Amirreza Naseri

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Professional Summary

Innovative Ph.D. candidate with over seven years of hands-on experience designing and deploying real-time control systems and embedded hardware for robotic devices. Skilled in CAD modeling and mechanical design, with a solid foundation in system integration for wearable robotics. Proficient in MATLAB/Python data analytics, machine-learning–driven and model-based control systems, and multi-sensor fusion to enhance the adaptivity of wearable robotic devices in human-robot interactions. Proven ability to translate cutting-edge research into robust prototypes and peer-reviewed publications, collaborating across mechanical, electrical, and clinical teams to deliver user-centered solutions that advance robotic assistive technologies.

Technical Skills

Programming and Modeling: MATLAB, Simulink, Python, C/C++.

Software and Tools: Real-time Control (TwinCAT, LabVIEW, xPC-Target), Microcontrollers (Jetson, Raspberry Pi, Arduino), Machine Learning (Reinforcement Learning, Neural Networks, SVM, Gaussian Process), ML Libraries (PyTorch, TensorFlow, Scikit-Learn), Sensor Integration (fusion of multimodal sensor data into control systems).

Biomechanical Measurement Systems: IMU (Xsens and Parker), In-shoe Pressure sensor (Novel, PEDAR), Optical Motion Capture (Vicon), Spirometry Measurement Systems, Visual3D, User Study Design and Survey Development.

CAD and Prototyping: CATIA, SolidWorks, ADAMS, 3D Printing, CNC Machining.

Education

North Carolina State University and UNC Chapel Hill, Jan 2021 – August 2025
Ph.D. in Biomedical Engineering. Raleigh, NC, US

Tarbiat Modares University, Sep 2016 – May 2019
Master of Science in Mechanical Engineering (Applied Design). Tehran, IRAN

Yazd University, Sep 2012 – May 2016
Bachelor of Science in Mechanical Engineering. Yazd, Iran

Research Experiences

Model-Based and Learning-Driven Control of Real-Time Robotic Systems with Applications in Wearable Devices, North Carolina State University — Jan 2021 – Present

Robotic Knee Prosthesis

- Developed and implemented a machine-learning-based active Fault-Tolerance Mechanism for AI-driven robotic knee prosthesis to detect and compensate for intrinsic control errors in real time, improving user stability and safety during locomotion (NC State OTL licensing & copyright pending).
- Designed and implemented a real-time controller for a robotic knee prosthesis using TwinCAT3–Simulink RT over EtherCAT on a $Windows\ 11$ OS desktop, converting a LabVIEW–NI DAQ system with a KEB $C6$ router to increase control loop frequency from 100 Hz to 1 kHz for enhanced communication speed and responsiveness.
- Establish data communication between UART and EtherCAT for IMU sensor (Microstrain, $3DM\text{-}CV7$-AHRS), and develop a Raspberry PI as an EtherCAT slave (GitHub Link).
- Conducted biomechanics human-centered experiments with robotic knee prostheses to investigate the relationship between user-perceived balance and quantitative gait stability metrics.

Robotic Ankle Prosthesis

- Developed a shared control framework for a robotic ankle prosthesis using TwinCAT3–Simulink RT, integrating real-time EMG and IMU signals to augment a position-tracking controller for adaptive obstacle avoidance.
- Integrated and tuned ELMO Gold Solo Twitter servo drives for BLDC motor control in position, velocity, and current modes; calibrated multi-turn encoders, load cells, and potentiometers for robotic prostheses.

Robotic Hip Exoskeleton

- Designed and implemented a real-time adaptive controller for a hip exoskeleton, using $TwinCAT3$–Simulink

RT, to assist mediolateral balance by leveraging whole-body angular momentum feedback from IMU sensors.

- Performed human motion analysis using optical motion capture, in-shoe pressure sensors, and force plates across multiple studies to evaluate the effectiveness of control strategies for prostheses and exoskeleton systems.

Mechanical Design and System Integration of Energy-Efficient Mechanisms with Wearable Assistive Devices Applications, Tarbiat Modares University — Sep 2016 – May 2019

- Designed and fabricated a novel hybrid ankle prosthesis (H2AP) with a passive hydraulic unit and cam-follower clutch mechanism to enhance energy storage and push-off during gait (US PATENT ISSUED).
- Conducted model-based optimization and ADAMS simulations to tune spring-damper parameters for prosthetic performance, replicating human ankle biomechanics.
- Designed and fabricated hydraulic control valves for a passive hydraulic prosthesis (NATIONAL PATENT ISSUED).
- Performed gait analysis via motion capture, force plates, and indirect spirometry to assess prosthesis performance.
- Designed a fuzzy logic controller for a smart HVAC vent system, integrating sensor-actuator feedback to adaptively modulate airflow based on temperature input and seasonal mode (collaborative side project).

Real-Time Adaptive Control of Actuated Robotic Systems Using Force Feedback: A Case Study in Wearable Robotics, Technical University of Darmstadt, Germany — Feb. 2018 – May. 2018

- Developed and implemented a real-time finite-state controller with piece-wise impedance functions for a robotic ankle prosthesis using xPC Target System–Simulink RT interface.
- Developed and validated bioinspired control strategies for robotic ankle prosthesis by integrating neuromechanical template models and reflex-based architectures, enabling human-like torque generation and stable walking across conditions in both simulations (Neuromuscular Model) and human-subject experiments.
- Conducted gait analysis using motion capture and indirect calorimetry to evaluate the developed control strategy.

Teaching Experience

North Carolina State University — Aug. 2022 – Dec. 2022

- BME 444/445: Orthopaedic Biomechanics (grading, delivered a lecture, and preparing lab materials.)
- BME 398: Junior Design (debugging and troubleshooting student SolidWorks design and grading)

Patent & Publications

A. Naseri, M. Moghadam, M. A. Sharbafi, M. Gharini, Prosthetic Foot. (US Patent: 12,064,360).

A. Naseri, V. Nalam, W. Hong, M. Liu, IC. Lee, Helen Huang, Fault Tolerance in Intelligent Robotic Knee Prostheses for Safer Adaptive Locomotion. (Under Review, Science Robotics).

A. Naseri, I. Lee, H. Huang, M. Liu, Investigating the Association of Quantitative Gait Stability Metrics with User Perception of Gait Interruption due to Control Faults during Human-Prosthesis Interaction (IEEE Transactions on Neural Systems and Rehabilitation Engineering).

A. Naseri, M. Moghadam, M. Grimmer, M. A. Sharbafi, Passive hydraulic prosthetic foot to improve push-off during walking (Mechanism and Machine Theory).

A. Naseri, M. Liu, I. Lee, W. Liu, H. Huang, Characterizing prosthesis control fault during human-prosthesis interactive walking using intrinsic sensors (IEEE RA-L letter and IROS 2022).

A. Naseri, V. Nalam, I. Lee, M. Liu, H. Huang. Development and Online Validation of an Intrinsic Fault Detector for a Powered Robotic Knee Prosthesis (IROS 2023).

A. Naseri, M. Grimmer, A. Seyfarth, M. A. Sharbafi, Neuromechanical Template-Based Control of a Powered Prosthetic Foot (Wearable Technologies).

M. A. Sharbafi, A. Naseri, A. Seyfarth, M. Grimmer. Neural Control in Exoskeletons and Prosthesis: (Elsevier).

Award

NCSU/UNC BME Graduate Student Service Award — 2024–2025

- Recognized for outstanding advocacy and support of international students and dedicated contributions to departmental events.)

NCSU/UNC BME Travel Award (ICRA 2022, IROS 2023, ICRA 2025) — 2022–2025

Author of Featured article (MDPI Actuators, Issue, 2020) — 2020