Marius Neuhalfen

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Mechanical Engineering student searching for a Master's thesis in optimization of energy systems.

SUMMARY

Master's engineering student and junior machine learning engineer interested in optimization, control theory and renewable energy. Previously carried out research and published in the field of visual navigation for in-space operations. Now looking to expand into optimization for the energy transition in the frame of a Master's thesis.

EDUCATION

RWTH Aachen University **2025 - 2027 (expected, ongoing)**
Master of Science, General Mechanical Engineering (Allgemeiner Maschinenbau) *Aachen, Germany*

- **Relevant modules:** Applied Numerical Optimization, Design and Transformation of Energy Systems, Processes for Emission-free Energy Supply, Model Predictive Control of Energy Systems, Reinforcement Learning and Learning-based Control, Robotic Systems.
- Shifting focus from aerospace to optimization, control theory and renewable energy systems.

École Centrale de Lille **2022 - 2024**
Diplôme d'Ingénieur, General Engineering (Ingénieur Généraliste) *Lille, France*

- Double Master's Degree in the frame of the T.I.M.E. program with the RWTH to obtain the French "Diplôme d'Ingénieur" (M.Sc. equivalent). Placed in the top 5% in 2nd year.
- **Relevant Modules:** Real-Time Estimation (A+), Control Theory: Robotics Applications (A+), Eco-design for positive energy habitats (A), Design and management of a robotic production line (A).
- Various successful group projects: Life-Cycle Assessment for improved dismantling of wind turbines in the Hauts-de-France region, construction of cold gas thrusters for rocket attitude control in collaboration with the French space agency CNES, development of an AI facial recognition model, design of a radial piston pump.
- 2022-2024: Rocket team-lead in the Aero&Space student association for the creation of an air-launched rocket.

RWTH Aachen University **2020 - 2025**
Bachelor of Science, Mechanical Engineering (Maschinenbau) *Aachen, Germany*

- **Relevant modules:** Dynamics of Rigid Bodies, Mathematics, Simulation Methods, Thermodynamics.
- **Bachelor thesis:** Optimization of synthetic datasets for training robust pose estimation models. Received top grade of 1.0. Supervised by Prof. Moormann at Institute of Flight Dynamics jointly with Blackswan Space.
- 2020-2022: On-board computer team-lead of the nanosatellite project of the Space Team Aachen student association. Worked on embedded ARM-processor programming. Continued afterwards as mentor to the team.

WORK EXPERIENCE

Blackswan Space **October 2025 - Present**
Machine Learning & Computer Vision Engineer *Remote; Vilnius, Lithuania*

- Received full-time return offer from company after internship, continuing part-time alongside Master's studies.
- Leading qualification campaign of pose estimation algorithms for scheduled upcoming in-orbit demonstration mission. Realizing technical requirements from customers while adhering to a rapid development schedule.

Blackswan Space **March - September 2025**
Internship, Reference: Marius Klimavičius (CEO), marius@blackswanspace.com *Vilnius, Lithuania*

- Combined internship and Bachelor thesis stay. Successfully managed to satisfy both commercial & research constraints from internal and university stakeholders. Thesis results implemented and still in internal use.
- Developed pose estimation models for in-orbit servicing trained using synthetic image datasets. Determined optimal data generation approaches in the frame of my thesis, including improved pose distributions and adverse sampling, thus decreasing position estimation errors by 32%. Synthetic data generation and neural network training approaches are also applicable to global optimization methods in energy systems.
- Created a novel, cloud-based version control system for trained neural network weights. This significantly enhanced repeatability and traceability of training runs and enabled parameter-driven test campaigns.

- Introduced the team's first unit and integration-tests and deployed them in a CI/CD pipeline via GitHub Actions.
- Overhauled internal pose estimation evaluation methods by using realistic, physics-based datasets generated in closed-loop using mission-like optimal controllers (LQR) and guidance modes (phasing, approach, fly-around).

European Space Agency (ESTEC) **July – December 2024**
Internship, Reference: Jonathan Grzymisch, jonathan.grzymisch@esa.int *Noordwijk, The Netherlands*

- Developed a novel view synthesis-based method for validating vision-based navigation systems. Demonstrated that models trained with the synthesized views from this method fulfill the 1% position error requirement relative to inter-satellite distance, even with datasets 3–8× less dense than current benchmarks—thus enabling real-time validation of image processing. Results published with a paper at EUCASS 2025.
- Developed a new mathematical measure of pose difficulty (Boresight Deviation Distance) that characterises more accurately than existing measures the semantic differences in images captured from different viewpoints.

Laboratoire de Mécanique des Fluides "Kampé de Fériet" **January – February 2023**
Internship *Lille, France*

- Performed CFD simulations with Star-CCM++ on novel wind turbine blade designs. Used a wind tunnel to characterize the stall angle, lift performance and pressure profile of the blades, optimizing energetic efficiency.

PUBLICATIONS

Neuhalfen, M., Grzymisch, J., & Sanchez-Gestido, M. (2025). *Enabling Robust, Real-Time Verification of Vision-Based Navigation through View Synthesis*. **EUCASS 2025 (Oral Presentation).** arXiv:2507.02993

LANGUAGES, SOFTWARE SKILLS & INTERESTS

- **Languages** German (native language), English (C2, TOEIC 990/990), French (C1, DALF)
- **Software**
  - Programming: Python, MATLAB/Simulink, C, C++, ROS2
  - Machine Learning: PyTorch, HRNet, YOLO, Data version control (DVC)
  - DevOps & Cloud: Git, AWS (EC2 & S3), CI/CD (GitHub Actions)
  - Design: CAD (Fusion 360, Onshape), KiCAD, LaTeX
  - Simulation: FEM (Catia), CFD (Star-CCM+), Life-Cycle Assessment (SimaPro)
- **Interests** Entrepreneurship and Founding, Improvisational theater (performing several times a year)

POSITIONS OF RESPONSIBILITY

- **Young ESA Entrepreneurship Group Event coordinator (ESA, 2024):** Organization of internal Masterclasses inviting accomplished start-up founders from the European aerospace industry with the goal of inspiring young engineers and scientists for entrepreneurship. Finding speakers strengthened my prospecting skills.
- **President of the Bureau des Arts (École Centrale de Lille, 2023-2024):** First international student of the school to hold this role. Led the organisation of events with 400+ participants from engineering schools across France. Enhanced leadership skills and project management by balancing internal and external stakeholders.
- **Délégué de promotion (École Centrale de Lille, 2023-2024):** Represented international students, relaying their concerns to the school administration and negotiating solutions. Helped organise the reduction of the cost of student club membership for international students by 90%. Spearheaded the creation of a similar role in the student association council and was its first office-holder.
- **Buddy (RWTH, 2021-2022):** Active in the RWTH BeBuddy program. Helped international students with finding apartments, general administrative tasks, managing their classes and finding their way in Aachen.

ACHIEVEMENTS & AWARDS

- **1st place European Defense Tech Hackathon Vilnius (2025):** Achieved first place in a team of 4 by proposing a solution for distributed drone detection systems to support Ukrainian defense efforts. Developed the machine learning-based pose estimation algorithm and trained it using open-source datasets.
- **1st place FH Aachen Hackathon "Urban Gardening" (2022):** Worked during two days on the topic of efficient and ecological food provision in urban spaces. Placed first with a team of 4 people by proposing a solution of movable food lockers with in-built cooling that are filled directly by farmers, reducing the need for discounters.