Qiang Zhang, Ph.D.

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EDUCATION AND TRAINING

Post-Doc research fellow in the Closed-Loop Engineering for Advanced Rehabilitation (CLEAR) 11/2021 - Present
The University of North Carolina at Chapel Hill and North Carolina State University, NC, USA

Advisor: Dr. Michael Lewek and Dr. He (Helen) Huang

Ph.D. in Biomedical Engineering 08/2019 - 10/2021
The University of North Carolina at Chapel Hill and North Carolina State University, NC, USA
Advisor: Dr. Nitin Sharma and Dr. Kang Kim
Dissertation Title: "Ultrasound Imaging and Surface Electromyography-based Voluntary Effort Prediction and Control Strategies for Ankle Assistance"

M.S. in Mechanical Engineering 08/2017 - 08/2019
The University of Pittsburgh, Pittsburgh, PA, USA
Advisor: Dr. Nitin Sharma and Dr. Kang Kim

M.S in Mechatronics Engineering 09/2014 - 07/2017
Wuhan University, Wuhan, Hubei, China
Advisor: Dr. Xiaohui Xiao and Dr. Zhao Guo
Thesis Title: "Design and Control of a Cable-Driven Upper Limb Rehabilitation Exoskeleton Robot Using Series Elastic Actuator"

B.S. in Mechanical Engineering 09/2010 - 06/2014
Wuhan University, Wuhan, Hubei, China

RESEARCH INTERESTS

- Lyapunov-based nonlinear control, adaptive control
- Machine learning-based control of robotic devices
- Impedance control for rehabilitative/assistive robotic devices
- Neuromuscular modeling and functional electrical stimulation (FES) control
- Surface electromyography (sEMG) and ultrasound imaging signal processing
- Human motion intent detection
- Human walking gait kinematics and kinetics analysis
- Cable-driven exoskeleton design and assist-as-needed control
- Serial elastic actuator design and control
- Linear/nonlinear observer design
- Sensor fusion with multi-rate observer
- Human-robot interaction

RESEARCH EXPERIENCE

Research Associate (11/2021 - Present)

UNC/NCSU Joint Department of Biomedical Engineering - *The University of North Carolina at Chapel Hill and North Carolina State University, Raleigh, NC*

Closed-Loop Engineering for Advanced Rehabilitation (Advisors: Dr. Michael Lewek and Dr. Helen (He) Huang)

Project: Combined Human and Rehabilitative Machine System (CHARMS, *Supported by National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR) # 90ARHF0004*)

- Development of a reinforcement learning (RL)-based coordinative control approach for a bilateral hip exoskeleton to provide personalized robotic assistance for individual wearers with a goal of improving walking gait symmetry.
- Development of a RL-based impedance control approach for a bilateral hip exoskeleton to personalize the optimal assistance for individual wearers with a goal of regenerating normative hip joint motion.
- Implementation of the RL-based control framework to personalize the hip joint assistance and increase the hip joint range of motion and gait symmetry under multiple walking conditions in healthy participants and individuals with chronic stroke.
- Evaluation of how the RL-based control approach would affect human walking kinematic, kinetic, electromyographic, sonomyographic, and energy expenditure measurements.
- Development of an admittance controller-based desired torque profile tracking framework for a bilateral hip exoskeleton to achieve compliance for the human-machine-interaction system.

Research Assistant (08/2019 – 10/2021)

UNC/NCSU Joint Department of Biomedical Engineering - *The University of North Carolina at Chapel Hill and North Carolina State University, Raleigh, NC*
Neuromuscular Control and Robotics Lab (Advisors: Dr. Nitin Sharma and Dr. Kang Kim)
Project: Ultrasound-based Intent Modeling and Control Framework for Neurorehabilitation (*Supported by National Science Foundation Career Award # 2002261*)

- Investigation of a deep convolutional neural network-based deep feature extraction from skeletal muscle's ultrasound imaging to predict human motion intent for dynamic walking tasks at versatile speeds.
- Investigation of the combination between surface electromyography and ultrasound imaging-derived features to predict ankle joint kinematics and kinetics during both static (seated posture) and dynamic (treadmill walking) ankle joint tasks by applying multiple machine learning approaches, including support vector machine regression, feedforward neural network, multiple linear regression, and Gaussian process regression.
- Development of a surface electromyography-ultrasound imaging-driven Hill-type neuromuscular model to predict ankle joint net moment that is used for the assist-as-needed control of a cable-driven bidirectional ankle exoskeleton.
- Design and manufacture a cable-driven bidirectional ankle joint exoskeleton and develop an adaptive impedance controller-based assist-as-needed control framework for ankle plantarflexion assistance during the walking stance phase considering ankle joint net moment prediction.
- Development of a novel closed-loop control approach for functional electrical stimulation/neuromuscular electrical stimulation that embeds the discrete (low sampling rate) muscle activation measurement by using ultrasound imaging technique, and its implementation on the virtual constraint-based ankle joint dorsiflexion trajectory tracking control during the walking swing phase.
- Collaboration on the study of model predictive control for human elbow joint trajectory tracking task by using functional electrical stimulation on antagonistic muscles including biceps brachii and triceps brachii muscles.
- Collaboration on the development of a clustering-based unsupervised learning method for skeletal muscle's pennation angle detection from ultrasound imaging.

Research Assistant (08/2017 - 08/2019)
Department of Mechanical Engineering and Materials Science - *The University of Pittsburgh, Pittsburgh, PA*
Neuromuscular Control and Robotics Lab (Advisors: Dr. Nitin Sharma and Dr. Kang Kim)
Project: Ultrasound-based Intent Modeling and Control Framework for Neurorehabilitation (*Supported by National Science Foundation Career Award # 1750748*)

- Extraction of multiple features time sequence from tibialis anterior muscle's ultrasound imaging during isometric and dynamic ankle dorsiflexion functions, including pennation angle, fascicle length, echogenicity, tissue displacement, and tissue strain. Investigation of the relationship between the above ultrasound imaging-derived muscular features and ankle dorsiflexion mechanical functions (net moment and motion).
- Investigation of using surface electromyography and ultrasound imaging-derived feature fusion as inputs of a modified Hill-type neuromuscular model for predicting human ankle joint net dorsiflexion and plantarflexion

moment under isometric conditions.

- Development of a continuous observer for a class of nonlinear neuromusculoskeletal systems with multi-rate and delayed output measurements from inertial measurement unit and ultrasound imaging.
- Collaboration on iterative learning control development of a lower limb hybrid neuroprosthesis (functional electrical stimulation + powered exoskeleton) to track virtual constraint-based desired trajectories for both knee and hip joints during a sit-to-stand task.
- Collaboration on the study of characterizing tremors during a grasping motion by using ultrasound imaging.

Research assistant (11/2013 – 07/2017)
School of Power and Mechanical Engineering - *Wuhan University, Wuhan, Hubei, China*
(Advisors: Dr. Xiaohui Xiao and Dr. Zhao Guo)
Project: Research on Bionic Mechanism and Optimization Design Methodology of Skeletal Muscle-like Variable Stiffness Actuator (*Supported by NSFC, No. 51605339*)

- Design of the hardware and control platform of a portable upper limb exoskeleton prototype with 4 active DOFs and 2 passive DOFs, where active DOFs were actuated by series elastic actuators (SEAs) and Bowden cables.
- Development of a feedback linearization control strategy that is used for SEA motion tracking control and force control, as well as upper limb exoskeleton impedance control.

Project: Research on 4-DOFs Underactuated Bipedal Walking Robot

- Hardware design of an underactuated bipedal walking robot with 4 active DOFs and modeling of the prototype's equivalent multiple rigid links dynamics for the periodic stable off-line gait planning based on the Poincáre return mapping method.
- Development of the National Instrument single-board RIO-based control system of the bipedal walking robot, and LabVIEW programming to control the robot walking locomotion at a hung state in an open-loop manner.
- Collaboration on a human-inspired adaptive feedforward control strategy to stabilize the robot's underactuated bipedal walking locomotion on the compliant ground.

Project: Study on Coupling Dynamics and Gait Planning of 10-DOFs Bipedal Robot Walking on Compliant Ground (*Supported by NSFC, No. 51175383*)

- Development of a 3D CAD model of a fully actuated bipedal walking robot with 10 DOFs and performed the key components' stress analysis based on FEA software.
- According to the zero moment point criterion, the walking locomotion gait planning of the 10 DOFs bipedal robot on stiff ground and performed the virtual prototype dynamic simulation in ADAMS.
- Investigation of the kinematics and kinetics changes of the bipedal walking robot during the single support phase by changing the spring stiffness added on the ankle and knee flexible joints through dynamic simulation in ADAMS.
- Development of the ground compliance model based on distributed spring-damper system and performed compliant ground-rigid robot coupling simulations to investigate the effects of ground compliance on bipedal robot dynamic properties.
- Collaboration on a real-time 3D biped gait generation method based on a minimal energy control framework to keep the 10 DOFs robot walking on compliant or uneven ground stably.

GRANT/FUNDINGS WRITING AND APPLICATIONS

- National Institute on Disability, Independent Living, and Rehabilitation Research Switzer Research Fellowships (PI). $70, 000, 2023, submitted, under review.
- Pilot projects at the Restore Center from Stanford University (Co-PI). $30, 000, 2022, submitted, not funded.

PUBLICATIONS

Peer-reviewed journal publications:

1. **Q. Zhang**, K. Lambeth, Z. Sun, A. Dodson, X. Bao, and N. Sharma*, "Evaluation of a Fused Sonomyography and Electromyography-based Control on a Cable-Driven Ankle Exoskeleton", IEEE Trans. Robot., 2023, DOI: 10.1109/TRO.2023.3236958.
2. X. Bao, **Q. Zhang**, N. Fragnito, J. Wang, and N. Sharma*, "A Clustering-based Method for Estimating Pennation Angle from B-mode Ultrasound Images", Wearable Technologies, Wearable Technologies, 4 (2023): e6.

3. **Q. Zhang**, K. Lambeth, A. Iyer, Z. Sun, and N. Sharma*, "Ultrasound Imaging-based Closed-Loop Control of Functional Electrical Stimulation - A Case Study for Drop Foot Correction", IEEE Trans. Control Syst. Technol., 2022, DOI: 10.1109/TCST.2022.3207999.
4. **Q. Zhang**, V. Nalam, X. Tu, M. Li, J. Si, M. Lewek, and H. Huang*, "Imposing Healthy Hip Motion Pattern and Range by Exoskeleton Control for Individualized Assistance", IEEE Robot. Autom. Lett., vol. 7, no. 4, pp. 11126-11133, 2022.
5. **Q. Zhang**, A. Myers, N. Fragnito, J. R. Franz, and N. Sharma, "Fused Ultrasound and Electromyography-Driven Neuromuscular Model to Improve Plantarexion Moment Prediction Across Walking Speeds", J. Neuroeng. Rehabil., vol. 19, no. 86, 2022.
6. **Q. Zhang**, N. Fragnito, X. Bao, and N. Sharma*, "A Deep Learning Method to Predict Ankle Joint Moment during Versatile Walking Tasks with Ultrasound Imaging: A Framework for Assistive Devices Control", Wearable Technologies, 2022, 3, e20.
7. **Q. Zhang**, W. H. Clark, J. R. Franz, and N. Sharma*, "Personalized Fusion of Ultrasound and Electromyography-Derived Neuromuscular Features Increases Prediction Accuracy of Ankle Moment during Plantarflexion," Biomed. Signal Process Control, vol. 71, pp. 103100, 2022.
8. **Q. Zhang**, A. Iyer, K. Lambeth, K. Kim, and N. Sharma*, "Ultrasound Echogenicity as an Indicator of Muscle Fatigue during Functional Electrical Stimulation," Sensors, vol. 22, no. 1, pp. 335, 2022.
9. M. Vahidreza, **Q. Zhang**, X. Bao, and N. Sharma*, "An Iterative Learning Controller for a Switched Cooperative Allocation Strategy During Sit-to-Stand Tasks with a Hybrid Exoskeleton", IEEE Trans. Control Syst. Technol., vol. 30, no. 3, pp. 1021-1036, 2022.
10. **Q. Zhang**, A. Iyer, Z. Sun, K. Kim, and N. Sharma*, "A Dual-Modal Approach Using Electromyography and Sonomyography Improves Prediction of Dynamic Ankle Movement: A Case Study", IEEE Trans. Neural Syst. Rehabil. Eng., vol. 29, pp. 1944-1954, 2021.
11. **Q. Zhang**, A. Iyer, K. Kim*, and N. Sharma*, "Evaluation of Noninvasive Ankle Joint Effort Prediction Methods for Use in Neurorehabilitation Using Electromyography and Ultrasound Imaging," IEEE Trans. Biomed. Eng., vol. 68, no. 3, pp. 1044–1055, 2021.
12. M. Vahidreza, **Q. Zhang**, X. Bao, B. Dicianno, and N. Sharma*, "Shared Control of a Powered Exoskeleton and Functional Electrical Stimulation using Iterative Learning and Fatigue Optimization", Front. Robot. AI, 8: 711388, 2021.
13. **Q. Zhang**, K. Kim*, and N. Sharma*, "Prediction of Ankle Dorsiflexion Moment by Combined Ultrasound Sonography and Electromyography," IEEE Trans. Neural Syst. Rehabil. Eng., vol. 28, no. 1, pp. 318–327, 2020.
14. **Q. Zhang**, D. Sun, W. Qian, X. Xiao, and Z. Guo*, "Modeling and control of a cable-driven rotary series elastic actuator for an upper limb rehabilitation robot," Front. Neurorobot., vol. 14, pp. 13, 2020.
15. **Q. Zhang**, Y. Wang, and X. H. Xiao*, "Effects of Ground Compliance on Bipedal Robot Walking Dynamic Property", Journal of the Chinese Society of Mechanical Engineers, 2016, 37(4): 335-342.
16. Y. Wang, **Q. Zhang**, and X. H. Xiao*, "Trajectory Tracking Control of the Bionic Joint Actuated by Pneumatic Artificial Muscle Based on Robust Modeling," ROBOT, 2016, 38(2): 248-256. (In Chinese)
17. **Q. Zhang**, X. H. Xiao*, Y. Wang, et al, "Compliant joint for biped robot considering energy consumption optimization", Journal of Central South University, 2015, 46(11): 4070-4076. (In Chinese)

Peer-reviewed conference publications:

1. **Q. Zhang**, X. Tu, J. Si, M. Lewek, and H. Huang*, "A Robotic Assistance Personalization Control Approach of Hip Exoskeletons for Gait Symmetry Improvement," in IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2023, under review.
2. **Q. Zhang**, V. Nalam, X. Tu, M. Li, J. Si, M. Lewek, H. Huang*, "Normalizing Hip Movement Pattern and Range by Exoskeleton Control for Individualized Assistance", in IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2022.
3. A. Iyer, M. Singh, **Q. Zhang**, Z. Sun, and N. Sharma*, "An Online Actor-Critic Identifier with Sampled Fatigue Measurements for Optimal Adaptive Control of FES and an Electric motor", in IEEE Conference on Control Technology and Applications (CCTA), 2022.

4. **Q. Zhang**, A. Iyer, K. Lambeth, K. Kim, and N. Sharma*, "Ultrasound Echogenicity-based Assessment of Muscle Fatigue During Functional Electrical Stimulation", in 2021 43rd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC), IEEE, 2021, pp. 5948-5952.
5. **Q. Zhang**, N. Fragnito, A. Myers, and N. Sharma*, "Plantarflexion Moment Prediction during the Walking Stance Phase with an sEMG-Ultrasound Imaging-Driven Model", in 2021 43rd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC), IEEE, 2021, pp. 6267-6272.
6. Z. Sun, X. Bao, **Q. Zhang**, K. Lambeth, and N. Sharma*, "A Tube-based Model Predictive Control Method for Joint Angle Tracking with Functional Electrical Stimulation and An Electric Motor Assist", in Proc. Amer. Control Conf., 2021, pp. 1390-1395.
7. **Q. Zhang**, A. Iyer, K. Kim*, and N. Sharma*, "Volitional contractility assessment of plantar flexors by using non-invasive neuromuscular measurements," in 2020 8th IEEE RAS/EMBS International Conference for Biomedical Robotics and Biomechatronics (BioRob). IEEE, 2020, pp. 515–520.
8. A. Iyer, Z. Sheng, **Q. Zhang**, K. Kim, and N. Sharma*, "Analysis of Tremor During Grasp Using Ultrasound Imaging: Preliminary Study", in 2020 8th IEEE RAS/EMBS International Conference for Biomedical Robotics and Biomechatronics (BioRob). IEEE, 2020, pp. 533–538.
9. **Q. Zhang**, A. Iyer, Z. Sun, A. Dodson, and N. Sharma*, "Sampled-Data Observer Based Dynamic Surface Control of Delayed Neuromuscular Functional Electrical Stimulation", in Dynamic Systems and Control Conference, Vol. 84270, p. V001T14A003, American Society of Mechanical Engineers, 2020.
10. **Q. Zhang**, A. Iyer, N. Sharma*, "Ultrasound based Sensing and Control of Functional Electrical Stimulation for Ankle Joint Dorsiflexion: Preliminary Study", in 2020 International Symposium on Wearable Robotics. Springer, 2020, pp. 207-311.
11. **Q. Zhang**, Z. Sheng, F. Moore-Clingenpeel, K. Kim, and N. Sharma*, "Ankle dorsiflexion strength monitoring by combining sonomyography and electromyography," in Proc. Int. Conf. Rehabil. Robot. IEEE, 2019, pp. 240–245.
12. **Q. Zhang**, Z. Sheng, K. Kim, and N. Sharma*, "Observer design for a nonlinear neuromuscular system with multi-rate sampled and delayed output measurements," in Proc. Amer. Control Conf. IEEE, 2019, pp. 872–877.
13. V. Molazadeh, **Q. Zhang**, X. Bao, and N. Sharma*, "Neural-network based iterative learning control of a hybrid exoskeleton with an MPC allocation strategy," in Dynamic Systems and Control Conference, vol. 59148, p. V001T05A011. American Society of Mechanical Engineers, 2019.
14. **Q. Zhang**, B. Xu, Z. Guo, and X. Xiao*, "Design and modeling of a compact rotary series elastic actuator for an elbow rehabilitation robot," in Proc ICIRA. Springer, Cham, 2017, pp. 44–56.
15. **Q. Zhang**, X. Xiao*, and Z. Guo, "Power Efficiency-Based Stiffness Optimization of a Compliant Actuator for Underactuated Bipedal Robot," in Proc ICIRA. Springer, Cham, 2016, pp. 186–197.
16. **Q. Zhang**, L. Teng, Y. Wang, T. Xie, and X. Xiao*, "A study of flexible energy-saving joint for biped robots considering the sagittal plane motion," in Lecture Notes in Computer Science, 2015, vol. 9245, pp. 333–344.

In preparation and under review:

1. **Q. Zhang,** X. Tu, J. Si, M. Lewek, and H. Huang*, "Towards gait symmetry enhancement hip exoskeleton assistance personalization control for post-stroke individuals", Sci, Robot., 2023 (In preparation).
2. **Q. Zhang**, J. Si, X. Tu, M. Li, M. Lewek, and H. Huang*, "Towards Task-Independent Optimal Adaptive Control of a Hip Exoskeleton for Locomotion Assistance in Neurorehabilitation", IEEE Trans. Syst. Man Cybern.: Syst., 2023 (Under review, second round).
3. **Q. Zhang,** V. Nalam, M. Li, M. Liu, J. Si, M. Lewek, and H. Huang, "Paradigms and emerging pathways in personalizing assistance for lower-extremity wearable robots?" J. Neuroeng. Rehabil., 2023 (Under review, second round).

INVITED TALKS AND PRESENTATIONS:

1. ACRM 2023 100th Annual Conference, Progress in Rehabilitation Research, "A Model-free Reinforcement Learning-based Control Approach to Provide Personalized Assistance for People with Stroke", 10/2023
2. ASB 2023 extended presentation during the Journal Award podium session, "Towards gait symmetry improvement using automatic robotic assistance personalization control for active hip exoskeletons", 08/2023

3. The Department of Mechanical Engineering at the University of Vermont, 03/2023
4. The Department of Mechanical Engineering at the University of North Texas, 03/2023
5. The Department of Mechanical Engineering at Stevens Institute of Technology, 03/2023
6. The Department of Mechanical Engineering at the University of Alabama, 03/2023
7. The Department of Mechanical and Materials Engineering at the University of Denver, 02/2023
8. The Department of Mechanical Engineering at the University of Texas at San Antonio, 01/2023
9. The Department of Mechanical Engineering at Texas Tech University, 01/2023
10. The Department of Mechanical Engineering at the University of Hong Kong, 01/2023
11. The Department of Biomechanics at the University of Nebraska Omaha, 11/2022
12. Modeling, Estimation, and Control Conference (MECC) 2022, "Evaluation of a Fused Sonomyography and Electromyography-based Control on a Cable-driven Ankle Exoskeleton", 10/2022
13. ICRA 2022 Workshop: Intelligent Control Methods and Machine Learning Algorithms for Human-Robot Interaction and Assistive Robotics, "Normalizing Hip Movement Pattern and Range by Exoskeleton Control for Individualized Assistance", 05/2022
14. ICRA 2022 Workshop: Intelligent Control Methods and Machine Learning Algorithms for Human-Robot Interaction and Assistive Robotics, "Ultrasound Imaging-sEMG Based Plantarflexion Assistance Control of a Cable-Driven Ankle Exoskeleton", 05/2022
15. Southeast Control Conference (SECC) 2021, "Towards Surface Electromyography-Ultrasound Imaging-based Human Volitional Effort Prediction for the Assist-as-needed Control of a Cable-Driven Ankle Exoskeleton",11/2021
16. Neuroscience 2021, "Ultrasound echogenicity-based sensing and control of functional electrical stimulation to correct ankle joint dorsiflexion", 11/2021

PATENTS:

1. N. Sharma, **Q. Zhang**, A. Dodson, and A. Iyer, Systems for closed-loop ultrasound-imaging based control and related methods. Patent, US20230116271A1, 2023.
2. Z. Guo, X. H. Xiao, Y. Yao, **Q. Zhang**. A Portable Elbow Exoskeleton Robot with Compliant Joint Actuator. Patent CN 106393073 B, 2018.
3. Z. Guo, X. H. Xiao, B. Y. Xu, **Q. Zhang**, D. Y. Sun. A Compliant Cable-Driven Upper Limb Exoskeleton Robot. Patent CN 107669442 A, 2018.
4. X. H. Xiao, **Q. Zhang**, D. J. Yao, et al. An Underactuated Bipedal Walking Robot Driven by Compliant Actuator. Patent CN 105599822 B, 2017.
5. X. H. Xiao, **Q. Zhang**, Y. Wang, et al. A Modular Bipedal Walking Robot with Ten Degrees of Freedom. Patent CN 104071250 A, 2014.
6. **Q. Zhang**, F. You, Y. Wang, et al. A Foot Module for Bipedal Walking Robot. Patent CN 203946189 U, 2014.
7. **Q. Zhang**, F. You, Y. Wang, et al. A Cross-shaped Joint Module for Bipedal Walking Robot. Patent CN 203946188 U, 2014.

AREAS OF TEACHING EXPERTISE

- Mechanical mechanism and mechanical design
- System dynamics / rigid body dynamics
- Linear control system / linear system theory
- Advanced feedback control
- Introduction to nonlinear control
- Adaptive control

TEACHING/MENTORING EXPERIENCE

- MEMS 1042 at the University of Pittsburgh: Mechanical Measurements 2 (Fall 2017, 60 students)
  - Teach and guide students to perform dynamics/control-related experiments and record data
  - Review students' reports for each experiment
  - Hold office hours to address students' questions
- MEMS 1015 at the University of Pittsburgh: Rigid Body Dynamics (Spring 2018, 120 students)
  - Grade homework every week and grade midterm exam
  - Hold office hours to address students' questions
- Student Mentoring
  - David Hu (Undergraduate student, the University of Pittsburgh)
  - Yao Peng (Undergraduate student, the University of Pittsburgh)
  - Natalie Fragnito (Undergraduate student, UNC-Chapel Hill and NC State University)
  - Noor Hakam (Undergraduate student, UNC-Chapel Hill and NC State University)
  - Ali Myers (Undergraduate student, UNC-Chapel Hill and NC State University)
  - Claire Wiebking (Undergraduate student, UNC-Chapel Hill and NC State University)
  - Jake Polar (Ph.D. student, NC State University)
  - Krysten Lambeth (Ph.D. student, UNC-Chapel Hill and NC State University)
  - Ben Perrin (Undergraduate student, UNC-Chapel Hill and NC State University)
  - Avery Murray (Undergraduate student, UNC-Chapel Hill and NC State University)

FELLOWSHIPS AND AWARDS

- One of three finalists of the Journal of Biomechanics Award at ASB 2023 2023
- One of five finalists at the NIDILRR-sponsored Early Career Investigator Symposium 2023
- Dean's Distinguished Dissertation Award, UNC-Chapel Hill 2023
- ASME DSCD Rising Star 2022 Award 2022
- The UNC/NCSU BME Department PhD Student Research Award 2021
- The UNC/NCSU BME Department Travel Award 2021
- The UNC/NCSU BME Department Travel Award 2020
- The finalist for the Best Student Paper Award at the 16th IEEE/RAS-EMBS International Conference on Rehabilitation Robotics (ICORR 2019) 2019
- The finalist for the Engineering Medical Innovation Global Competition (EMEDIC 2017) 2017
- The Second Prize of Central China Area in the 11th National Post-Graduate Electronics Design Contest 2016
- The First Prize of Interdisciplinary Youth Scholar Symposium, Wuhan University (Top 2) 2015
- The National Scholarship, Wuhan University (2%) 2015
- The First Level Academic Scholarship and Outstanding Student, Wuhan University (10%) 2015
- The First Prize of Post-Graduate Talent Competition, Wuhan University (5%) 2015
- The First Prize of the Nation in the 11th National Post-Graduate Mathematics Contest in Modeling (2.45%) 2014
- The Excellent New Post-Graduate Student Award, Wuhan University (5%) 2014
- The Outstanding Graduate, Wuhan University (15%) 2014
- The Second Prize of the Nation in the 12th Asia-Pacific Robot Contest (ABU Robocon) in China (Top 16) 2013
- The Second Prize of Wuhan University in the 6th National College Advanced Graphic Skill Competition 2013
- Two years of National Encouragement Scholarship, Wuhan University (3%) 2012, 2013
- The Second Level Scholarship and Merit Student, Wuhan University (10%) 2013

- The Second Prize of Wuhan University in the 5th National College Advanced Graphic Skill Competition 2012
- The Third Prize of Wuhan University in the 5th National College Mechanical Innovation Competition 2012
- The First Level Scholarship and Merit Student, Wuhan University (5%) 2012
- The Third Level Scholarship and Outstanding Student, Wuhan University (15%) 2011

PROFESSIONAL SKILLS

- 2D or 3D modeling with AutoCAD, SolidWorks, CATIA, UG, and Pro/E;
- Mechanical machining with CNC machine and 3D printer;
- Dynamic simulation or finite element analysis with ADAMS, Matlab, and ANSYS;
- Programming with C, C#, Matlab/Simulink, and LabVIEW;
- Data processing and analyzing with SPSS, Matlab, and R;
- Human motion analysis with Vicon, Visual3D, and OpenSim;
- Other skills including MS Office, Photoshop, Visio, Dreamweaver.

PROFESSIONAL MEMBERSHIPS

- ASB Member (since 2023)
- IEEE Member (since 2019)
- ASME Student Member

ACADEMIC SERVICE (JOURNAL OR CONFERENCE PAPER REVIEW)

- Science Robotics
- Nature Communication Engineering
- IEEE Transactions on Industrial Electronics
- IEEE Transactions on Cybernetics
- IEEE Transactions on Robotics
- IEEE Transactions on Control System Technology
- IEEE Control System Magazine
- IEEE Transactions on Neural System and Rehabilitation Engineering
- IEEE Robotics and Automation Letter
- IEEE Open Journal of Control Systems
- IEEE Journal of Electromagnetics, RF and Microwaves in Medicine and Biology
- IEEE Transactions on Huma Machine Systems
- Journal of NeuroEngineering and Rehabilitation
- Current Opinion in Biomedical Engineering
- Scientific Reports
- Scientific Data
- PLOS ONE
- Frontiers in Neuroscience
- Frontiers in Human Neuroscience
- Frontiers in Robotics and AI
- Frontiers in Neurorobotics
- Nonlinear Dynamics

- Cambridge Core: Wearable Technologies
- MDPI Sensors, Micromachines, Brain Sciences
- Proceedings of the Institution of Mechanical Engineers, Part I: Journal of Systems and Control Engineering
- IEEE Conference on Robotics and Automation (ICRA)
- IEEE Conference on Decision and Control (CDC)
- American Control Conference (ACC)
- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
- IEEE/RAS/EMBS International Conference on Rehabilitation Robotics (ICORR)
- IEEE/RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics (BioRob)
- ASME Dynamic Systems and Control Conference (DSCC)
- IEEE Conference on Control Technology and Applications (CCTA)
- IEEE International Conference on Advanced Robotics and Mechatronics (ARM)