

Kasra Sinaei

Robotic Software Developer and Control Engineer | Authorized to work in the US
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EDUCATION

PENNSYLVANIA STATE UNIVERSITY

PHD IN ELECTRICAL ENGINEERING

Thesis: Safety Guarantee for Learning Controllers via Barrier Functions
Summer 2027 | State College, PA

PENNSYLVANIA STATE UNIVERSITY

MSC. IN ELECTRICAL ENGINEERING

Paper: Model-free Safety-critical Position Control of Robots
May 2024 | State College, PA

UNIVERSITY OF TEHRAN

BSc. IN MECHANICAL ENGINEERING

Capstone Project: Motion Planning & Control of Wheeled-legged Robot
Jan 2022 | Tehran, Iran
Cum. GPA: 17 / 20

SKILLS

PROGRAMMING

C++ • Python • C • MATLAB • C# • Shell

SW DEVELOPMENT TOOLS

ROS1/2 • Git • Docker • CUDA • .NET

SIMULATION

Nvidia IsaacSim • MuJoCo • Gazebo • Unity •
RaiSim • PyBullet • Chorenoid

COMPUTER VISION & AI

PyTorch • OpenCV • JAX • Hugging-face • YOLO

THEORETICAL

Safety-Critical Systems • Nonlinear Control • Convex Optimization • MPC • Adaptive/Robust Control • VLA, LLM • RL • State Estimation

CAD/CAE

SolidWorks • ANSYS • CATIA • AutoCAD

TEACHING ASSISTANT

Continuous-Time Linear Systems (EE350)

Intro. to Digital Control Systems (EE482)

AI and ML in Mechanical Engineering

Automatic Control of Linear Systems

Electrical Circuits and Electrical Machines

LANGUAGE SKILLS

ENGLISH

Full Professional Proficiency C2 (CEFR)

PERSIAN

Native or Bilingual Proficiency

SPANISH

Elementary Proficiency A2 (CEFR)

EXPERIENCE

ALPHAZ INC. | ROBOTICS SOFTWARE DEVELOPER INTERN

May 2025 - Aug 2025 | Palo Alto, CA

Architected motion primitives and trajectory planners for **dual-arm** mobile manipulator. Built high-reliability **ROS2** perception pipelines (C++/Python) for **state estimation** and object detection. Integrated **safety checks** and error recovery for autonomous door opening.

MEWE CO. | MECHANICAL ENGINEERING INTERN

May 2019 - Aug 2019 | Tehran, Iran

Practicing the Engineering design process, CAD, Pump Station design, numerical analysis, and helping the ME and CE teams in the ongoing projects.

RESEARCH

CARL | GRADUATE RESEARCHER

Aug 2022 - Now | State College, PA

Control & Autonomous Robotics Lab (CaRL) is advised by Dr. Donald Ebeigbe. Designed **safety systems** and **real-time failsafes** for robotic platforms using Control Barrier Functions. Validated algorithms on hardware, ensuring **sensor consistency** and robust performance under uncertainty.

CAST | UNDERGRADUATE RESEARCHER

Sep 2019 - Mar 2022 | Tehran, Iran

Developed core software for full-size **humanoid robot** at CAST. Implemented **low-level drivers**, **state estimation** fusing IMU/encoders, and closed-loop balance controllers. Designed gait controllers for traversing **uneven terrain**.

AWARDS & HONORS

MELVIN P. BLOOM MEMORIAL GRADUATE FELLOWSHIP |

\$850 | 2024

Awarded to outstanding graduate students in Electrical Engineering based on academic excellence and research potential.

MILTON & ALBERTHA LANGDON MEMORIAL GRADUATE FELLOWSHIP | \$810 | 2023

Merit-based fellowship recognizing exceptional graduate student performance and research contributions.

FA25 DR. ARTHUR H. WAYNICK GRADUATE SCHOLARSHIP IN EE

SP24 | \$3,147 | 2022

Prestigious scholarship awarded to top-performing graduate students in Electrical Engineering department.

FA20

COLLEGE OF ENGINEERING GRADUATE FELLOWSHIP |

\$6,000 | 2022-2023

Competitive fellowship supporting outstanding graduate students pursuing advanced degrees in engineering disciplines.

GOVERNMENTAL BSC. SCHOLARSHIP | FULL TUITION

WAIVER | 2017-2021

National merit-based scholarship covering complete undergraduate tuition for academically distinguished students.

PUBLICATIONS

- [1] Kasra Sinaei and Donald Ebeigbe. Safe adaptive control with vanishing conservativeness for robotic systems with unknown dynamics via barrier functions. *IEEE robotics and automation letters*, 1(1):1–8, 2026.
- [2] Kasra Sinaei, Kasun Weerakoon, Christopher Bradley, Seyed Abolfazl Fakoorian, and Donald Ebeigbe. Optimal motion planning for mobile manipulators navigating doorways via nonlinear mpc. In *2026 IEEE International Conference on Robotics and Automation (ICRA)*, 2026.
- [3] Kasra Sinaei and D. Ebeigbe. Safe robust control of nonlinear systems with uncertain regressor and parameter vector. In *IEEE Conference on Control Technology and Applications (CCTA)*, aug 2025.
- [4] Kasra Sinaei, H. Wu, and D. Ebeigbe. Safety-critical position control of robots: A model-free approach. In *American Control Conference (ACC)*, jun 2025.
- [5] Pezhman Abdolahnezhad, Aghil Yousefi-Koma, Amirhosein Vedadi, Kasra Sinaei, Behnam Maleki, and Milad Shafiee. Online bipedal locomotion adaptation for stepping on obstacles using a novel foot sensor. In *2022 IEEE-RAS 21st International Conference on Humanoid Robots (Humanoids)*, pages 344–349. IEEE, 2022.
- [6] Amirhosein Vedadi, Kasra Sinaei, Pezhman Abdolahnezhad, Shahriar Sheikh Aboumasoudi, and Aghil Yousefi-Koma. Bipedal locomotion optimization by exploitation of the full dynamics in dcm trajectory planning. In *2021 9th RSI International Conference on Robotics and Mechatronics (ICRoM)*, pages 365–370. IEEE, 2021.
- [7] Kasra Sinaei and MRS Yazdi. Pid controller tuning with deep reinforcement learning policy gradient methods. In *Proceedings of the 29th International Conference of Iranian Society of Mechanical Engineers & 8th Conference on Thermal Power Plants, Tehran, Iran*, pages 25–27, 2021.

PROJECTS

SAFE VLA VIA BARRIER ENHANCED FLOW MATCHING | INDEPENDENT RESEARCH

2026 | CARL, Penn State University

Utilizing the barrier function theories in conjunction with flow matching generative models to develop a novel approach for safe inference in robotic systems. The method ensures safety constraints are satisfied during the generative process without compromising the quality of generated action trajectories.

AUTONOMOUS DOOR OPENING WITH MOBILE MANIPULATORS | INTERNSHIP PROJECT

2025 | AlphaZ Inc.

Developed a complete autonomous system for door handle detection and manipulation using mobile manipulator. Implemented a novel motion planning algorithm and real-time control and perception pipelines to make the entire operation autonomous.

MODEL-FREE SAFETY-CRITICAL ROBOT CONTROL | MASTER'S THESIS PROJECT

2022 - 2024

Created a model-free safety control framework using control barrier functions for position controlled robotic systems. Validated safety guarantees through Lyapunov analysis and demonstrated on Unitree Go1 quadrupedal robot.

HUMANOID ROBOT GAIT CONTROLLER | UNDERGRADUATE CAPSTONE PROJECT

Jan 2020 - May 2022 | University of Tehran

Developed DCM-based trajectory generation and closed-loop control for full-size humanoid robot. Implemented adaptive gait patterns for uneven terrain traversal with real-time balance control. Achieved stable walking on 10cm height variations.

AUTONOMOUS RACING: OPTIMAL RACING LINE & VEHICLE CONTROL | COURSE PROJECT

2023-2024 | Penn State University

Demonstrated different approaches for finding the optimal racing and comparing model-based method (MPC) to model-free learning algorithms (RL). Showcasing the vehicle control using policy-based learning methods and classic controllers.

DEEP REINFORCEMENT LEARNING FOR PID TUNING | INDEPENDENT RESEARCH

2021 | University of Tehran

Implemented policy gradient methods (PPO, A3C) for automatic PID controller parameter optimization. Compared against traditional tuning methods and achieved 40% improvement in settling time and overshoot reduction.

EXTRACURRICULARS & HOBBIES

- Astrophotography and Astronomical Data Aquisition
- 2D Game Development and Design (Unity and .NET frameworks)
- Sports and Recreational Activities: Snowboarding, Tennis, Volleyball, Surfing, Hiking