Mohsen Sombolestan

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Education

- **University of Southern California** — Los Angeles, CA
  Ph.D. in Mechanical Engineering (Robotics) — *Aug 2021 - May 2025 (expected)*
  - **GPA**: 4.0/4.0
  - **Advisor**: Quan T. Nguyen
- **Isfahan University of Technology** — Isfahan, Iran
  M.Sc. in Mechanical Engineering (Robotics) — *2017 - 2020*
  - **GPA**: 4.0/4.0
  - **Thesis**: Real-time Haptic Rendering for Deformable Objects based on Machine Learning
- **Sharif University of Technology** — Tehran, Iran
  B.Sc. in Mechanical Engineering — *2013 - 2017*
  - **GPA**: 3.71/4.0
  - **Thesis**: Optimal Path-Planning for Mobile Robots based on Machine Learning

Research Interests

- Robotics
- Model Predictive Control
- Legged Locomotion and Manipulation
- Machine Learning

Publications

[1] **M. Sombolestan** and Q. Nguyen, *Hierarchical Adaptive Motion Planning with Nonlinear Model Predictive Control for Safety-Critical Collaborative Loco-Manipulation*, Nov. 2024. [Online]. Available: https://arxiv.org/abs/2411.10699v1.

[2] **M. Sombolestan** and Q. Nguyen, *Safety-critical Motion Planning for Collaborative Legged Loco-Manipulation over Discrete Terrain*, Oct. 2024. [Online]. Available: https://arxiv.org/abs/2410.11023v1.

[3] **M. Sombolestan** and Q. Nguyen, "Adaptive-Force-Based Control of Dynamic Legged Locomotion Over Uneven Terrain," *IEEE Transactions on Robotics*, vol. 40, pp. 2462–2477, Mar. 2024, ISSN: 1552-3098. DOI: 10.1109/TRO.2024.3381554.

[4] **M. Sombolestan** and Q. Nguyen, "Hierarchical Adaptive Control for Collaborative Manipulation of a Rigid Object by Quadrupedal Robots," in *2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, IEEE, Oct. 2023. DOI: 10.1109/IROS55552.2023.10341700.

[5] **M. Sombolestan** and Q. Nguyen, "Hierarchical Adaptive Loco-manipulation Control for Quadruped Robots," in *2023 IEEE International Conference on Robotics and Automation (ICRA)*, IEEE, May 2023, pp. 12 156–12 162. DOI: 10.1109/ICRA48891.2023.10160523.

[6] **M. Sombolestan**, Y. Chen, and Q. Nguyen, "Adaptive Force-based Control for Legged Robots," in *2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, IEEE, Sep. 2021, pp. 7440–7447. DOI: 10.1109/IROS51168.2021.9636393.

[7] **S. M. Sombolestan**, A. Rasooli, and S. Khodaygan, "Optimal path-planning for mobile robots to find a hidden target in an unknown environment based on machine learning," *Journal of Ambient Intelligence and Humanized Computing*, May 2019. DOI: 10.1007/s12652-018-0777-4.

Talks & Presentations

- "Hierarchical Adaptive Control for Legged Locomotion and Manipulation," *USC Robotics Seminars (UROS)*, April, 2024.
- "Utilizing Adaptive Control techniques for Legged Locomotion and Manipulation," *Southern California Control Workshop*, March, 2023.
- "Adaptive Loco-manipulation Control for Quadruped Robots," *Southern California Robotics Symposium*, September, 2022.

Honors

- Ranked **1st** among more than 140 mechanical engineering students in Master Degree 2020
- Ranked **268th** among 260000 participants in Iranian University Entrance Exam (Konkur) 2013
- One of the finalist team in Mathematics A-lympiad competition, Amsterdam, Netherlands 2012

Work Experiences

- **Field AI** Mission Vijeo, CA
  Ph.D. Research Intern *Mar 2023 - Oct 2023*
  - Designing and implementing a vision-based locomotion controller for Unitree quadruped robots utilizing nonlinear model predictive control (NMPC). The aim was to facilitate stair climbing and enhance navigation through complex terrains found in construction sites.
- **Dr. Robot Co.** Tehran, Iran
  Robotics Engineer *2016 - 2017*
  - Contributed as a member of the technical team for the ROMA robot project, an innovative humanoid robot designed specifically for the fashion industry to captivate customer attention.

Research Experiences

- **Dynamic Robotics & Control Lab (DRCL)** Los Angeles, CA
  Graduate Research Assistant - Supervised by Dr. Q. T. Nguyen *Apr 2020 - present*
  - Focused on enhancing legged robot dynamic locomotion in real-world environments by combining adaptive control with model predictive control (MPC) to address uncertainties.

  - Leveraging the quadruped robot's body for manipulating unknown objects through introducing an adaptive loco-manipulation controller and extending the approach to a team of robots for collaborative manipulation tasks.
  - I have hands-on experience in designing and implementing controllers for Unitree quadruped robots (A1, Go1, and AlienGo) as well as our custom bipedal robot, HECTOR, both in physical hardware and simulation environments.

- **Isfahan University of Technology** Isfahan, Iran
  Research Assistant - Supervised by Dr. M. Danesh *2018 - 2019*
  - Developing a model-free control method for continuum manipulators using an adaptive neural network, applied to a tube catheter for surgical applications.

- **Center of Excellence in Design, Robotics, and Automation (CEDRA)** Tehran, Iran
  Research Assistant - Supervised by Dr. A. Meghdari *2016 - 2017*
  - Develop the ROMA, autonomous *Robotic Mannequin* for the fashion industry. This robot is designed to replicate human postures while interacting with customers.

Software and Programming Skills

- Programming and Markup Languages:
  - **Professional**: C++, Python, MATLAB
  - **Have Experience with**: Jax, PyTorch
- Technical Software and Simulators:
  - **Professional**: ROS, Gazebo, MuJoCo, Simulink
  - **Have Experience with**: Brax, Pybullet
- Optimization Packages:
  - **Professional**: OCS2, OSQP, qpOASES
- Software Development:
  - Check out my GitHub profile to explore open-source code related to my research.

Teaching Assistant Experiences

- **University of Southern California**
  - Robot Dynamics and Control [AME 556] Spring 2023 & 2024

Professional Services

Papers reviewed for:

- ICRA (2023, 2024, 2025)
- IROS (2022, 2023)
- RA-L (2023, 2024)