

# Samuel Balula

## Curriculum Vitæ

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Born 10.1993 (30)  
Citizen of Portugal



A creative problem solver, with an engineering physics background, who loves to model and automate.

### Experience

01.2024–Present **Post-doctoral Scientific Assistant**, *Control Theory and Systems Biology Lab, Department of Biosystems Science and Engineering (D-BSSE), Swiss Federal Institute of Technology Zurich (ETH), Basel, Switzerland*



- Development and automation of biological experimental apparatus.
- Control of biological processes with genetic engineering.

06.2018–05.2023 **Scientific Assistant**, *Automatic Control Lab/Inspire AG, Swiss Federal Institute of Technology Zurich (ETH), Zürich, Switzerland*



- Teaching Assistant for “Nonlinear Systems and Control”, “System Identification”, and the “General Control Laboratory”.
- Supervised a total of 17 Semester and Master projects on a variety of control applications.

01.2017–04.2018 **Head of Research**, *Trigger.Systems, Lisbon, Portugal*



- Trigger.Systems is a technological startup focused on closing the control loop with IoT solutions for agriculture, irrigation, and energy management. I was hired as the 5<sup>th</sup> employee.
- Responsible for electronic design, mathematical modelling, optimisation, and product development. Participated in HR selection, contacted clients, suppliers, and, to a lesser extent, investors. As project manager, supervised the work of a small team of engineers.

09.2015–01.2017 **Teaching Assistant**, *Instituto Superior Técnico – University of Lisbon, Lisbon, Portugal*



- Teaching Assistant for the “Microcontrollers” course (Engineering Physics program), where students learn basic concepts of electronics and embedded systems, by programming dsPIC microcontrollers in C and assembly. 2015/16 Excellence in Teaching Award.

09.2013–08.2015 **Researcher**, *Instituto de Plasmas e Fusão Nuclear (IPFN), Lisbon, Portugal*



- Collaborated in the development of the e-lab platform, where physics experimental apparatus are available online for remote control and data acquisition.
- Developed and integrated the firmware, electronics, and science apparatus, taking projects from idea to deployment.

### Education

06.2018–08.2023 **Doctor of Science in Automatic Control**, *Automatic Control Lab, Department of Information Technology and Electrical Engineering (D-ITET)/Inspire AG, Swiss Federal Institute of Technology Zurich (ETH), Zürich, Switzerland*



- Developed optimisation-based algorithms for trajectory planning, leveraging data-driven machine learning models, validated both with high-fidelity simulations and empirically.
- Applications in Precision Motion System control and Autonomous Robotic Inspection.

09.2014–11.2016 **Master of Science in Engineering Physics**, *Instituto Superior Técnico – University of Lisbon*, Lisbon, Portugal



- The broad curriculum combines physics and engineering and includes theoretical and experimental physics, analogue and digital electronics, automatic control, robotics, and machine learning.
- Used optimal control in the master thesis to plan trajectories and control a nonlinear, unstable system. 2017 Luís Vidigal Prize, APCA 2018 M.Sc. Thesis Award.

09.2011–07.2014 **Bachelor of Science in Engineering Physics**, *Instituto Superior Técnico – University of Lisbon*, Lisbon, Portugal



- The curriculum combines physics and engineering and includes theoretical and experimental physics, mathematics, electronics, mechanics, and management.

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## Selected Publications

Samuel Balula. *Optimization-Based Trajectory Planning for Precision Motion Systems and Autonomous Robotic Inspection*. PhD thesis, ETH Zurich, 2023.

Samuel Balula, Dominic Liao-McPherson, Alisa Rupenyan, and John Lygeros. Data-driven reference trajectory optimization for precision motion systems. *Control Engineering Practice*, 144:105834, 2024.

Samuel Balula, Dominic Liao-McPherson, Stefan Stevšić, Alisa Rupenyan, and John Lygeros. Drone-based volume estimation in indoor environments. *International Federation of Automatic Control (IFAC) World Congress*, 56(2):5009–5014, 2023.

Samuel Balula, Efe C Balta, Dominic Liao-McPherson, Alisa Rupenyan, and John Lygeros. Sequential quadratic programming-based iterative learning control for nonlinear systems. In *2023 IEEE Conference on Control Technology and Applications (CCTA)*, pages 162–167. IEEE, 2023.

Samuel Balula, Alex Liniger, Alisa Rupenyan, and John Lygeros. Reference design for closed loop system optimization. In *2020 European Control Conference (ECC)*, pages 650–655. IEEE, 2020.

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## Other skills, interests and prizes

**Software** Linux enthusiast, confident with Python, C, Julia, Mathematica, and Matlab. Experienced with C++, Bash, Assembly, HTML, javascript, CAD, Kicad, (ng)spice, Git, ROS, MQTT, etc.

**Hardware** Circuit and PCB design. I may tear things apart to understand how they work.

**Math Olympics** National Math Olympiad Finals (2010 & 2011). Bronze medal at the 2010 Paulista Math Olympiad.

**Music** High school level diploma in music (*8° grau*), with a major in Piano.

**Volunteering** Association of Scientific Staff of ETH; Engineers without borders Switzerland

**Languages** Native Portuguese, C2 English, B1 French, A1 German.

