Anas Makdesi

R&D Engineer | Robotics, Control and State Estimation | PhD
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PROFILE

R&D engineer in robotics and control with 6+ years of R&D (PhD, postdoc and industry), including a year leading a five-engineer robotics team. PhD in automatic control (CentraleSupélec), postdoc at LMU Munich. I design model predictive controllers, state estimators and data-driven models and implement them in Python, C++ and MATLAB/Simulink. I have tuned closed-loop control on physical equipment: a 3-DOF helicopter rig, motor control on mobile robots and university control-lab benches. At Subh Engineering my team delivered a surveying robot with sub-millimeter localization and a field-tested sewer inspection robot. Available to start immediately.

CORE SKILLS

Control: MPC (robust, learning-based), optimal control, PID control and tuning, motion and trajectory planning, safety verification (reachability analysis, controlled invariant sets), closed-loop tuning on physical equipment.

Estimation and modeling: state estimation (Kalman filter, EKF/UKF, observers), sensor fusion, system and parameter identification, data-driven modeling with guaranteed error bounds.

Learning-based control: reinforcement learning (SAC, PPO), learning-based MPC, DeePC, safety filters for learned controllers.

Optimization: convex, linear, mixed-integer and nonlinear optimization, LMIs.

Software: Python (NumPy, SciPy, Pandas, PyTorch, CVXPY), C/C++ (pybind11, OpenMP), MATLAB/Simulink, ROS 2, Git, Linux, Docker, CI (GitHub Actions), pytest. Also: acados, CasADi, Gurobi, MOSEK, Simulink code generation, real-time/embedded code.

Engineering: system architecture, requirements definition, hazard and failure analysis, analog circuit design (sensor signal conditioning, filters, motor drivers), embedded electronics (Arduino, Raspberry Pi), computer vision and camera-based localization (Python, OpenCV).

PROFESSIONAL EXPERIENCE

Independent R&D: Open-Source Robotics and Control Software 09/2026 – present
Munich, Germany | Projects: anas-makdesi.github.io | Code: github.com/anas-makdesi

- ddma: open-source toolbox of my PhD and postdoc methods (Python and MATLAB, multithreaded C++ core): models with guaranteed error bounds from data and safe controller synthesis. On PyPI and MATLAB; 490+ tests, CI.
- Safety filter (my 2024 design) around RL (SAC, PPO) and DeePC controllers for lane keeping and a quadrotor, also learned from real driving logs: 0 crashes in 40 training runs vs 81–318 per run without.
- Real-time nonlinear MPC (acados) for a race car, a quadrotor and a 7-DOF robot arm, with C++ ROS 2 nodes, Docker and CI: 0.4–3.5 ms solve times.
- Vision-based surveying (Python, OpenCV): rebuilding my surveying-robot method with camera calibration, marker ranging, resection and least-squares adjustment.

Postdoctoral Researcher 02/2025 – 08/2026
Ludwig-Maximilians-Universität München (LMU), Munich, Germany | Group of Prof. Majid Zamani

- Developed a method that computes safe operating sets (controlled invariant sets) directly from measured trajectories, without identifying a model of the system.
- Developed monotone embeddings that extend fast interval-based reachability and safety tools to a wider class of nonlinear systems.
- Results: 4 conference papers (IFAC World Congress ×2, IEEE CDC, IEEE CCTA).

Independent Research 2024
Between PhD and postdoc, alongside travel in Europe

- Extended my safe learning-based MPC to online model updates during operation (IFAC ADHS 2024).
- Researched data-driven safety; first ideas for computing safe sets directly from data (IFAC World Congress 2026).
- Designed a safety filter that keeps learning-based controllers (e.g. RL agents) inside safe sets certified from data.

PhD Researcher in Automatic Control 09/2020 – 12/2023
Laboratory of Signals and Systems (L2S), CentraleSupélec, Université Paris-Saclay, France

- Developed one of the first data-driven methods for abstraction-based controller synthesis, which gives controllers with formal safety guarantees from measured data. Proved it reaches the lowest possible conservatism.

- Built a MATLAB/Python toolbox that takes measured data, a model structure and a partition size, and returns a model for controller synthesis. Using vectorization and better data structures, scaled it from a few hundred to 10^8 data points on fine partitions of 6–7-dimensional state spaces.
- Designed a safe learning-based MPC scheme: a guaranteed model built from data enforces safety, while a learned model drives performance. Case studies: unicycle robots, vehicle platooning, adaptive cruise control.
- Taught optimization tutorials (~25 students) and supervised linear control labs on physical benches (~30 students). Research visit to Newcastle University on safe learning (06/2023).
- Results: IEEE Transactions on Automatic Control, European Journal of Control, L4DC (selected for oral presentation), IFAC ADHS.

Research Intern 05/2019 – 07/2019
CERN, Geneva, Switzerland

- Worked on position estimation for a mobile robot and on battery charging circuits.

Team Lead, Research and Development 04/2018 – 05/2019
Subh Engineering, Damascus, Syria

- Led a team of five engineers building mobile robots for civil engineering: defined the system architecture and requirements, planned the projects, hired two engineers, and did the scientific work on the hardest technical tasks.
- Surveying robot: reached sub-millimeter position accuracy by combining an older total station with a mounted commercial camera and printed markers. Built the robot's vision-based localization in Python (OpenCV): image processing, marker detection, triangulation and visual odometry.
- Sewer robot for in-pipe inspection: designed the embedded electronics and wrote the robot's software (Raspberry Pi, Python, C/C++). The robot was delivered and field-tested.

Research and Development Engineer 10/2017 – 03/2018
Subh Engineering, Damascus, Syria

- Wrote the C/C++ control and sensing code for the robots and implemented and tuned closed-loop motor control on the real hardware.
- Developed the surveying robot and the sewer inspection robot as an engineer in the newly founded robotics section, before leading its team.

EDUCATION

PhD in Automatic Control 2020 – 2023
Université Paris-Saclay (CentraleSupélec), France | Supervisors: Antoine Girard, Laurent Fribourg

MSc in Automation, Signal and Image Processing 2019 – 2020
Université Paris-Saclay, France | Thesis: data-driven control of monotone systems

Diplôme d'Ingénieur in Electronic Systems (+ M1 in Control Systems) 2012 – 2018
Higher Institute for Applied Sciences and Technology (HIAST), Damascus, Syria

- Graduation project: control of a 3-DOF helicopter lab rig; designed and tuned the controllers and built the circuits that filter the sensor signals and drive the motors.
- Fourth-year project: Linear Variable Differential Transformer (LVDT) position sensor; designed the excitation and signal-conditioning circuits.

Summer schools: Data and Learning for Control (Grenoble, 2021); Learning-Based Predictive Control (ETH Zurich, 2022); Learning to Control (Imperial College London, 2023).

PUBLICATIONS

2 journal papers (IEEE Transactions on Automatic Control, European Journal of Control) and 7 conference papers (incl. L4DC oral, IFAC World Congress, IEEE CDC). Full list on Google Scholar.

ADDITIONAL INFORMATION

Languages: Arabic (native), English (excellent), French (good), German (A1).

Awards: First place, Syrian Robot Olympiad (2013, 2015); qualified twice for the International Robot Olympiad.

Service: Reviewer for Automatica, IEEE L-CSS, IEEE Transactions on Industrial Electronics, CDC, ECC.

References: available on request.