in an energy grid from the perspective of the energy management
- Cost analysis/savings potential of the billing power
- Use of the KERS to maximize the yield of wind turbines; Suitability of the KERS to reduce the costs in energy-intensive industries

Supervisor	Prof. Dr.-Ing. Frank Worlitz

Hochschule Zittau/Görlitz - University of Applied Sciences *Zittau, Germany*

Graduate Engineer in Mechatronics, Robotics and Automation Engineering (Diploma)

September 2001 - December 2005

- Project Planning / Design / Simulation of Mechatronic Systems
- Electrical Engineering / Electronics, Electrical Machines, Measurement Technology, Control Engineering, Magnetic Bearing Technology, Process Communication, Sensor Technology, Robotics
- Construction / CAD, Machine Elements, Machine Dynamics

Bundeswehr *Brandenburg, Germany*

Obergefreiter

June 2000 - April 2001

- Military Service in the Signal Corps
- Commitment; Personality development to an extroverted character; Discipline and focus on the essentials; Direct structures and clear statements; Unconditional will to accomplish missions
- Temporary assumption of responsibility for daily tasks in maintenance (formal recognition); Temporary leadership of comrades on guard duty (deputy guard)
- Maintenance and servicing of communication equipment

Project Experience

Industrial R&D

Investigation of a Radial Backup Bearing for the Use in Machines with Magnetic Bearings *Germany*

Team Leader | Member of Scientific Staff

2015 - 2016

- Backup bearing solutions are a critical component of magnetically levitated machines, ensuring rotor support and guidance during standstill or in the event of active magnetic bearing malfunctions.
- For an industrial partner, the design of a high-performance radial rolling bearing – featuring a cageless architecture, ceramic rolling elements and increased bearing clearance – was verified.
- Key parameters, including track temperatures and the kinematics of the rolling elements (displacement, velocity and acceleration), were captured through precision measurements. To enable this, the bearing was instrumented immediately upon delivery.
- At the MFLP test facility, the bearings underwent rigorous load testing at varying rotational speeds and drop heights, assessing wear behavior such as progressive spring characteristics.
- The product is deployed in demanding industrial applications, including magnetically levitated gas compressors.

Partner	Schaeffler Technologies AG & Co. KG
Keywords	Backup Bearing Systems, Magnetically Levitated Machinery, Rolling Bearing Design and Testing, High-Precision Instrumentation and Measurement
Skills	Team lead, Sensor technology, AMB Design, Rotor dynamics

Manufacturing, Commissioning and Calibration of alpha-beta Filter Assemblies *Germany*

Team Leader | Member of Scientific Staff

2013

- Alpha-beta filters are a streamlined alternative to Kalman filters and are used to detect errors and malfunctions in active radial magnetic bearings.
- For an industrial client, production-ready technical documentation was created based on a pre-series circuit design. The assemblies were manufactured in close technological collaboration with a local company.
- The project was successfully completed with commissioning, calibration and comprehensive documentation. The product was deployed in magnetically levitated gas compressors—first as a mobile solution and later as a permanent installation.

Partner	Siemens AG, Drive Technologies Division, Erlangen
	INNOTAS GmbH
Keywords	Alpha-Beta Filter, Magnetic Bearing Systems, Circuit Design for Manufacturing (DFM), Calibration, Commissioning, Frequency Response
Skills	Mechatronics, Circuit Design, PCB Design, Filter Design

Development of a Lubricant-free Industrial Steam Turbine (SFDT)
MEMBER OF SCIENTIFIC STAFF

Germany

January 2007 - January 2018

- Conception, design, construction and testing of an industrial steam turbine equipped with magnetic bearings
- The project aimed to develop innovative magnetic bearing concepts for industrial applications, particularly under extreme conditions in steam turbines.
- R&D efforts focused on analyzing the dynamic behavior of an active magnetic bearing concept (AMBC) to assess its feasibility in such environments. Key aspects included split magnetic bearings (stators with a horizontal partial gap) and a cooling system for rotor-side laminations and air gaps.
- The work involved modeling, dynamic simulations and experimental validation at the SFDT test facility. Simulation results were cross-verified through physical testing, confirming that a fully magnetically levitated industrial steam turbine is viable under extreme conditions.
- The development culminated in a 10 MW magnetically levitated feed pump drive turbine, successfully tested in continuous operation at a large thermal power plant.

Partner	Siemens Energy Global GmbH & Co. KG - Turbinenwerk Görlitz
	EAAT GmbH Chemnitz
Keywords	High-power Turbomachinery, Magnetic Bearings, Design Verifivation, MADYN 2000
Skills	Rotor Dynamics, Modeling and Simulation

PUBLIC R&D

Economic Energy Storage Solutions within the Energy Policy Quadrangle (Power4Life)
PROJECT DEVELOPER | TEAM LEADER | MEMBER OF SCIENTIFIC STAFF

Germany

April 2022 - October 2023

- Topic: Economic Storage Solutions in the Context of the Energy Policy Quadrangle and Intelligent Energy Infrastructures (Power4Life)
- Transmission and distribution grids, as well as specific grid segments like local grids and railway power systems, can be stabilized using storage power plants. The question is no longer whether energy storage is needed, but rather where within the grid it should be deployed, with what capacity and power rating.
- High-speed flywheel energy storage systems (FESS) are particularly well-suited as short-term storage solutions, enabling critical grid services such as qualified primary frequency regulation.
- A feasibility study was conducted to assess their potential. The results confirm both the technical and economic viability of the approach. The study also included dynamic simulations of storage units interacting with an electrical power grid.
- The findings clearly demonstrate that FESS can provide highly dynamic compensation for both positive and negative residual loads.

Partner	Technická univerzita v Liberci – Fakulta mechatroniky, informatiky a mezioborových studií
	Technická univerzita v Liberci – Ekonomická fakulta
Keywords	Flywheel Energy Storage Systems (FESS), Grid Stabilization and Frequency Regulation, Feasibility Study, Dynamic Grid Simulation
Skills	Team Lead, Modeling and Simulation, AMB System Design

Lightweight Functional Structures for Efficient Energy Supply & Storage (LuE)
PROJECT DEVELOPER | TEAM LEADER | MEMBER OF SCIENTIFIC STAFF

Germany

May 2021 - present

- Topic: Functionally Integrated Lightweight Structures for Efficient Energy Supply and Storage (LuE)
- Ensuring a reliable energy supply is a core responsibility of power plant and grid operators. High-speed flywheel energy storage systems (FESS) are well-suited for stabilizing electrical grids, while large-scale power conversion in conventional power plants remains a critical topic.
- This project addresses both challenges by developing a fiber-reinforced turbine blade for high-performance applications.
- Both technologies leverage functionally integrated lightweight design as a bridging technology, enabling high energy storage and power density with compact, lightweight components.
- As a result, an innovative high-speed flywheel has been developed, offering a configurable energy capacity between 3 and 10 kWh at a maximum rotational speed of 16,500 rpm, all within a footprint of just 1m³. Additionally, project partners have engineered an advanced lightweight turbine blade suitable for industrial steam turbines, as well as compressor stages in gas turbines and compressed-air energy storage systems.

Partner	Fraunhofer Institute for Machine Tools and Forming Technology IWU - Fraunhofer Plastics Technology Center Oberlausitz
Keywords	CFRP, CAE Pipeline, Energy Conversion, Renewable Power
Skills	Creativity, Team Lead, Mechatronics, Sensor Technology

Efficient Magnetic Bearings in Extreme Environments – Experimental Validation
PROJECT DEVELOPER | MEMBER OF SCIENTIFIC STAFF

Germany

July 2019 - June 2021

- Topic: Energy-efficient Magnetic Bearings for Applications under Extreme Environmental Conditions – Verification and Experimental Validation
- Theoretical and experimental investigations of the temperature properties of magnetic materials
- Experimental validation of the inductive position sensor under thermal load
- Further investigations to validate the backup bearing complex model
- Qualification of the Maglap++ data acquisition system
- Virtualization in industrial applications (VR)

Keywords	Unreal Engine, Virtual Reality, Industrial Virtualization and Data Acquisition
Skills	Sensor Technology, Modeling and Simulation, AMB Design

Efficient Magnetic Bearings in Extreme Environments – Fundamentals & Modeling

Germany

PROJECT DEVELOPER | MEMBER OF SCIENTIFIC STAFF

December 2015 - June 2019

- Topic: Energy-efficient Magnetic Bearings for Applications under Extreme Environmental Conditions – Fundamentals, Modeling and Simulation
- Development of models for simulating magnetic and backup bearings under application-specific loads
- Development and testing of a sensor system for use in extreme environmental conditions
- Investigation of sliding bearings for use as backup bearings, considering tribology
- Theoretical and experimental investigations on the safe operation of magnetically levitated rotors under extreme conditions (power failure, high temperatures, aggressive atmosphere, humidity)
- Transfer of research results into student education and SMEs in the Free State of Saxony

Keywords	Efficiency, Industrial Scaled Test Facility, MFLP
Skills	Modeling and Simulation, Sensor Technology, FEM

Optimizing Energy Efficiency in Electric Traction Systems using FESS

European Union

PROJECT DEVELOPER | MEMBER OF SCIENTIFIC STAFF

December 2013 - January 2015

- Topic: Investigation of Components and Methods for Improving the Energy Efficiency of Electric Traction Systems, Incorporating Flywheel Energy Storage Systems
- High-frequency operation requires rapid acceleration and braking in tram systems, leading to volatile residual loads with steep gradients and fluctuations in railway power grids.
- Currently, these grids are designed to handle such power peaks. However, mismatches in demand and supply can cause load spikes in the national power grid, resulting in efficiency losses and increased costs.
- Stationary flywheel energy storage systems (FESS) can help mitigate these effects. To analyze its impact, both a tram and a partner substation were instrumented to continuously record electrical parameters throughout day and night operations.
- The resulting positive and negative power-time areas (energy) were located and used to design an optimized FESS. Simulation results confirmed that load peaks could be significantly smoothed.

Partner	Technická univerzita v Liberci – Fakulta mechatroniky, informatiky a mezioborových studií
	Dopravní podnik měst Liberce a Jablonce nad Nisou a. s.
Keywords	Flywheel Energy Storage Systems (FESS), Railway Power Grid, Load Peak Mitigation in Tram Systems, Real-Time Power Monitoring
Skills	Project Development, Mechatronics, Modeling and Simulation

Improving Turbomachinery Efficiency with Innovative Bearing Concepts (MFLP)

Germany

PROJECT DEVELOPER | TEAM LEADER | MEMBER OF SCIENTIFIC STAFF

September 2011 - March 2015

- Topic: Theoretical and Experimental Investigations to Increase the Energy Efficiency of Turbomachinery in Power Plants through Innovative Bearing Concepts (MFLP)
- Insights from the SFDT Project led to the development of a concept aimed at expanding the operational temperature range of bearing actuators through intelligent design and material selection, particularly in relation to sleeve and air-gap cooling.
- The goal is to eliminate the need for peripheral cooling systems in the future.
- To achieve this, the Magnetic and Backup Bearing Test Bed (MFLP) was designed with a high degree of modularity. Additionally, overheated steam can be directed into a process area.
- The test field allows the adjustment of various load conditions for both magnetic and backup bearings, including the necessary operational instrumentation. The housing design enables the integration of different bearing components.
- As a result, the test field was constructed, the MFLP was commissioned and extensive testing was carried out. A sliding backup bearing was also designed and constructed.

Partner	Siemens Energy Global GmbH & Co. KG - Turbinenwerk Görlitz
	EAAT GmbH Chemnitz
Keywords	High-Temperature Bearing Design, Magnetic & Bearing Test Bed (MFLP), Integrated Cooling Solutions, Modular Bearing Test Infrastructure
Skills	Project Development, Project Coordination, Team Lead, Mechatronics, Rotor Dynamics, AMB System, Sensor Technology

Integrated Methods for Reliability Analysis of Magnetic Bearings

Germany

PROJECT DEVELOPER | MEMBER OF SCIENTIFIC STAFF

September 2008 - August 2011

- Topic: Complex and Integrated Methods for the Reliability Analysis of Contactless Magnetic Bearings
- Mechatronic systems – such as active magnetic bearings – integrate highly interdependent mechanical, electrical and electronic components. Increasingly, software governs core system functions, defining operational behavior.
- While magnetic bearing systems can be parametrically designed based on nominal values, macroscopic physical effects are typically well-represented through model equations. However, system stability can be compromised due to parameter drifts caused by varying load conditions, operating point deviations and component aging.
- This project focused on developing and implementing advanced methodologies for the comprehensive characterization of active magnetic bearings, explicitly considering uncertainties within system components. A major challenge is still modeling aging effects, which shall be systematically addressed using a physics-based modeling approach.
- The outcome was an enhanced nominal design process, incorporating high-fidelity models and Monte Carlo simulations to derive statistical distributions for critical technical parameters, improving system robustness and reliability.

Keywords	Active Magnetic Bearings (AMB), Physics-Based Modeling, System Uncertainty & Aging Effects, Monte Carlo Simulation
Skills	Modeling and Simulation, Control Technology, AMB Design

ReActor for Process heat, Hydrogen And ELectricity generation (RAPHAEL) *European Union*

MEMBER OF SCIENTIFIC STAFF *April 2005 - April 2009*

- Simulation and Experimental test of AMB supported rotor with additional PMB
- The R&D work was related to the determination of the dynamic behaviour of a Hybrid Magnetic Bearing Concept (HMBC) to investigate the potentials of such bearing concept for HTR-Applications.
- It was dealt with subtasks of the modelling and performance of dynamic simulation calculations for the HMBC. The single effects that were indicated by the simulation calculations were also verified by the effects indicated by experimental tests of the HMBC at the FLP 500 test facility.
- The results of the experimental tests show that a hybrid magnetic bearing concept is feasible. The control system is able to compensate the instability and missing damping properties that are introduced by the additional PMB.

Keywords	High Temperature Reactor (HTR), Backup Bearing Concept, Nuclear Power
Skills	Control Technology, C/C++, DSP, AMB System

PILOT STUDIES – STUDENT MENTORING

Modeling and Dynamic Simulation of a Direct Methanol Fuel Cell using AI Methods *China-Germany*

MENTOR | MEMBER OF SCIENTIFIC STAFF *June 2023 - August 2023*

- Topic: Cellular Autonomous Energy Systems/Energy Converters – Modeling and Dynamic Simulation of a Direct Methanol Fuel Cell (DMFC) using AI methods
- Provided technical guidance on the development and implementation of an LSTM model for dynamic simulation of a direct methanol fuel cell (DMFC) using PyTorch.
- Advised on model initialization and training with trajectories generated via a physical DMFC model.
- Supported validation via inference, demonstrating comparable model accuracy between LSTM and the physical model.
- Contributed to material and power balancing as a foundation for future lifetime analysis.

	Bachelor
	Tianci LIU
	Tongji University School of Sino-German Engineering
Keywords	Fuel cell, LSTM, Control Technology, Python

Modeling and Dynamic Simulation of a Direct Methanol Fuel Cell *China-Germany*

MENTOR | MEMBER OF SCIENTIFIC STAFF *March 2023 - May 2023*

- Topic: Cellular Autonomous Energy Systems/Energy Converters - Modeling and Dynamic Simulation of a Direct Methanol Fuel Cell (DMFC)
- Provided technical guidance on the modeling and simulation of a direct methanol fuel cell (DMFC), with emphasis on reaction kinetics and system behavior.
- Advised on research into DMFC functionality, design strategies, materials and relevant norms and standards.
- Supported the development of physical and electrochemical submodels for static and dynamic simulation of catalytic conversion processes.
- Contributed to the analysis and interpretation of simulation results involving mass flows and power balance in a complex system model.

	Internship
	Tianci LIU
	Tongji University School of Sino-German Engineering
Keywords	Fuel cell, Control Technology, Simulink

Pattern Discovery and Pattern Recognition in Load Profiles of Electric Power Grids *China-Germany*

MENTOR | MEMBER OF SCIENTIFIC STAFF *June 2023 - August 2023*

- Topic: Artificial Intelligence (AI) at the Edge/Smart Grid – Pattern Discovery and Pattern Recognition in Load Profiles of Electric Power Grids
- Provided scientific and technical support for a bachelor thesis on pattern recognition in load profiles of electric power grids, building on previous internship work.
- Supported the application of traditional machine learning techniques and introduced deep learning approaches for load profile classification.
- Advised on the collection and analysis of dynamic time series data to improve classification accuracy.

	Bachelor
	Jiabao SONG
	Tongji University School of Sino-German Engineering
Keywords	Pattern Recognition, Load Profile Analysis, Machine Learning, Time Series Data, Python

Compilation of Algorithms for Classification of Participants in Electric Power Grids *China-Germany*

MENTOR | MEMBER OF SCIENTIFIC STAFF *March 2023 - May 2023*

- Topic: Artificial Intelligence (AI) at the Edge/Smart Grid – Compilation and Application of Algorithms for Detection/Classification of Participants in Electric Power Grids
- Provided academic guidance on the development of a self-learning algorithm for detecting and classifying electrical sinks using event-based NILM techniques.
- Assisted in implementing two Python programs for statistical preprocessing, event detection and data clustering.
- Advised on applying statistical methods, pattern recognition and clustering to extract meaningful load profiles from raw data.
- Supported the successful identification of 24 clusters from overlapping consumption data in the context of Smart Grid analysis.

	Internship
	Jiabao SONG
	Tongji University School of Sino-German Engineering
Keywords	NILM, Clustering, Pattern Recognition, Python

Development of a Smart-Grid Controller for Use in Intelligent Electric Power Grids
China-Germany

Mentor | Member of Scientific Staff *June 2022 - August 2022*

- Topic: Artificial Intelligence (AI) at the Edge/Smart Grid – Development of a Smart-Grid Controller for Use in Intelligent Electric Power Grids
- Development of a smart grid controller integrating IoT-based edge computing for real-time load forecasting and clustering.
- Implementation and evaluation NeuralProphet and LSTM models; NeuralProphet for superior performance with smoothed data had been selected.
- Application of K-means++ algorithm for user-side load clustering to enable intelligent device management.

	Bachelor
	Kejia GAO
	Tongji University School of Sino-German Engineering
Keywords	Smart Grid Controller, Load Forecasting (NeuralProphet), LSTM, Python

Compilation and Application of Algorithms for Intelligent Power Grids (Smart Metering)
China-Germany

Mentor | Member of Scientific Staff *March 2022 - May 2022*

- Topic: Artificial Intelligence (AI) at the Edge/Smart Grid – Compilation and Application of Algorithms for Intelligent Power Grids (Smart Metering)
- Exploration of classical, machine learning and deep learning methods for power forecasting in smart grid environments.
- Conduction of a comparative analysis of five deep learning algorithms focusing on accuracy and computational speed.
- Identification of the GRU model as the most effective for high-accuracy, efficient time series forecasting.

	Internship
	Kejia GAO
	Tongji University School of Sino-German Engineering
Keywords	Smart Grid, Deep Learning (GRU), Time Series Analysis, Python

Video-supported Observation and Evaluation of the Vitality of Crops (Smart Farming)
China-Germany

Mentor | Member of Scientific Staff *June 2020 - August 2020*

- Monitoring and assessment of crop health using video imaging technology to measure key indicators of plant vitality, such as growth rate, leaf color and water stress.
- Research and evaluation of freely available pre-trained artificial neural networks (ANNs) for object and handwriting recognition.
- Comparison of the ANNs based on selected quality criteria regarding functionality and performance.
- Development of a concept using open-source tools for deployment on embedded platforms (Raspberry Pi, NVIDIA Jetson Nano).
- Implementation and testing of the software components according to the concept on the target platforms.

	Bachelor
	Jiaqi HUA
	Tongji University School of Sino-German Engineering
Keywords	Condition Diagnosis, Training, Image Forensics

Comparison of Pre-trained Artificial Neural Networks
China-Germany

Mentor | Member of Scientific Staff *March 2020 - May 2020*

- Topic: Comparison of Freely Available Pre-trained Artificial Neural Networks Regarding their Functional and Performance Capabilities
- Research and evaluation of freely available pre-trained artificial neural networks (ANNs) for object and handwriting recognition.
- Comparison of the ANNs based on selected quality criteria regarding functionality and performance.
- Development of a concept using open-source tools for deployment on embedded platforms (Raspberry Pi, NVIDIA Jetson Nano).
- Implementation and testing of the software components according to the concept on the target platforms.

	Internship
	Jiaqi HUA
	Tongji University School of Sino-German Engineering
Keywords	Benchmark, ANN, Computer Vision

System for State Diagnosis and Evaluation of Crops (Precision Farming)
China-Germany

Mentor | Member of Scientific Staff *June 2020 - August 2020*

- Topic: Implementation of a System for State Diagnosis and Evaluation of Crops on an Embedded Hardware Platform
- Programming and testing of an existing fuzzy logic control system in Python for real-time control of irrigation, fertilization and pest/disease control.
- Demonstration of the processing chain on self-selected examples and comparison of the results with Matlab simulations.

	Bachelor
	Yuan XU
	Tongji University School of Sino-German Engineering
Keywords	Embedded Systems, Fuzzy Logic, Python

Concept Development for the Observation and State Evaluation of Crops
China-Germany

MENTOR | MEMBER OF SCIENTIFIC STAFF   *March 2020 - May 2020*

- Conceptualization and development of a system for condition diagnosis and assessment of cultivated plants based on vitality features, measurement data and a cultivation knowledge base.
- Development of a fuzzy logic control system to derive control variables for irrigation, fertilization and pest/disease control.
- Modeling and simulation of the control system in Matlab/Simulink.

	Internship
	Yuan XU
	Tongji University School of Sino-German Engineering
Keywords	Smart Farming, Fuzzy Logik, Matlab

PRELIMINARY RESEARCH

Low-Cost Assistance System for Intelligent Monitoring of the Cardiovascular System
Zittau, Germany

PROJECT DEVELOPER | MEMBER OF SCIENTIFIC STAFF   *2024*

- Concept development for intelligent cardiovascular monitoring using AI methods, especially neural networks (LSTM) in MATLAB Simulink and Python
- Implementation of a test framework for preprocessing and inference between expert knowledge and measured ECG vital data
- Successful inference tests for detecting disease-specific patterns (e.g., Chagas-related cardiomegaly) in large ECG datasets

Keywords	Artificial Intelligence (AI), Neural Networks (LSTM), ECG Data Analysis, Intelligent Health Monitoring
Skills	Machine Learning, Signal Processing, PyTorch

Research Publications

Hyblerová, Š., Černíková, M., Düsterhaupt, S., *Economic evaluation of kinetic energy storage systems as key technology of reliable power grids*. PLoS One, PUBLIC LIBRARY SCIENCE, 29 pages, ISSN: 1932-6203, n. 10, San Francisco, USA, 2024.

Düsterhaupt, S., Hoffmann, H., Neumann, H., Rottenbach, T., Worlitz, F., Berek, T., Scholz, S., *Development of Functionally Integrated High-Speed Kinetic Energy Recovering Systems with Magnetic Bearings*. 13th Workshop Magnetic Bearing Technology Zittau-Chemnitz, Chemnitz, Germany, 2023.

Düsterhaupt, S., Hoffmann, H., Neumann, H., Noack, I., Rottenbach, T., Worlitz, F., *Development and testing of a high-temperature sensor system for use on turbomachinery*. 12th Workshop Magnetic Bearing Technology Zittau-Chemnitz, Zittau, Germany, 2019.

Düsterhaupt, S., Worlitz, F., *Reliability assessment of active magnetic bearings taking into account extended environmental conditions*. 11th Workshop Magnetic Bearing Technology Zittau-Chemnitz, Chemnitz, Germany, 2017.

Düsterhaupt, S., Neumann, H., Rottenbach, T., Vanek, C., Worlitz, F., *High temperature active magnetic bearings in industrial steam turbines*. The 15th International Symposium on Magnetic Bearings (ISMB15), Kitakyushu, Japan, 2016.

Düsterhaupt, S., Neumann, H., Noack, I., Panescu, C., Reinicke, S., Rottenbach, T., Worlitz, F., *Magnetic and backup bearing test rig MFLP for testing magnetic and backup bearings taking into account extreme environment conditions*. 10th Workshop Magnetic Bearing Technology Zittau-Chemnitz, Zittau, Germany, 2015.

Düsterhaupt, S., Neumann, H., Panescu, C., Rottenbach, T., Worlitz, F., *Test Field for Magnetic Bearing Applications under Extreme Conditions*. The 14th International Symposium on Magnetic Bearings (ISMB14), Linz, Austria, 2014.

Neumann, H., Panescu, C., Düsterhaupt, S., Worlitz, F., *MFLP - Magnetic and backup bearing test rig of the Zittauer Power Plant Laboratory*. 9th Workshop Magnetic Bearing Technology Zittau-Chemnitz, Chemnitz, Germany, 2013.

Düsterhaupt, S., Worlitz, F., *Complex and Integrated Methods for the Reliability Analysis of Contactless Magnetic Bearings*. The 13th International Symposium on Magnetic Bearings (ISMB13), Virginia, USA, 2012.

Düsterhaupt, S., Worlitz, F., *HiL simulation of a Kalman filter for active magnetic bearings based on a digital signal processor*. 13th Junior Scientists' Conference of Central German Universities of Applied Sciences, Görlitz, Germany, 2012.

Düsterhaupt, S., Worlitz, F., *Modeling and simulation of the reliability of machines with magnetic bearings*. 8th Workshop Magnetic Bearing Technology Zittau-Chemnitz, Zittau, Germany, 2011.

Düsterhaupt, S., Gronek, M. Worlitz, F., *Advantages of a Hybrid Magnetic Bearing Concept for the Suspension of Blower Rotors*. 5th International Topical Meeting on High Temperature Reactor Technology (HTR2010), Prague, Czech Republic, 2010.

Presentation

INTERNATIONAL

The 15th International Symposium on Magnetic Bearings (ISMB15)
Kitakyushu, Japan

PRESENTER | HIGH TEMPERATURE ACTIVE MAGNETIC BEARINGS IN INDUSTRIAL STEAM TURBINES *August 2016*

- Prototype Development & Industrial Implementation – Led the successful commissioning of a feed water pump power turbine (SPAT) with active magnetic bearings at the Jänschwalde power plant in 2015, following eight years of industrial research and development in collaboration with Zittau/Görlitz University of Applied Sciences.
- High-Temperature Magnetic Bearing (HTAMB) Research – Investigated cooling challenges in turbo machines with magnetic bearings, focusing on eliminating lubricant-based cooling while addressing efficiency losses and cost implications of tube cooling and peripheral systems.
- Material Innovation & Experimental Validation – Developed HTAMB concepts by exploring temperature-resistant materials for rotor lamination, reducing the complexity of sleeve cooling. Conducted theoretical and experimental studies at the MFLP test rig to analyze component performance under scaled power plant conditions.

The 14th International Symposium on Magnetic Bearings (ISMB14)
Linz, Austria

PRESENTER | TEST FIELD FOR MAGNETIC BEARING APPLICATIONS UNDER EXTREME CONDITIONS *August 2014*

- Development of High-Temperature Active Magnetic Bearings (HTAMBs) – Explored advanced insulation techniques and materials to overcome the limitations of traditional active magnetic bearings (AMB) in extreme environments, such as high temperatures, corrosive fluids and gases.
- Material Science & Surface Technology Innovations – Investigated the use of physical vapor deposition (PVD) for low-cost, micrometer-thin coatings, allowing AMBs to operate at temperatures beyond the conventional 160 °C limit, with potential for up to 450 °C.
- Integration of AMBs with Backup Bearings – Led the development of integrated bearing units combining AMBs and backup bearings, optimizing machine design for compactness and ensuring reliable performance in harsh process environments, including direct integration into the process section when needed.

The 13th International Symposium on Magnetic Bearings (ISMB13)
Virginia, USA

PRESENTER | COMPLEX AND INTEGRATED METHODS FOR THE RELIABILITY ANALYSIS OF CONTACTLESS MAGNETIC BEARINGS *August 2012*

- Reliability Analysis of Active Magnetic Bearings (AMB) – Investigated the reliability of AMBs in power plant turbomachinery under extreme operational conditions, addressing nonlinearities and load-dependent failures due to mechanical, electrical and magnetic parameter drifts.
- Failure Probability Assessment – Applied Monte Carlo simulations and fault tree analysis to quantify failure probabilities of individual components and the entire system, ensuring robust AMB performance in safety-critical applications.
- Design Optimization & Redundancy Strategies – Evaluated the need for redundant/diverse system components early in the design phase, considering environmental factors such as high temperatures and unexpected axial thrust loads in nuclear power plant cooling pumps.

DOMESTIC

13th Workshop Magnetic Bearing Technology Zittau-Chemnitz
Chemnitz, Germany

PRESENTER | DEVELOPMENT OF FUNCTIONALLY INTEGRATED HIGH-SPEED FESS WITH MAGNETIC BEARINGS *September 2023*

- Flywheel Energy Storage Systems (FESS) – Researched and developed high-speed flywheel energy storage (SMS) solutions, leveraging kinetic energy storage for high-cycle, high-power applications.
- Advanced Materials & Power Electronics – Investigated carbon fiber-reinforced polymers (CFRP) for rotor and flywheel construction, alongside advancements in power electronics and bearing technologies, enabling efficient and secure energy storage up to 150 kWh.
- Structural Design & Engineering Challenges – Provided strategic insights into hybrid metal-CFRP structures for high-speed rotors, addressing key engineering challenges in the design and application of FESS for grid stabilization (0.5–50 MW).

12th Workshop Magnetic Bearing Technology Zittau-Chemnitz
Zittau, Germany

PRESENTER | DEVELOPMENT AND TESTING OF A HIGH-TEMPERATURE SENSOR SYSTEM FOR USE ON TURBOMACHINERY *2019*

- High-Temperature Sensor Development – Researched and developed position sensors for high-temperature magnetic bearings in turbomachinery, ensuring durability under extreme environmental conditions while providing precise rotor position data for control systems.
- Material Selection & Feasibility Analysis – Evaluated potential sensing principles, analyzed temperature-resistant materials and conducted a market study to assess component availability for sensor construction.
- Prototype Design & Implementation – Designed and fabricated a combined inductive radial-axial position sensor prototype using a MATLAB-based analytical design algorithm, developed the corresponding sensor electronics and integrated the system for testing on the MFLP magnetic bearing test rig.

13th Junior Scientists' Conference of Central German Universities of Applied Sciences
Görlitz, Germany

PRESENTER | HiL SIMULATION OF A KALMAN FILTER FOR ACTIVE MAGNETIC BEARINGS BASED ON A DIGITAL SIGNAL PROCESSOR *2012*

- Advanced Control Systems – Developed and implemented a Kalman filter for active magnetic bearing (AML) control, leveraging model-based measurement techniques for enhanced system performance.
- Simulation & Verification – Conducted parameter identification for filters and controllers, validated models through numerical simulations and integrated Hardware-in-the-Loop (HiL) testing as a key step in system development.
- Real-Time System Implementation – Deployed Kalman filtering and control algorithms on a real-time DSP computing platform, interfaced with dSpace for full closed-loop simulation and validated results against numerical benchmarks.

Entrepreneurial Activities

CB-601 – the open tec Elevator   *Germany*
Core Member & CTO   *May 2020 - present*

- Alignment with future-oriented business sectors
- Establishment and cultivation of strategic R&D partnerships
- Development of a distinct corporate identity through proprietary services, products and reference projects
- Execution and management of international collaborations with industrial firms and research institutions
- Presentation of research findings at leading international conferences
- Oversight of strategic and technical coordination for project execution

Octoteq   *Prague, Czech Republic*
Co-Founder & CTO | Scientific Staff Member | Member of the Supervisory Board   *October 2020 - present*

- A cutting-edge semi-submerged floating platform combining renewable power sources for optimized energy generation.
- Semi-submerged design enhances stability and performance in various weather conditions.
- Highly adaptable, with the capability to integrate additional technologies such as CO_2 scrubbing, aquaculture and water desalination.
- Constructed using advanced materials to reduce environmental impact and ensure long-term durability.
- A scalable solution for sustainable energy production, with the potential for widespread deployment.
- Demonstrates the future of offshore renewable energy, focusing on innovation, efficiency and environmental responsibility.

Honors & Awards

2015   **Prof. Hans-Joachim Hildebrand-Award,** Inauguration of the Zittau power plant laboratory   *Zittau, Germany*

Professional Experience

MECHATRONICS AND CYBER-PHYSICAL SYSTEMS

AMB Design	★★★★☆	Static and dynamic design of active magnetic bearings
Filter Design	★★★★☆	Analog and digital
Control Design	★★★★☆	Design and stability analysis/verification
Power Electronics	★★★☆☆	R&D of power amplifiers
Surface Technology	★★★☆☆	R&D of functional and decorative coating systems
Sensor Technology	★★★☆☆	In-house development and design of measurement concepts
FEM Analysis	★★★★☆	Magnetic, electrical, thermal, mechanical
Rotordynamics	★★★★☆	Theoretical eigenvalue investigations on magnetically levitated turbomachinery rotors

AI-DRIVEN ENGINEERING

Dynamic Simulation	★★☆☆☆	Direct Methanol Fuel Cell – Utilized AI for simulating and analyzing fuel cell performance
Forecasting	★★☆☆☆	Experience in using AI to predict energy usage
Recognition	★★☆☆☆	Applied AI to assess and monitor crop health and vitality

COMPUTER AIDED ENGINEERING COMPETENCIES

Matlab	★★★★☆	Model development and dynamic simulation (also) using Simulink
KiCAD	★★★★☆	Circuit and PCB design
NX	★★★☆☆	Components design and assemblies
Linux	★★★★★	Setting up and applying even complex IT structures
C/C++	★★★★☆	Microcontroller and DSP programming
Python	★★★★☆	Applying Python within frameworks as Tensorflow and pyTorch

PROJECT DEVELOPMENT AND MANAGEMENT

Creativity	★★★★★	Draft of project activities on trend and future fields
Team Lead	★★★★☆	Technical and personal responsibility
Communication	★★★★☆	Cultivating the team spirit

LANGUAGE ABILITIES

German	★★★★★	Native speaker
English	★★★★☆	Unicert II, Business fluent
Russian	★★☆☆☆	Expandable in word and writing

PROFESSIONAL MEMBERSHIPS

References

IPM	**Prof. Dr.-Ing. Frank Worlitz**	f.worlitz@hszg.de	Head of department, project manager, immediate supervisor
TUL	**Ing. Lukáš Hubka, Ph.D.**	lukas.hubka@tul.cz	Colleague in the context of bilateral project activities
TUM, IM MOTORS	**Kejia Gao**	kejia.gao@outlook.com	Master's student, AI engineer, former Bachelor's student