

Oguzhan Oruc

PROFESSIONAL PROFILE

Assistant Professor of Mechanical Engineering whose research advances intelligent autonomous systems through the integration of artificial intelligence, probabilistic robotics, nonlinear system identification, and control theory. My work combines first-principles modeling with machine learning to develop adaptive, interpretable, and data-driven methods for autonomous decision-making in complex and uncertain environments. Current research spans AI-enabled digital twins for personalized healthcare, probabilistic robotics, autonomous marine and aerial vehicles, nonlinear system identification, and human motion modeling. Through interdisciplinary collaborations supported by the National Science Foundation and the U.S. Department of Defense, my research seeks to bridge robotics, control engineering, and artificial intelligence to create reliable autonomous systems with applications in healthcare, advanced manufacturing, transportation, and defense.

Research interests:

- Artificial Intelligence and Machine Learning
- Probabilistic Robotics
- Autonomous Systems and Intelligent Vehicles
- Digital Twin Technologies
- Nonlinear System Identification (NARMAX)
- Nonlinear and Adaptive Control
- State Estimation, Sensor Fusion, and Autonomous Navigation
- Human Motion Modeling and Biomechanics
- Robotics for Healthcare and Rehabilitation
- Autonomous Ground, Aerial, Surface, and Underwater Vehicles

EDUCATION

University of New Hampshire - Durham, NH

August 2023

Ph.D. in Mechanical Engineering

GPA :4.00

- Research topics included nonlinear modeling, nonlinear system identification, and motion control system design for autonomous and unmanned vehicles, and AI applications in healthcare.
- Relevant coursework includes Nonlinear Control Systems, Robust and Optimal Control, Digital Signal Processing, Statistical Methods for Research.
- Conducted research at the Jere A. Chase Ocean Engineering Laboratory, focusing on advanced control system design for autonomous underwater vehicles.

Istanbul Technical University - Istanbul, Turkey

May 2017

M.Sc. in Mechanical Engineering

- Major in System Dynamics and Control. Research focused on system identification and control system design of thermal systems.

Istanbul Technical University - Istanbul, Turkey

May 2005

B.Sc. in Mechanical Engineering

- Major : System Dynamics and Control

EXPERIENCE

The Citadel - Charleston, SC

January 2024 – Present

Assistant Professor

- Maintain an active and diverse research program in robotics and autonomous vehicles.
- Serve as the instructor of record for 4 undergraduate or graduate-level courses per semester.
- Serve as a member of the Institutional Review Board (IRB).
- Courses taught:
- MECH 350 Modeling and Analysis of Dynamical Systems I
- MECH 351 Modeling and Analysis of Dynamical Systems II
- MECH 365 Computational Methods in Engineering

- MECH 450 Mechatronics with Laboratory
- MECH 497 Special Topics : Autonomous Vehicles, Control Design for UAVs
- MECH 497 Special Topics : Autonomous Vehicles, Control Design for UGVs
- MECH 697 Autonomous Vehicles (Graduate Level)
- MECH 697 AI, Probability and Robotics (Graduate Level)

University of New Hampshire - Durham, NH

September 2018 – August 2023

Research Assistant

- Led Experimental Measurement and System Dynamics Laboratory classes. Advised final projects and conducted recitation classes and lectures. Courses taught:
- ME 747 Experimental Measurement and Modeling of Complex Systems.
- ME 646 Experimental Measurement and Data Analysis.
- ME 670 Systems Modeling, Simulation and Control.
- IAM 550 Introduction to Engineering Computing.

Ford Otosan - Izmit, Turkey

February 2007 - February 2012

Maintenance and Project Engineer

- Robotized manufacturing line projects were planned, utilized, and supervised.
- Robotic and manual spot-welding manufacturing lines were designed. MIG-MAG and TIG machines were renovated.
- Maintained industrial robots, including ABB, Comau, and KUKA systems.
- Advanced breakdown analysis on pneumatic and hydraulic control systems were conducted.
- Adjusted and repaired manufacturing systems according to engineering specifications, as-built documentation, and established procedures.
- Maintenance and repair activities of all equipment were planned and executed, according to TPM and FTPM procedures.

PROJECTS

Clemson-Medical University of South Carolina-The Citadel

January 2024 - Current

Thrust Leader Co-PI

- Title: ADAPT in SC: AI-enabled Devices for the Advancement of Personalized and Transformative Healthcare in South Carolina.
- Funded by the National Science Foundation (Award No. 224812).
- Serves as Thrust Leader for Digital Twin for Gait Rehabilitation through Manipulation of the Mechanical Context (Thrust 3–4).
- The project addresses AI-enabled Digital Twin technologies for biomedical and rehabilitation systems.
- The goal is to develop a patient-specific, predictive digital twin capable of modeling and forecasting foot placement dynamics in individuals with altered gait (primarily stroke survivors).

White River Technologies-UNH - Durham, NH

February 2022 – August 2023

Research Assistant

- Title: Demonstration of Highly Integrated Autonomous ROV-based 3DEM for Underwater Advanced Geophysical Classification.
- Funded by the U.S. Department of Defense under the Environmental Research Program (MR22-7454).
- The topic of the research is detection, classification, localization, and remediation of military munitions in underwater environments.
- Autonomous surface/underwater vehicle control systems are being developed to provide an autonomous mission execution. Adaptive control algorithms based on NARMAX identification to compensate for different payload skids and geometrical changes on the vehicle are being developed.
- Field tests will be conducted with the implemented control systems.

Naval Sea Systems Command-UNH - Durham, NH

January 2020 – August 2022

Independent Researcher

- Title: Coordination of multi-platform UUV/ASV system.
- Funded by Naval Sea Systems Command of US Navy (FY20-FY23: DoD N00174-20-1-0006).
- Developed a multi-domain network of collaborative autonomous vehicles for unpiloted missions, including ASVs, AUVs, and UUVs.
- Developed dynamic nonlinear models and control algorithms based on NARMAX system identification.
- Formation control for collaborative multi-platform ASV/UUV and fish-like biomimetic vehicle swarms are being developed.
- Autonomous real-time path planning with obstacle avoidance and autonomy of the vehicles are being designed.
- Mentored 24 undergraduate students participating in the project and related senior design activities.

Naval Sea Systems Command-UNH - Durham, NH

January 2018 - January 2020

Independent Researcher

- Title: Development of a multi-domain network of collaborative autonomous vehicles for unpiloted missions.
- Funded by Naval Sea Systems Command FY17-FY20: DoD N00174-17-1-0002.
- Modeled autonomous vehicles using nonlinear system identification techniques.
- Simulation studies for ASVs, UUVs, AUVs were done to analyze the behavior of the vehicles in different environmental conditions.
- Developed process, simulation, and control models.
- Navigation systems with EKF and UKF for each different type of vehicles are designed.
- Undergraduate research and senior design projects of 26 students were advised.

PUBLICATIONS

- **Oruc, O.**, et al., " Nonlinear System Identification Model-Based Inverse Optimal Controller (NX-IOC) with NMPC Trajectory Generation for Uncrewed Underwater Vehicles", *submitted to IEEE Journal of Oceanic Engineering* 25-0467.
- S. Shokouhi, **Oruc, O.**, and M.-W. Thein, "Self-Supervised Learning-Based Path Planning and Obstacle Avoidance Using PPO and B-Splines in Unknown Environments," in Proceedings of the 2026 American Control Conference (ACC), Atlanta, GA, USA, 2026.
- Vesali, N., & **Oruc, O.**, & Singleton, E., & Kaufman, H., & Aggarwal, S., & Williams, A. B. (2026, June), *Expanding Access to Humanoid Robotics and AI Education: A Comparative Case Study of Two Youth Summer Camps for Underrepresented Students* Paper presented at 2026 ASEE Annual Conference & Exposition, Charlotte, North Carolina. 10.18260/1-2--59663
- **O. Oruc**, "An Integrated Approach to AI, Probability and Robotics Education for Mechanical Engineering Students," in Proceedings of the 2026 ASEE Southeastern Section Conference, Memphis, TN, USA, Mar. 2026.
- **Oruc, O.**, Singleton, E., Skenes, K., Williams, A. Development of a New Course : Control Design for Autonomous Vehicles Using A Quadcopter As the Learning Platform ASEE SE 2025 Conference
- **Oruc, O.**, Singleton, E., Skenes, K., Williams, A. A Systematic Teaching Method for Modeling, Simulation and Control of Quadrotor Uncrewed Aerial Vehicle ASEE SE 2025 Conference
- Singleton, E. T., & **Oruc, O.**, & Ragan, D. D., & Vesali, N., & Williams, A. B. (2025, June), The First AI+ Health & Humanoids Camp for Underrepresented Minority Middle School Girls in South Carolina (Work in Progress) Paper presented at 2025 ASEE Annual Conference & Exposition , Montreal, Quebec, Canada
- **Oruc, O.**, Cook, A., Thein, M-W., Mu, B. Nonlinear System Identification for Heading and Pitch Control of a Tethered Uncrewed Underwater Vehicle in Changing and Uncertain Environments. Oceans 2022 Hampton Roads Conference.
- **Oruc, O.**, Nonlinear System Identification and Motion Control System Design for Uncrewed Underwater Vehicles, Ph.D. dissertation, University of New Hampshire, Durham, NH, USA, 2023.
- **Oruc, O.**, M. -W. Thein and B. Mu, "Nonlinear System Identification and Motion Control Design for an Unmanned Underwater Vehicle," OCEANS 2022 - Chennai, Chennai, India, 2022,