Aaron Dsouza

Project Portfolio

M.Sc. Mechatronics, Robotics and Biomechanical Engineering, TUM
+49 176 32638559 | aarondsouza2406@gmail.com |
linkedin.com/in/aarondsouza24

Modelling and Control
MATLAB, Simulink
observers, identification

Simulation and Data
Python, MATLAB
automated analysis tools

Hands on Testing
hardware assembly
test procedures

What I would like you not to overlook

- Almost a year at **Airbus Defence and Space**, building tools that engineers used for spacecraft thermal analysis. My reference states that my performance **exceeded expectations**.
- A complete **model, identify, control** workflow in MATLAB and Simulink at TUM, from robot dynamics to observers and adaptive controllers.
- Hands on hardware experience: assembling and testing **battery modules for medical devices**.
- I enjoy turning raw data into clear results that other people can act on.

Note: industrial work is described at a general level to respect confidentiality. Diagrams in this portfolio are schematic illustrations of my work.

1 Post Processing Tools for the Airbus Thermal Tool Suite

Bachelor's thesis, Airbus Defence and Space, Immenstaad | Apr 2024 to Sep 2024 (after internship Jul 2023 to Dec 2023)

The problem. Thermal simulations of spacecraft produce large amounts of raw result data. Engineers spent a lot of time manually extracting, plotting and checking results before they could assess a design.

What I built. Python and MATLAB post processing modules inside the Airbus Thermal Tool Suite that read simulation output, analyse it and generate plots and reports automatically.

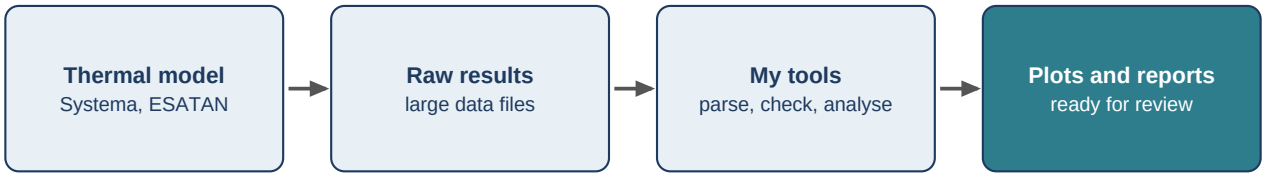


Figure 1: Automated post processing chain (schematic)

My contribution

- Simulated the thermal behaviour of spacecraft models in Systema and ESATAN during the internship, including updating models when the design changed.
- Developed preprocessing and postprocessing utilities in Python, MATLAB and Fortran in a Linux environment.
- Migrated and debugged existing processing workflows and validated outputs, so that reports stayed reliable.
- Worked side by side with the thermal engineers who used the tools daily and adapted features to their feedback.

Result

Repeatable, faster evaluation of simulation results and less manual work for the team. My internship reference confirms that my performance exceeded Airbus's expectations.

What I am most proud of: building tools that real engineers relied on every day, not just a student prototype.

Python	MATLAB	Fortran	Linux	Systema	ESATAN	Git

2 Robot Modeling, Identification and Control Laboratory

Technical University of Munich | Summer semester 2026 | MATLAB, Simulink

A full engineering workflow on planar serial robots: describe the system mathematically, identify its unknown parameters from measurements, then design and test controllers and observers on the real setup.

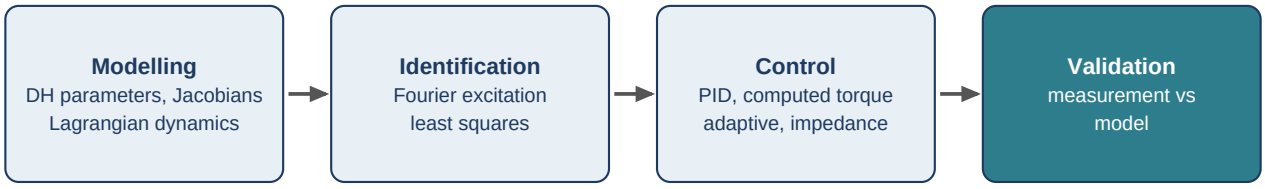


Figure 2: Workflow from model to validated controller

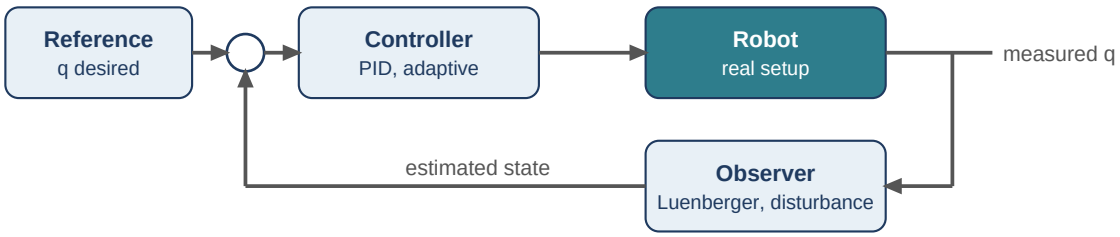


Figure 3: Closed loop with state observer (schematic)

My contribution

- Modelled robot kinematics and dynamics with modified DH parameters, homogeneous transformations, Jacobians and Lagrangian dynamics.
- Identified inertial parameters using Fourier excitation trajectories, minimal regressors and least squares estimation.
- Implemented PI and PID control, computed torque, Lyapunov based adaptive control, impedance control and state feedback.
- Built Luenberger and disturbance observers as well as force and collision observation.

What I am most proud of: closing the loop from theory to hardware, where the identified model actually improved the controller on the real robot.

MATLAB	Simulink	System identification	Nonlinear control	Observers

3 Physics Informed Neural Network for a Damped Oscillator

TUM project | Summer semester 2026 | Python, PyTorch

The idea. Reconstruct the full continuous motion of a damped oscillator from only **eight measurements** by teaching a neural network the governing differential equation, not just the data.

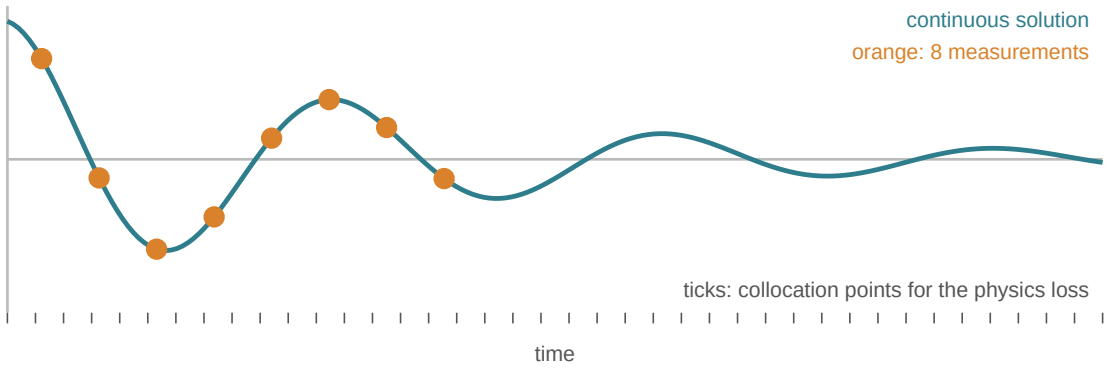


Figure 4: Problem setup (illustration): few data points plus the physics over the whole time range

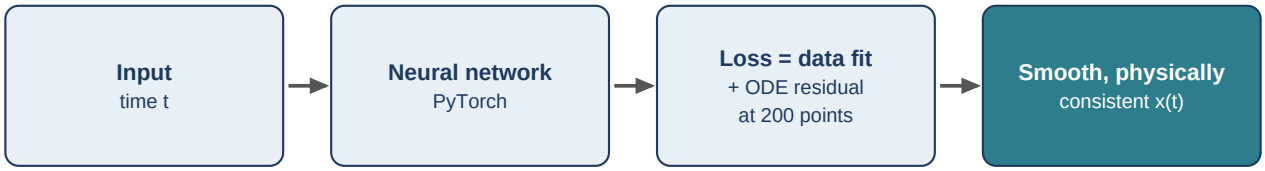


Figure 5: PINN training principle

My contribution

- Implemented the network and the combined loss from eight measurements and differential equation residuals at 200 collocation points.
- Used automatic differentiation to evaluate the oscillator equation inside the loss.

Why it matters: it links my control and modelling background with machine learning, which is useful wherever data is expensive but the physics is known.

Python	PyTorch	Differential equations	Machine learning

4 Battery Module Assembly and Testing for Dialysis Systems

Working student, Hightech Electronic GmbH, Geldersheim | Mar 2022 to Dec 2022

Assembled and tested battery modules in series and parallel configurations for integration into Fresenius dialysis systems, a medical device where reliability and traceability are essential.

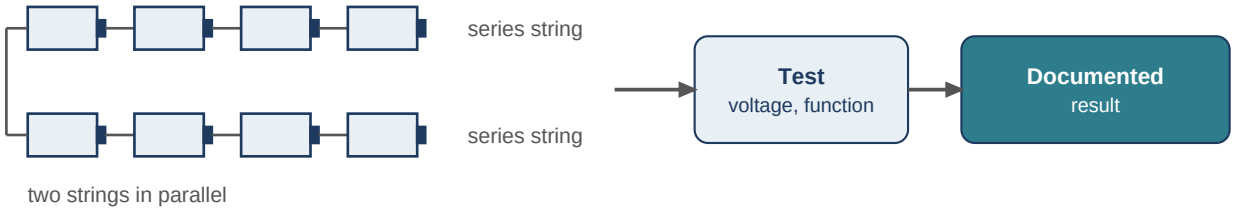


Figure 6: Module configuration and test flow (schematic)

- Followed defined assembly and test procedures and documented every result.
- Learned how strict quality and documentation requirements are in medical technology.

5 Real Time Object Detection and Tracking

Personal project | Jan 2023 to Feb 2023 | Python, OpenCV, NumPy

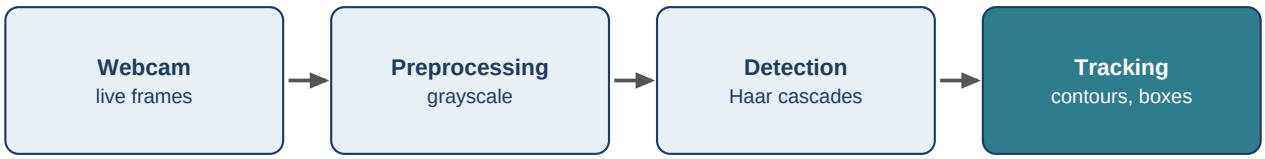


Figure 7: Detection and tracking pipeline

- Implemented object detection and tracking from live webcam input using Haar cascade classification, contour extraction and bounding boxes.

Skills at a Glance

Modelling and control	Dynamic system modelling, system identification, PID, computed torque, adaptive, nonlinear and impedance control, state space control, observers
Simulation and analysis	MATLAB, Simulink, Systema, ESATAN, numerical simulation, engineering data analysis, model validation
Programming	Python, MATLAB, C and C++ basics, Fortran, SQL, PyTorch, OpenCV
Tools and environment	Linux, Git, Docker basics, ROS and ROS2, MS Office
Hands on	Hardware assembly, test procedures, laboratory experiments, documentation
Languages	English: professional proficiency | German: B2

Education

- **M.Sc. Mechatronics, Robotics and Biomechanical Engineering**, Technical University of Munich, since Oct 2025
- **B.Eng. Mechatronics**, THWS Würzburg Schweinfurt, Oct 2020 to Oct 2024

Thank you for taking the time to look at my work. I am happy to walk you through any of these projects in more detail.