SANDER TONKENS

Ph.D. student in Mechanical and Aerospace Engineering · Robotics
La Jolla, California, USA
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EDUCATION

University of California, San Diego July 2025 (Expected)
Doctor of Philosophy (Ph.D.) - Mechanical and Aerospace Engineering *La Jolla, CA*

Overall GPA: 4.0
Relevant Coursework: Machine Learning for Robotics, Mathematics for Robotics, and Deep Generative Models.

Stanford University December 2020
Master of Science (M.S.) - Mechanical Engineering *Stanford, CA*

Overall GPA: 4.0
Focus in Numerical Mathematics, Robotics, and Machine Learning.
Relevant Coursework includes Optimal and Learning-Based Control, Convex Optimization I & II, Reinforcement Learning, Principles of Robot Autonomy, Mechatronics I & II, State Estimation, and Medical Robotics.

École Polytechnique Fédérale de Lausanne (EPFL) July 2017
Bachelor of Science (B.Sc.) - Mechanical Engineering *Lausanne, Switzerland*

Overall GPA: 5.4 / 6
Focus in Mathematics and Control Theory.
Relevant coursework includes Control Theory, Multivariate Control, Dynamics I & II, and Complex Analysis.

RESEARCH EXPERIENCE

Safe Autonomous Systems Laboratory - UC San Diego September 2021 - Present
Graduate Student Researcher - PI: Prof. Sylvia Herbert *La Jolla, CA*

· Conducting research on generalization and active learning to ensure safety for learning-based autonomy stacks.
· First Ph.D. student in new research group, taking leading role in setting up hardware & computation platforms.

Control Systems Tech. Group - Eindhoven University of Technology March 2021 - July 2021
Research Assistant - PI: Dr. Ir. Mauro Salazar *Eindhoven, The Netherlands*

· Conducting research on dynamic programming approach for vaccine allocation optimization.
· Large data-driven system identification for deterministic and stochastic graph-based epidemiology models.
· Developed open-source codebase with the objective of facilitating government policy making.

Autonomous Systems Laboratory - Stanford University September 2019 - January 2021
Research Assistant - PI: Prof. Marco Pavone *Stanford, CA*

· Conducting research on efficient constrained optimal control of high-dimensional nonlinear systems.
· Applied research to soft robots modeled using FEM models to devise highly-accurate reduced order models.
· Developed control scheme decoupling output feedback controller from optimization problem, together with reduced order model yielding a state-of-the-art method for complex dynamic tasks, e.g., trajectory tracking.
· Developed open-source codebase for simulation and hardware experiments, interfacing with SOFA framework.

CHARM Lab - Stanford University March 2019 - June 2019
Independent Research Project - PI: Prof. Allison Okamura *Stanford, CA*

· Fabricated pneumatically actuated 3-DoF elastomer-based soft wearable haptic devices.
· Developed & implemented inverse dynamics feed-forward adaptive controller with state prediction, P-MRAC, enabling matching soft actuator performance across devices with significantly reduced response latency.
· Validated control design with hardware experiments and received the best grade for a related course project.

PUBLICATIONS

Sander Tonkens, Alex Toofanian, Zhizhen Qin, Sicun Gao, and Sylvia Herbert, "Patching Neural Barrier Functions using Hamilton-Jacobi Reachability", *IEEE Conference on Decision and Control*, 2023 (Submitted).

Sander Tonkens and Sylvia Herbert, "Refining Control Barrier Functions using Hamilton-Jacobi Reachability", *IEEE/RSJ International Conference on Intelligent Robots & Systems*, 2022 `https://arxiv.org/abs/2204.12507`.

Sander Tonkens, Paul de Klaver, and Mauro Salazar, "Optimizing Vaccine Allocation Strategies in Pandemic Outbreaks: An Optimal Control Approach", *European Control Conference*, 2022, `https://arxiv.org/abs/2112.11908`.

Sander Tonkens, Joseph Lorenzetti, and Marco Pavone, "Soft Robot Optimal Control Via Reduced Order Finite Element Models", *IEEE International Conference on Robotics and Automation*, 2021, `https://arxiv.org/abs/2011.02092`.

TEACHING EXPERIENCE

Graduate Course Assistant - Stanford University   March 2020 - July 2020
AA203: Optimal and Learning-Based Control   *Stanford, CA*

· Created new assignments on the topics of reachable sets/tubes, sequential convex programming, comparison of classical and learning-based approaches for control, and reinforcement learning using PyTorch.
· Conducted office hours, graded assignments, and mentored custom class projects focused on optimal control.

Undergraduate Course Assistant - EPFL   September 2015 - July 2017
Physics I, Analysis II, III & IV, Dynamics I   *Lausanne, Switzerland*

· Taught fundamental and advanced undergraduate Mechanical Engineering courses in English and French.
· Responsibilities included leading tutorial sessions, preparing exam questions, and holding office hours.

PROFESSIONAL EXPERIENCE

Auris Health   June 2019 - September 2019
Controls & Robotics Intern   *Redwood City, CA*

· Developed improved nonlinear dynamics model of next-generation teleoperated flexible endoscope for novel treatments leading to significant improvement in end-effector position control.
· Designed & implemented automated nonlinear system identification procedure and tuning GUI for endoscopes.
· Improved modeling and control aided with the retirement of multiple key endoscope user-responsiveness issues, yielded more intuitive robot, and gave surgeons access to previously inaccessible regions of the target organ.
· Conducted controller performance feedback sessions with clinical engineers during in-vivo lab sessions.

McKinsey & Company   April 2018 - August 2018
Business Analyst Intern   *Geneva, Switzerland*

· Developed strategy and modeled ROI of generic drug treatment accessibility incentive in Sub-Saharan Africa.
· Co-created & developed IoT use cases for packaging machinery manufacturer and a leading PaaS provider.

LM Wind Power   September 2017 - April 2018
R&D Engineering Intern   *Kolding, Denmark*

· Propotyped & tested adhesive bonding evaluation tool for 80+ meter wind turbine blades.
· Designed & led field test evaluation of autonomous control system for a novel blade ice mitigation system.

SKILLS

Programming	Python, Julia, C/C++, Rust.
Learning & Robotics	ROS, PyTorch, TensorFlow, JAX, MuJoCo.
Design	CATIA, LabVIEW, Simulink, Solidworks.
Languages	Dutch (mother tongue), English, French (Fluent), German, Spanish (Beginner).

AWARDS & FELLOWSHIPS

· MAE Department Ph.D. Fellowhsip, University of California San Diego, 2021.
· First year Ph.D. Fellowship, University of California Berkeley, 2021 (Declined).
· Dean's Fellowship, University of Pennsylvania, 2021 (Declined).
· First year Ph.D. Fellowship, Princeton University, 2021 (Declined).
· Netherlands America Foundation Graduate Fellowship, 2018.
· Fulbright Graduate Scholar, 2018.

INVITED TALKS

· 39th Southern California Control Workshop, April 2022.

SERVICE

Reviewing	**CDC** ('23), **ICRA** ('23), **T-RO** ('23, '22), **IROS** ('23, '22), **L4DC** ('23, '22), **RA-L** ('22, '21), **ECC** ('22), **NeurIPS** ('21), **IEEE Access** ('21).
Community	Vice-President UC San Diego Robograds (June 2022 - Present) · Graduate student org. hosting academic and social events for robotics grad students. SafeRL workshop program committee member @ NeurIPS 2021