

M. Reza Mousaei

U.S. LAWFUL PERMANENT RESIDENT

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Education

Carnegie Mellon University

Ph.D. IN ROBOTICS

Dec 2025 (Expected)

University of Illinois at Chicago

M.S.C. IN ELECTRICAL AND COMPUTER ENGINEERING

Nov. 2017

Shahid Beheshti University

B.S. IN ELECTRICAL AND COMPUTER ENGINEERING

Jan 2015

Skills

Programming C/C++, C#, Python, MATLAB, JAVA, iOS (Swift)

Robotics Frameworks ROS (Robot Operating System), Gazebo, OMPL, ISAAC Sim, Mujoco

Embedded Systems AVR, ARM, FPGA, PLC, NVIDIA Xavier, Intel NUC

Hardware Design Altium Designer, Eagle

Mechanical Design Shapr3D, SolidWorks, Catia

PhD Research Experience

Carnegie Mellon University

DOCTORAL RESEARCH ASSISTANT AT AIRLAB

Pittsburgh, PA

Aug. 2019 - present

Contact Inspection and Aerial manipulation

Advisor: Dr. Sebastian Scherer

- **Modeling** contact dynamics using Physics-Informed Neural Networks (PINNs) and Graph Neural Networks (GNNs).
- **Achieved centimeter-level accuracy** in aerial writing task using a fully-actuated aerial manipulator.
- **Designed and developed** custom task planning, motion planning, dynamics analysis, and model based control algorithms (MPC, MPPI).
- **Desinged and built** our custom fully actuated hexarotor for aerial manipulation tasks and **developed** full-scale simulation in Mujoco, Gazebo and Isaacsim. [More information](#)

Design, Modeling and Control for a Tilt-rotor VTOL UAV in the Presence of Actuator Failure

- **Led the design and development** of hardware and software for a fully autonomous delivery VTOL UAV with failure redundancy.
- **Modeled** full system dynamics and **Developed** Model Predictive Controller (MPC) for unified control of the system
- **Developed** custom optimization based control allocation system to use redundancy for failure recovery
- **Evaluated** and tested our system successfully **recovering** from all actuation failures (motor, tilt, control surfaces). [More information](#)

DARPA Subterranean challenge multi robot collision avoidance system

- Our team achieved **1st place** in phase I of the Darpa Subterranean Challenge (SubT)
- **Developed** collision avoidance system using Ultra-Wideband (UWB) and control barrier function. [More information](#)

Work Experience

Near Earth Autonomy

ROBOTICS RESEARCH ENGINEER

Pittsburgh, PA

Jan. 2019 - Aug. 2019

Flying Outdoors and Indoors with Limited-sensing Aerial Autonomy

- Achieved **millimeter-level localization** by re-localizing the vehicle in a pre-mapped environment using LiDAR and monocular camera.
- Established **3D correspondences** between camera keypoints and point clouds for precise navigation.

RadPiper: Autonomous Inspection of Nuclear Pipes

Advisor: Prof. William (Red) Whittaker

- **Led** the autonomy team to develop autonomous navigation of pipes.
- Developed 3D mapping in post processing using ICP acheiving **milimiter-level** accuracy
- **Developed** online obstacle detection and avoidance algorithms for unsafe conditions using a geometric methods in point-cloud.
- **Developed** localization system using EKF for online localization and factor-graph for offline localization. [More information](#)

Developing Software/Hardware custom Lidar for MoonRanger Robot

- **Developed hardware and software** for a custom lightweight LiDAR system (50g) for the MoonRanger robot under NASA's CLPS program.
- Achieved **centimeter-level accuracy** in 3D point-cloud reconstruction using time-of-flight measurements with a Raspberry Pi Mini and rotating point laser.
- **Optimized** the LiDAR system for space applications, focusing on weight reduction and robustness. [More information](#)

DARPA Subterranean challenge aerial platform planning system

Advisor: Dr. Sebastian Scherer

- **Developed** decision-making systems for aerial platforms using state machine.
- **Developed** local planning system using primitive motions. [More information](#)

Patents & Invention Disclosures

- J. Park, L. Chen, I. Higgins, **M. Mousaei**, S. Willits, E. Xing, S. Scherer, J. Oh; **VEHICLE OPERATOR WORKLOAD ESTIMATION SYSTEM AND METHOD**, *US Patent*
- J. Park, L. Chen, I. Higgins, **M. Mousaei**, S. Willits, E. Xing, S. Scherer, J. Oh; **Pilot Workload Estimation in VTOLs by Multimodal Machine Learning**, (*Under Honda Research Institute Grant #POHRI003654 / AWD00002163 / OSP00007260*)
- S. Scherer, **M. Mousaei**, J. Geng, Y. Jangir, G. He; **Integration and development of a GPS-denied aerial manipulation approach for ship-to-ship operation**. *Under LMCO Grant #RPS009 / AWD00001942*
- **M. Mousaei**, A. Keipour, S. Scherer, J. Geng; **Wrench space control and planning for aerial manipulation**, (*Under Pennsylvania Infrastructure Technology Alliance Grant # C000075560*).
- A. Keipour, S. Scherer, **M. Mousaei**, J. Geng; **Wrench space computation and analysis for aerial manipulation**, (*Under Pennsylvania Infrastructure Technology Alliance Grant # C000075560*).

Selected Publications

- X Guo, G He, **M. Mousaei**, J Geng, S. Scherer, G Shi **Flying Calligrapher: Contact-Aware Motion and Force Planning and Control for Aerial Manipulation**, *Robotics and Automation Letters (RAL)*, 2024.
- JH. Park, L. Chen, I. Higgins, Z. Zheng, S. Mehrotra, K. Salubre, **M. Mousaei**, S. Willits, B. Levedahl, T. Beker, E. Xing, T. Misu, S. Scherer, J. Oh, **How is the Pilot Doing: VTOL Pilot Workload Estimation by Multimodal Machine Learning on Psycho-physiological Signals**, *IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)*, 2024.
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- X Guo, G He, **M. Mousaei**, J Geng, G Shi, S. Scherer, **Tactile-Based Aerial Interaction**, *International Conference on Robotics and Automation (ICRA)*, 2024.
- G He, Y Jangir, J Geng, **M. Mousaei**, D Bai, S. Scherer, **Visual Servoing for Aerial Manipulation via Image-Based Control Using a Fully-Actuated UAV**, *International Conference on Intelligent Robots and Systems (IROS)*, 2023.
- Q. Chen, Z. Hu, J. Geng, D. Bai, **M. Mousaei**, S Scherer, **A Unified MPC Strategy for a Tilt-rotor VTOL UAV Towards Seamless Mode Transitioning**, *AIAA SCITECH*, 2024.
- A Keipour, **M. Mousaei**, J Geng, D Bai, S. Scherer, **UAS Simulation for Free Flight and Interaction Analysis and Control**, *AIAA SCITECH*, 2023.
- **M. Mousaei**, J. Geng, A. Keipour, D. Bai, S. Scherer, **Design, Modeling and Control for a Tilt-rotor VTOL UAV in the Presence of Actuator Failure**, *International Conference on Intelligent Robots and Systems (IROS)*, 2022.
- A. Keipour, **M. Mousaei**, M. Bandari, S. Scherer, **Detection and Physical Interaction with Deformable Linear Objects**, *International Conference on Robotics and Automation (ICRA)*, workshop, May 2022.
- **M. Mousaei**, A. Keipour, J.Geng, S. Scherer, **VTOL Failure Detection and Recovery by Utilizing Redundancy**, *International Conference on Robotics and Automation (ICRA)*, workshop, May 2022.
- A. Keipour, **M. Mousaei**, S. Scherer, **ALFA: A dataset for UAV fault and anomaly detection**, *The International Journal of Robotics Research (IJRR)*, Oct 2020.
- A. Keipour, **M. Mousaei**, S. Scherer, **Automatic Real-time Anomaly Detection for Autonomous Aerial Vehicles**, *International Conference on Robotics and Automation (ICRA)*, May 2019.
- H. Jones, S. Maley, **M. Mousaei**, D. Kohanbash, W. Whittaker, J. Teza, A. Zhang, N. Jog, W. Whittaker, **A Robot for Nondestructive Assay of Holdup Deposits in Gaseous Diffusion Piping**, *WM Conference 2019. Best Poster Award*
- H. Jones, S. Maley, K. Yonekawa, **M. Mousaei**, J. D. Yesso, D. Kohanbash, W. Whittaker, **Automated Analysis, Reporting, and Archiving for Robotic Nondestructive Assay of Holdup Deposits**, *WM Conference 2019*.