

Hamed Mozaffari

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SUMMARY

Dual Ph.D. Robotics and Control Engineer with strong expertise in industrial and automotive robotic systems. Proven record in state estimation, real-time control, motion planning, and sensor fusion using LiDAR, IMU, and camera data. Experienced in developing model-based and learning-based controllers, testing and validating actuators and sensors, and automating robotic platforms using ROS2, C++, Python, and MATLAB. Focused on advancing intelligent autonomy through integration of AI-based control, electromechanical systems, and sensor-actuator coordination.

EDUCATION

Southern Illinois University (SIUC-SIUE), Edwardsville, IL, USA AUG 2022 – JUN 2026 (Expected)
Ph.D. in Science Engineering (Robotics Track), GPA: 4/4
Dissertation: High-Precision Rigid Body Pose Estimation Using Constrained Sensor Fusion with Delay Compensation

K. N. Toosi University of Technology AUG 2011 – OCT 2019
Ph.D. in Mechanical Engineering (Control and Dynamics), GPA: 3.75/4
Dissertation: Modeling human driver behavior based on task-difficulty homeostasis theory to improve drowsy driver assistance systems in a driving simulator

K. N. Toosi University of Technology
M.Sc. in Mechanical Engineering (Control and Dynamics), GPA: 3.78/4
Thesis: Modeling human driver behaviors in a driving simulator

K. N. Toosi University of Technology
B.Sc. in Mechanical Engineering (Control and Dynamics), GPA: 3.16/4
Thesis: Gear Shift Strategy for Optimized Fuel Consumption and Longitudinal Performance

SKILLS

HRI	steering haptic interaction, Human Driver Model
Estimation	sensor fusion (LiDAR, IMU, Stereo Camera), Filter Based SLAM, EKF, UKF, CKF, Particle Filter, Bayesian methods)
Control	Torque MPC, LQR, LQG, SMC, Computed Torque Control (CTC), Lyapunov based Control, Stability analysis, delayed systems
ML Packages	PyTorch (CNN, RL, IRL, LSTM, ML,)
Planning	Model Predictive Planning (MPC), Convex optimization based methods
Software	C/C++, MATLAB, LabVIEW, Ubuntu, Python, ROS, Gazebo, SolidWorks, AutoCAD, OpenCV
Hardware	Sensors (position, velocity, force, torque, IMU, Lidar, RGBD Camera) and Actuators (Servo motors, Stepper motors, linear actuator),
Embedded Systems	Arduino, Raspberry Pi, STM32, sensor interfacing, motor drivers, stepper/servo motors, communication protocols (PCI/I2C/UART/CAN/PWM)
Modeling and Simulation	Dynamic and vibration analysis, Kinematics & kinetics analysis of Robots, Multibody Dynamics,

EXPERIENCES

Development of Estimation Package ADROCO Research Group, SIUE, Edwardsville, IL
Graduate Assistance, Supervisor: Dr. Arman Dabiri Sep 2023 – Dec 2024

- Developed a sensor fusion estimation package to address missed measurements, multi-rate sampling, and time-varying delays for human-robot interaction and SLAM applications. [mozaffari2025quaternion].
- Currently working on employing LSTM to estimate noise covariance data for applications with unknown or variable stochastic uncertainties using PyTorch.

Development of Path Planning Package

Graduate Assistance, Supervisor: Dr. Arman Dabiri

ADROCO Research Group, Edwardsville, IL

Aug 2022 – Aug 2023

- Developed a robust path planning framework that integrates graph-based, sampling-based, and optimization-based techniques, including Model Predictive Control (MPC), to improve robot planning reliability and performance.
- Designed a reinforcement learning (RL) strategy to guide sampling-based path planning, enabling smooth motion generation for a 6-DOF Trossen robotic arm.
- Developed an inverse kinematics model using convolution neural networks (CNNs) implemented in PyTorch, trained on simulation data from Gazebo and validated on a 6-DOF Trossen robotic arm. The model achieved sub-millimeter position accuracy and a quaternion orientation error below 0.01.

Improvement of ADAS Interaction with Human Drivers

Senior Researcher, Supervisor: Dr. Ali Nahvi

Nasir Tech co

Aug 2019 – May 2022

- Developed a human driver model for human-ADAS interaction to predict human driver behaviors in near-crash scenarios by utilizing a Lyapunov function grounded in psychological motivations to manage steering control haptic interaction. The model was calibrated through parameter identification to align with human behavior in software-in-the-loop (SIL) tests, achieving a mean prediction error of 7% [mozaafari2018motivational].
- Designed a multi-objective motivational model to enhance decision-making in near-crash situations. The autonomous vehicle (AV) algorithm based on this model outperformed 10 human drivers in SIL tests conducted in a driving simulator. An activation function was also introduced to calculate motivations with zero false positives or negatives. The model was implemented in C++ for SIL testing and developed in MATLAB/Simulink for research demonstrations [mozaafari2020motivational].
- Applied the model to a drowsy driver assistance system, coordinating autonomous driving with motivation-based activation logic. SIL tests involving 15 professional bus drivers demonstrated perfect activation performance, with no false positives or negatives [gharagozlou2015correlation, mazloumi2014estimating].
- Extended the motivational model using reinforcement learning (Q-learning) with a motivation-driven reward function to address decision-making in non-collision, dynamic traffic scenarios. The model optimizes the decision policy and was verified using MATLAB/Simscape/SimDriveline with a 6-DOF planar vehicle model, achieving a 91.8% success rate in optimal decision-making.

Modeling and Simulation of Vehicle Dynamics in Driving Simulators

Automotive and Control Engineer, Supervisor: Dr. Ali Nahvi

Nasir Tech co

Sep 2014 – Dec 2018

- Developed computationally efficient 6-DOF and 14-DOF dynamic models of ground vehicles in C++ for use in traffic simulation platforms.
- Implemented 14-DOF dynamic models of 2- and 4-wheeled vehicles using NVIDIA PhysX SDK for high-fidelity driving simulators.
- Validated vehicle dynamic models through comparison with CarSim simulations and experimental data from Iranian vehicles.
- Managed real-time haptic steering feedback in a driving simulator using torque control of AC servo motors, implemented in C++ and Labview.
- Designed a zero-backlash gearbox to enable accurate and responsive haptic interaction between the simulator and human drivers.
- Controlled AC servo motors to actuate a parallel robotic platform used in a motion-based driving simulator.

Design and Analysis of 2MW Wind Turbine Gearbox

Mechanical Engineer, Supervisor: Dr. Morteza Fathi

Niroo research Institute

Aug 2010 – Dec 2012

- Designed the gearbox shell using SolidWorks and performed structural stress analysis using ANSYS.
- Conducted dynamic modeling and simulation of a planetary gearbox for a 2 MW wind turbine using Simscape in MATLAB.
- Performed fatigue analysis of the gearbox shell in ANSYS to evaluate durability under operational loads.
- Designed the sealing and bearing systems of the gearbox to ensure reliability and minimize maintenance.

Teaching Experience

Course	Role	Institution	Dates
Sensors and Actuators	Instructor	SIUE	Fall 2025
Integrated Mechatronics: Raspbian Pi	Instructor	SIUE	Summer 2024
Dynamic Systems Lab	Instructor	SIUE	Spring 2022 --Spring 2024
Dynamic Systems	TA	SIUE	Fall 2022
Ground Vehicle Dynamics	TA	K. N. Toosi University of Technology	Fall 2018
Automatic Control	TA	K. N. Toosi University of Technology	Spring 2018
Ansys	Software Instructor	Tehran Institute of Technology	2017
SolidWorks	Software Instructor	Tehran Institute of Technology	2017
MATLAB, Simulink, Simscape	Software Instructor	Tehran Institute of Technology	2014 --2016

Honors & Awards

- Outstanding Graduate Student, Mechanical Engineering Department, K. N. Toosi University of Technology (2010)
- Brilliant Talented Student and Exempted from Tuition for the graduate program at K. N. Toosi University of Technology (2012)

RELATED PUBLICATIONS

Publications

1. H. Mozaffari and A. Dabiri, *Precision Quaternion Estimation With Partially Norm-Constrained Unscented Kalman Filtering*, ASME Letters in Dynamic Systems and Control, vol. 5, no. 3, 030902, 2025.
2. A. D. Hamed Mozaffari, *Iterative Augmented Lead Measurement Method for Efficient Nonlinear Motion Estimation With Delayed Measurements*, Proceedings of the ASME IMECE, 2025.
3. H. Mozaffari and A. Dabiri, *A Comprehensive Dynamic Continuous Impact Model With Plastic Deformation*, Proceedings of the ASME IDETC/CIE, 2023.
4. H. Mozaffari and A. Nahvi, *A motivational driver model for the design of a rear-end crash avoidance system*, Proceedings of the IMechE, Part I: Journal of Systems and Control Engineering, 2020.
5. H. Mozaffari and A. Nahvi, *Modeling of Driver Behavior in Complicated Traffic Conditions by Combining Psychological Theories and Automotive Control Techniques*, Modares Mechanical Engineering, vol. 19, no. 1, pp. 63--74, 2019.
6. H. Mozaffari and A. Nahvi, *A motivational driver steering model: Task difficulty homeostasis from a control theory perspective*, Cognitive Systems Research, vol. 50, pp. 67--82, 2018.
7. F. Gharagozlou, A. Mazloumi, G. N. Saraji, A. Nahvi, M. Ashouri, and H. Mozaffari, *Correlation between driver subjective fatigue and bus lateral position in a driving simulator*, Electronic Physician, vol. 7, no. 4, p. 1196, 2015.
8. A. Mazloumi, F. Gharagozlou, J. Nasl Saraji, A. Nahvi, M. Ashouri, and H. Mozaffari, *P28: Estimating bus driver fatigue through performance measures in a virtual driving environment*, The Neuroscience Journal of Shefaye Khatam, vol. 2, no. 4, p. 78, 2014.