

Ümit Şen

Northampton, MA, USA · +1 413 326 66 05 · umitsen@umass.edu · senumit.com

PhD researcher in soft robotics focusing on bio-inspired locomotion and compliant robot design with industry experience in control systems and a background in haptics.

EDUCATION

DOCTOR OF PHILOSOPHY IN MECHANICAL ENGINEERING · 2024 - Present
UNIVERSITY OF MASSACHUSETTS AMHERST · MA, USA
Current GPA: 4.00/4.00

BACHELOR OF SCIENCE IN MECHATRONICS ENGINEERING · 2019 - 2023
KADIR HAS UNIVERSITY · Istanbul, Turkey
GPA: 4.00/4.00 · Valedictorian

RESEARCH EXPERIENCE

- **SOFT ROBOTIC SNAKE DESIGN & LOCOMOTION** · 9/2024 - Present
PHD RESEARCH. Advisor: Assist. Prof. Gina OLSON
Developing a soft robotic snake to achieve bio-inspired locomotion on heterogeneous surfaces. Fabricated 2+ generations of McKibben actuators to improve pneumatic actuation quality and tested 5+ bio-inspired skin designs through elastomer molding and FDM-based thermoplastic printing. Demonstrated soft robotic snake locomotion on 5 different heterogeneous surfaces and correlated locomotion performance to friction test results — the first study to establish this link. Findings revealed that anisotropic friction alone does not determine locomotion performance, motivating ongoing work on mechanics of surface-snake scale interplay. First-year results published at RoboSoft 2026.
- **HAPTICS** · 10/2022 - 8/2024
Advisor: Assist. Prof. Mine SARAC STROPPA
Haptic Device Design: Designed a wrist-worn haptic interface that relocates tactile feedback from fingertip to wrist for freer VR/AR interaction. Built a custom voice-coil actuator with optimized neodymium magnet and coil geometry, iterated through 10+ 3D-printed case prototypes, and implemented embedded firmware for real-time actuation with tunable intensity. Validated through user studies on stiffness discrimination. Two publications: IEEE World Haptics 2023, IEEE RA-L 2024.
Haptic Game Design: Developed a Unity3D smartphone game as a gamified psychophysical testing platform replacing traditional tactile experiments. Implemented procedural path generation and three haptic feedback modes via Interhaptics Composer with real-time data collection of user responses. Published in IEEE Transactions on Haptics 2025.
- **VISIBLE LIGHT POSITIONING** · 2/2021 - 9/2022
Advisors: Emeritus Prof. Erdal PANAYIRCI, Assoc. Prof. Taner ARSAN
Contributed to the development of a spatial modulation-based 3D indoor visible light positioning (VLP) algorithm that achieved positioning errors an order of magnitude smaller than conventional RSS-based techniques. Designed and executed MATLAB simulations including user trajectory modeling, SNR-dependent pilot selection, and Monte Carlo-based error analysis across indoor environments. Published in Optics Communications 2023.
- **ROBOT SWARM COORDINATION** · 10/2020 - 10/2022
Advisor: Prof. Feza KERESTECIOGLU
Contributed to developing local cost-minimization strategies for circular formation of autonomous robot groups operating without communication, relying solely on sensor-based relative positioning of nearby members. Designed cost functions and simulation parameters that achieved arc, arc-triangle, and circle formations maintainable during navigation. Validated through MATLAB simulations across multiple trajectory scenarios. Published in Adaptive Behavior 2024.

WORK EXPERIENCE

ASELSAN

· 8/2023 - 8/2024

Control Design Engineer - Full Time

Designed and tuned controllers for 2-DoF and 3-DoF antenna systems using frequency domain analysis in MATLAB/Simulink. Performed system identification to characterize dynamic behavior, reducing identification duration and accelerating the overall design cycle. Deployed and debugged control architectures on industrial-grade hardware and conducted hardware-in-the-loop (HIL) validation using Speedgoat real-time computers. Built MATLAB App Builder tools to streamline and automate repetitive steps in the control design workflow.

JOURNAL PUBLICATIONS

- B. Kudsi, D. Xu, **U. Sen**, K.T. Yoshida, F. Stroppa, C.M. Nunez, M. Sarac, "Gamifying Haptics User Studies: Comparison of Response Times From Smartphone Interfaces," *IEEE Trans. Haptics*, vol. 18, no. 2, pp. 423–429, Apr. 2025, doi: 10.1109/TOH.2025.3536885.
- A. Adeyemi, **U. Sen**, S. M. Ercan, and M. Sarac, "Hand Dominance and Congruence for Wrist-Worn Haptics Using Custom Voice-Coil Actuation," *IEEE Robot. Autom. Lett.*, vol. 9, no. 4, pp. 3053–3059, Apr. 2024, doi: 10.1109/LRA.2024.3360815.
- **U. Sen**, Y. E. Yesilirmak, I. O. Bayman, T. Arsan, E. Panayirci, and N. Stevens, "3D indoor positioning with spatial modulation for visible light communications," *Optics Communications*, vol. 529, p. 129091, Feb. 2023, doi: 10.1016/j.optcom.2022.129091.
- F. Kerestecioğlu, **Ü. Şen**, Ç. Işıkver, and A. Göktekin, "Circular formations of non-communicating robot groups via local strategies," *Adaptive Behavior*, Aug. 2024, doi: 10.1177/10597123231204627.

CONFERENCE PUBLICATIONS

- **U. Sen**, A. Mahegan, and G. Olson, "Characterization and Correlation of Robotic Snake Scale Friction and Locomotion Speed," in *9th IEEE-RAS International Conference on Soft Robotics (RoboSoft)*, 2026. arXiv:2603.03735.
- Y. Nandwana, **U. Sen**, and G. Olson, "A Highly Articulated Backbone for Soft Snake Robots," in *Biomimetic and Biohybrid Systems*, vol. 15582, pp. 234–246. doi: 10.1007/978-3-032-07448-5_20.
- **U. Sen**, M. Sarac. "Design for Wrist-Worn Haptic Device with Custom Voice Coil Actuation," in *2023 IEEE World Haptics Conference (Work-in-Progress)*, Delft, Netherlands, 2023.

AWARDS & HONOURS

- **Robert and Deanna Hagerty Scholarship** · 2025
\$3,000 merit-based award for excellence in Robotics, University of Massachusetts Amherst.
- **Joseph E. Motherway Fellowship** · 2025
Merit-based award for excellence in design, University of Massachusetts Amherst.
- **Kadir Has University** · 2023
Valedictorian of the Class of 2023.

TEACHING & VOLUNTEERING

STUDENT VOLUNTEER: Student Volunteer at the **2023 World Haptics Conference**.

OUTREACH VOLUNTEER: Assisted at the 2026 UMass Engineering Open House, introducing K-12 students to soft robotics fundamentals through hands-on elastomer molding demonstrations.

ASSISTANTSHIPS: Teaching Assistant for the following courses:

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|--|---------------------------|
| • MIE124 - Computer Prog. for Eng. Problem Solving (Graduate TA) | <i>Spring 2024 - 2025</i> |
| • KHAS109 - Computational Thinking (Undergrad TA) | <i>Fall 2022 - 2023</i> |
| • KHAS110 - Civic Responsibility Project (Undergrad TA) | <i>Spring 2021 - 2022</i> |
| • KHAS101 - Origins and Consequences (Undergrad TA) | <i>Fall 2021 - 2022</i> |

SKILLS

- **PROGRAMMING & SOFTWARE:** MATLAB, Simulink, Python, ROS, C++, Arduino, MicroPython, C#, Unity3D, L^AT_EX
- **DESIGN & FABRICATION:** SolidWorks, Fusion360, Ansys, FDM 3D Printing, Elastomer Molding, Mechatronic Design
- **LANGUAGES:** Turkish (Native), English (Advanced, TOEFL iBT: 107)