

# Alp Sahin

Philadelphia, PA • (508) 310-3081 • alpsahin695@gmail.com  
linkedin.com/in/sahinalp • github.com/asahin1 • asahin1.github.io

## SUMMARY

PhD student in Robotics with 4+ years of experience in motion planning, algorithm design, and robotic system integration. Committed to a structured and meticulous approach in developing algorithmic solutions grounded in mathematical modeling and optimization. Proven track record of strong written and verbal communication skills, demonstrated through publications and presentations at respected robotics and controls venues. Enthusiastic about bridging the gap between research and practical applications, with a focus on creating transparent algorithms that enhance interpretability and reliability.

## EDUCATION

Lehigh University, Bethlehem, PA

Expected Graduation: May 2026

### PhD in Mechanical Engineering & Mechanics

Focus: Topological and Geometrical Methods for Robot Motion Planning

Awards: Dean's Fellow (Rossin College Doctoral Student Support Program)

Related Coursework: Robot Motion Planning and Control, Convex Optimization, Linear Systems and Control, Geometric Control of Robotic Systems, Analytical Methods in Dynamics and Vibrations, Differential Geometry I

Worcester Polytechnic Institute, Worcester, MA

Graduated May 2021

### MS in Robotics Engineering

MS Thesis: Region-based Planning for a 3D In-Hand Manipulation Platform Leveraging Variable Friction Fingers and External Surfaces

Awards: 2nd Place at WPI Graduate Research Innovation Exchange, WPI Robotics Engineering Graduate Student Travel Award (for presenting at the American Control Conference 2021)

Related Coursework: Artificial Intelligence, Robot Dynamics, Robot Control, Optimal Control

Bogazici University, Istanbul, Turkey

Graduated June 2019

### BS in Mechanical Engineering

Senior Project: Design and Development of an Optical Force Sensor for an Extensible Colonoscopy Robot

## RESEARCH EXPERIENCE

### Autonomous and Intelligent Robotics Lab

Aug. 2021 – Present

Lehigh University, Bethlehem, PA

#### Search-Based Multi-Path Planning

- Developed a graph-search based path planning algorithm that computes multiple locally optimal solutions in configuration spaces, leveraging concepts from topology and geometry
- Implemented the algorithm in C++, with visualizations created using OpenCV, OpenGL, and Blender
- Adapted the approach to tethered robot motion planning problems, finding optimal paths for a robot attached to a base via a fixed-length tether
- Conducted real-robot experiments using the OptiTrack motion capture system and the Crazyflie quadrotor platform
- Submitted a paper to IEEE Transactions on Robotics, currently under review

#### Kinematic Control Framework for FLX BOT

- Developed an optimization-based controller that addresses the control challenges near the singular configurations of the FLX BOT, a user teleoperated inspection robot
- Presented a paper at the IEEE Conference on Control Technology and Applications (CCTA 2024)

#### Network Graph Optimization for Resonance Reduction

- Explain here.

### Manipulation and Environmental Robotics Lab

Jan. 2020 – June 2021

Worcester Polytechnic Institute, Worcester, MA

#### Region-based Planning for 3D Within-Hand-Manipulation via Variable Friction Fingers and Extrinsic Contacts

- Designed a region-based cost function and developed an A\*-based motion planning algorithm that computes a sequence of manipulation primitives for a robotic manipulation platform featuring a Franka Emika Panda arm and a variable friction gripper

- Conducted simulated experiments using ROS and Gazebo, creating custom plugins to simulate the variable friction mechanism, and developing user interfaces using Qt for gripper control and parameter tuning
- Implemented the motion planning algorithm in Python and conducted real robot experiments integrating it with MoveIt to control the Panda arm and the gripper
- Presented the work at the IEEE Conference on Robotics and Automation (ICRA 2021)

## Robotics, Mobility and Cyber-physical Systems Lab

May 2020 – June 2021

Worcester Polytechnic Institute, Worcester, MA

### Development and Benchmarking of Feedback-Based Dynamic Data Acquisition Methods

- Developed a feedback-based dynamic feature selection algorithm, a reinforcement learning approach that dynamically collects data and revises its policy based on performance in supervised learning tasks, implemented using Python and the scikit-learn library
- Created a benchmarking tool to evaluate the performance of dynamic data collection policies
- Presented findings at the IEEE American Control Conference (ACC 2021) and SAE WCX 2021 Digital Summit

## PUBLICATIONS & PRESENTATIONS

- [1] A. Sahin, N. Kozachuk, R. S. Blum and S. Bhattacharya, "Resonance Reduction Against Adversarial Attacks in Dynamic Networks via Eigenspectrum Optimization," arXiv [cs.SI]. 2024, <https://doi.org/10.48550/arXiv.2410.00126>
- [2] A. Sahin, S. Brawner, M. Bilsky and S. Bhattacharya, "Real-Time Joystick-based Kinematics Control of a Snake-like Robot with Robustness Near Singular Configurations," 2024 IEEE Conference on Control Technology and Applications (CCTA), Newcastle upon Tyne, United Kingdom, 2024, pp. 663-668, <https://doi.org/10.1109/CCTA60707.2024.10666648>
- [3] Z. Wang, A. Sahin and X. Zeng, "Efficient Data Collection for Connected Vehicles With Embedded Feedback-Based Dynamic Feature Selection," in IEEE Transactions on Intelligent Vehicles, vol. 9, no. 1, pp. 2509-2519, Jan. 2024, <https://doi.org/10.1109/TIV.2023.3314788>
- [4] X. Wang, A. Sahin, and S. Bhattacharya, "Coordination-free Multi-robot Path Planning for Congestion Reduction Using Topological Reasoning," Journal of Intelligent & Robotic Systems, vol. 108, no. 3, p. 50, Jul. 2023, <https://doi.org/10.1007/s10846-023-01878-3>
- [5] A. Sahin and S. Bhattacharya, "Topo-Geometrically Distinct Path Computation using Neighborhood-augmented Graph, and its Application to Path Planning for a Tethered Robot in 3D," arXiv [cs.RO]. 2023, <https://doi.org/10.48550/arXiv.2306.01203>
- [6] A. Sahin, A. J. Spiers and B. Calli, "Region-Based Planning for 3D Within-Hand-Manipulation via Variable Friction Robot Fingers and Extrinsic Contacts," 2021 IEEE International Conference on Robotics and Automation (ICRA), Xi'an, China, 2021, pp. 6549-6555, <https://doi.org/10.1109/ICRA48506.2021.9561376>
- [7] A. Sahin and X. Zeng, "Feedback-Based Dynamic Feature Selection for Constrained Continuous Data Acquisition," 2021 American Control Conference (ACC), New Orleans, LA, USA, 2021, pp. 3507-3512, <https://doi.org/10.23919/ACC50511.2021.9483180>
- [8] A. Sahin and X. Zeng, "A Framework for Benchmarking Feedback-Based Dynamic Data Collection Methods in Connected Vehicle Networks," SAE Technical Paper 2021-01-0184, 2021, <https://doi.org/10.4271/2021-01-0184>

## INDUSTRY EXPERIENCE

### Tooling Process and Design Intern

Jan. 2019 – Feb. 2019

Beycelik GESTAMP Teknoloji ve Kalip A.S., Bursa, Turkey

- Observed and participated in the design procedures of steel stamping dies in CATIA V5

### Press and Die Production Intern

June 2018 – July 2018

TOFAS Turk Otomobil Fabrikasi A.S., Bursa, Turkey

- Automated the process capability reporting procedures for the stamped automobile parts using Office VBA
- Gave a presentation on Lean Production and Six Sigma

### Process Engineering Intern

July 2017 – Aug. 2017

GESTAMP Metalbages, Santpedor, Spain

- Studied types of sheet metal forming lines including progressive dies and transfer dies featuring robotic arms

## LEADERSHIP, OUTREACH and SERVICE

### Scholarly Reviewer | IEEE Publications

May 2023 – Present

- Conducted scholarly reviews for the journals: IEEE Robotics and Automation Letters, IEEE Transactions on Intelligent Vehicles

### Robotics Activity Organizer | CHOICES, Lehigh University

June 2022 and June 2023

- Lead a team of graduate students in developing an interactive capture the flag game using mobile robots equipped with raspberry pi
- Designed a user friendly interface for observing and commanding the robots through a mouse and a keyboard
- Supervised 20+ middle school students, who successfully navigated robots to their goals as a part of the activity

### MS Trainee | FORW-RD NSF NRT Program, Worcester Polytechnic Institute

Aug. 2020 – May 2021

- Completed a course on Robot/AI Ethics, featuring discussions on the communication of ethical and societal impacts of scientific research and technology development

- Participated in seminars and workshops focusing on user experience design and applications
- Authored a broader impacts chapter as a part of the MS Thesis, focusing on the societal and ethical implications of the work

**Vice President and Diving Instructor** | Underwater Sports Club, Bogazici University May 2016 – July 2019

- Provided theoretical and in-water diving training across various certificate levels in CMAS
- Organized (transportation, accommodation, diving) 50+ people diving trips in Turkey as a member of the club board
- Managed and maintained club-owned diving equipment including breathable air cylinders, regulators, buoyancy vests, air compressors

## **SKILLS**

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Computer skills: MATLAB, C++, Python, HTML, CSS, Mathematica, Qt, OpenCV, OfficeVBA

Software: SolidWorks, ROS, Gazebo,

Drawing and Typesetting: Inkscape, Office, Latex

Manufacturing: Silicone molding, Plastic injection, General machine shop skills

Language proficiency: English (fluent), Turkish (native), German (intermediate)