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Regensburg, 25.06.2025

Application for PhD Position in "Data-driven surrogate modelling for differential-algebraic port-Hamiltonian systems"

Dear Prof. Dr. Birgit Jacob,

I'm genuinely inspired to apply for the PhD position in "Data-driven surrogate modelling for differential-algebraic port-Hamiltonian systems" at Bergische Universität Wuppertal, captivated by the launch of the Collaborative Research Centre (CRC) 1701 "Port-Hamiltonian Systems," backed by the German Research Foundation. The center's bold vision to revolutionize modeling of intricate, interconnected dynamical systems across diverse domains sparks my enthusiasm, and I'm eager to bring my passion for machine learning and simulation to drive this groundbreaking research forward.

During my Master's program, focusing on AI, I primarily used Python and Ubuntu as my development environment to develop applications for AI-driven tasks. One notable project involved autonomous navigation of the Turtlebot3 in a selected area, incorporating object detection and avoidance, while also mapping the area and ensuring the robot could return to its origin. This project utilized ROS (Noetic) and Gazebo for virtual testing, with key ROS nodes developed in both C++ and Python. Leveraging PyTorch, I harnessed the Turtlebot's sensor data to train Neural Networks, analyzing movement patterns to retrain the robot for sharper decision-making, optimizing its navigation efficiency in complex environments. Parallel to my academic pursuits, during nine months at AVL, I worked on the Adaptive AUTOSAR middleware (Service-Oriented Architecture) and developing its applications in C++. These Adaptive Applications were deployed on a custom Real Time Linux Operating System using Yocto project. After this, I continued at AVL for my Master's thesis, where I was tasked with upgrading their legacy FMU Generation Utility (written in C++) from the FMI 2.0 to the FMI 3.0 standard, thereby enhancing the functionality of the existing tool for co-simulation of automobile parts built in different systems like MATLAB, C++, etc. In my thesis, I also leveraged Google Protocol Buffers through ASAM OSI for efficient data serialization, streamlining integration of sensor and environmental models in driving simulations, enhancing virtual testing capabilities. At Persystems, I was a Junior C++ Developer, where I developed Virtual TestBench, a Qt Desktop application for simulations of electrical components, leveraging Persystems' proprietary library. My responsibilities included designing the UI/UX in the Qt Creator IDE with C++ to ensure a seamless user experience. I have also implemented the application's logic by connecting UI widgets to custom slots, using Qt's signal-slot mechanism to manage data flow between the UI and the backend operations interfacing with Persystems' testbench library. Additionally, I have built a separate license check application for Virtual TestBench using Qt and C++.

Drawing from my Master's work in AI, where I honed advanced machine learning skills using PyTorch and Python for autonomous navigation and simulation, alongside my professional experience at AVL and Persystems, I am ideally suited for the PhD role at Bergische Universität Wuppertal. My thesis at AVL, upgrading the FMU Generation Utility to FMI 3.0, involved co-simulation of systems with differential-algebraic equations, directly aligning with the CRC 1701 project's focus on data-driven surrogate modeling for port-Hamiltonian systems. My expertise in training neural networks to optimize Turtlebot3's navigation decisions, combined with proficiency in C++ and numerical simulation, equips me to advance structure-preserving scientific machine learning. My experience with Linux, Git, and CI/CD pipelines, paired with collaborative efforts on interdisciplinary teams at AVL and Persystems, ensures I can contribute to the CRC's research, international collaborations, and publications, while my initiative and English proficiency position me to drive innovative machine learning solutions and share findings globally.

Among the many skills I have honed throughout my academic and professional journey, collaboration stands out as the most pivotal for advancing technology. My experiences have underscored that breakthroughs in technology are often the result of interdisciplinary teamwork and shared expertise. I am committed to contributing my utmost from the very start, beginning immediately.

I would be greatly honoured to receive an invitation for an interview.

Yours sincerely,

Regensburg, 25.06.2025