

CHAD G. ROSE

2452 Wiggins Hall, Department of Mechanical Engineering, Auburn University, 36849
P: (334)-844-3401 E: chadgrose@auburn.edu W: <https://ecm.eng.auburn.edu/wp/webr/>

Assistant Professor with experience designing robotic devices for neuro-rehabilitation and assistance and creating hands-on engineering education mechatronic curricula seeking to build a highly collaborative research program.

EDUCATION

Rice University- Houston, Texas, GPA 3.84

PhD in Mechanical Engineering – *Hybrid Rigid-Soft Exoskeleton Design* 08/2018

Committee: Marcia O'Malley (chair, advisor), Benjamin Fregly, Fathi Ghorbel, and Phil Kortum

MS in Mechanical Engineering – *Hardware-versus Human-centric Assessment of Rehabilitation Robots*
05/2015

Committee: Marcia O'Malley (chair, advisor), Andrew Dick, Fathi Ghorbel, and John Clark

Auburn University- Auburn, Alabama GPA 4.0

Bachelor of Mechanical Engineering, summa cum laude, Honors Scholar, German Minor 05/2012

ACADEMIC APPOINTMENTS

Auburn University – Assistant Professor, Wearable and Bio-Robotics (WeBR) Lab director 01/2020 - present

University of Texas at Austin – Postdoctoral Researcher, ReNeu Robotics Lab 09/2018-12/2019

JOURNAL PUBLICATIONS

9. Garza, K.B., Davis, B., Kelley, J., Richardson, A., Seals, C., Hawkins, G., McGuckin, L., **Rose C.G.**, and Grabowsky, A., Assessing the effectiveness of virtual reality to promote empathy for patients through a mixed-methods study, *American Journal of Pharmaceutical Education*, Volume 88, Issue 6, 2024, 100702, <https://doi.org/10.1016/j.ajpe.2024.100702>.
8. Baskaran, A., Hollinger, D., Hailey, R., Zabala, M.E., and **Rose, C.G.** "Neuromuscular State Estimation via Space-by-Time Neural Signal Decomposition." *ASME Letters in Dynamic Systems and Control* (2023): 1-6.
7. **Rose C.G.**, Gan D., and Hussain I. "Wearable Robots and Sensorimotor Interfaces: Augmentation, Rehabilitation, Assistance or Substitution of Human Sensorimotor Function." *Frontiers in Neurorobotics* 16 (2022).
6. **Rose, C.G.**, Deshpande A.D., Carducci, J., and Brown, J.D. "The road forward for upper-extremity rehabilitation robotics." *Current Opinion in Biomedical Engineering* 19 (2021).
5. Yousaf, S.N., Joshi, V.S., Britt, J.E., **Rose, C.G.**, and O'Malley, M.K. "Design and Characterization of a Passive Instrumented Hand," *ASME Letters in Dynamic Systems and Controls* (DSC-L) 1.1 (2021).
4. **Rose, C.G.** and O'Malley, M.K. "A Hybrid Rigid-Soft Hand Exoskeleton to Assist Functional Dexterity." *IEEE Robotics and Automation Letters*, Special Issue on Intelligent Human-Robot Interaction for Rehabilitation and Physical Assistance. 4.1, pgs. 73-80, 2018.
3. **Rose, C.G.**, Pezent, E., Kann, C.K., and O'Malley, M.K. "Assessing Wrist Movement with Robotic Devices." *IEEE Transactions on Neural Systems and Rehabilitation Engineering*. 26.8 pgs. 1585-1595. 2018.
2. **Rose, C.G.**, McDonald, C.G., Clark, J.P., and O'Malley, M.K. "Reflection on System Dynamics Principles Improves Student Performance in Labs with the Haptic Paddle." *IEEE Transactions on Education*. 61.3 pgs. 245 – 252. 2018.
1. Zeng, Y., **Rose, C.G.**, Taha, W., Duracz, A., Atkinson, K., Philippsen, R., and O'Malley, M.K. "Modeling electro-mechanical aspects of cyber-physical systems." *Journal of Software Engineering for Robotics* 7.1. pgs 100-119. 2016.

REFEREED CONFERENCE PROCEEDINGS

28. Baskaran, A., Basyal, S., Allen, B.C., and **Rose, C.G.** "Neuromuscular Model-free Epistemic Risk Guided Exploration (NeuroMERGE) for Safe Autonomy in Human-Robot Interaction" 2024 American Control Conference (ACC), Toronto, ON, CAN 2024.
27. Baskaran, A., Basyal, S., Allen, B.C., and **Rose, C.G.** "NeuroGAIN: Neuromechanical Generative Demand Forecasting Toward Optimal Control of Soft Hand Exoskeletons." 2024 International Symposium on Medical Robotics (ISMR), Atlanta, GA, USA, 2024.
26. Fabian Schirmer, Philipp Kranz, Balachandra Bhat, Chad G. Rose, Jan Schmitt, and Tobias Kaupp. 2024. "Towards a Path Planning and Communication Framework for Seamless Human-Robot Assembly". In Companion of the 2024 ACM/IEEE International Conference on Human-Robot Interaction (HRI '24).

Association for Computing Machinery, New York, NY, USA, 960–964.
<https://doi.org/10.1145/3610978.3640732>

25. F. Schirmer, V. K. Srikanth, P. Kranz, C. G. Rose, J. Schmitt and T. Kaupp, "Towards Automatic Extraction of Product and Process Data for Human-Robot Collaborative Assembly," 2023 21st International Conference on Advanced Robotics (ICAR), Abu Dhabi, United Arab Emirates, 2023, pp. 520-525, doi: 10.1109/ICAR58858.2023.10406471.
24. Schirmer, F., Kranz, P., Manjunath, M., Raja, J. J., Rose, C. G., Kaupp, T., & Daun, M. (2023). Towards a Conceptual Safety Planning Framework for Human-Robot Collaboration. ER 2023 - International Conference on Conceptual Modeling. Lisbon, Portugal. Nov. 2023.
23. Schirmer, F., Kranz, P., Rose, C.G., Schmitt, J., and Kaupp, T. Holistic Assembly Planning Framework for Dynamic Human-Robot Collaboration. International Conference on Intelligent Autonomous Systems (IAS), July 2023
22. Garza, K. B., Davis, B. R., Richardson, A., Seals, C., Rose, C. G., Hawkins, G., & Grabowsky, A. (2023). Walking in Their Shoes: Using Virtual Reality to Promote Empathy for Patients Among Student Pharmacists. *American Journal of Pharmaceutical Education*, 87(8).
21. Heqin, Y., Alexicia, R., Curtis, J. R., Cheryl, S., Gary, H., Rose, C. G., & Garza, K. B. (2023). User acceptance of virtual reality and haptic devices among people with rheumatologic conditions. *Research in Social and Administrative Pharmacy*, 19(3), 7.
20. Schirmer, F., Srikanth, V. K., Kranz, P., Rose, C. G., Schmitt, J., & Kaupp, T. (2023, December). Towards Automatic Extraction of Product and Process Data for Human-Robot Collaborative Assembly. In *2023 21st International Conference on Advanced Robotics (ICAR)* (pp. 520-525). IEEE.
19. Curtis, J., Garza, K., Clinton, C., Yang, H., Richardson, A., Seals, C., ... & Fraenkel, L. (2022, September). Acceptance of Virtual Reality for Managing Their Disease Among People with Rheumatologic Conditions with and Without Prior Experience Using Virtual Reality. In *ARTHRITIS & RHEUMATOLOGY* (Vol. 74, pp. 368-369). 111 RIVER ST, HOBOKEN 07030-5774, NJ USA: WILEY.
18. Hailey, Rhet O., Ana C. De Oliveira; Keya Ghonasgi; Bob Whitford; Robert K. Lee; **Chad G. Rose**; Ashish D. Deshpande., "Impact of Gravity Compensation on Upper Extremity Movements in Harmony Exoskeleton," 2022 International Conference on Rehabilitation Robotics (ICORR), 2022.
17. Baskaran, Avinash, and **Rose, C.G.** "Assessment of Neuromuscular Fatigue from Muscle Synergies in Hand Poses." IFAC-PapersOnLine 55.37 (2022): 382-387.
16. Steadman, Kathleen, Chandler Stubbs, Avinash Baskaran, **Chad G. Rose**, and David M. Bevly. "Teleoperated Ground Vehicle Rollover Prevention via Haptic Feedback of the Zero-Moment Point Index". 2022 NDIA Ground Vehicle Systems Engineering and Technology Symposium (GVSETS), Artificial Intelligence & Robotics Technical Session, August 16-18, 2022. Novi, Michigan
15. Britt, John E., O'Malley, M.K., and **Rose, C.G.**, "Electromyographic Classification to Control the SPAR Glove," AAC/IFAC Modeling, Estimation, and Control Conference (MECC) 2021.
14. Baskaran, A., Esmatloo, P., Times, M. Deshpande, A.D., and Rose, C.G. "An Anthropomorphic Passive Instrumented Hand for Validating Wearable Robotic Systems" IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM) July 2021.
13. Ghonasgi, K., **Rose, C.G.**, de Oliveira, A.C., Varghese, R.J., and Deshpande, A.D. "Design and Validation of a Novel Exoskeleton Hand Interface: The Eminence Grip" IEEE International Conference on Robotics and Automation 2021.
12. Ghonasgi, K., de Oliveira, A.C., Shafer, A., **Rose, C.G.**, and Deshpande, A.D. "Estimating the Effect of Robotic Intervention on Elbow Joint Motion." Proceedings of the IEEE International Conference on Robot & Human Interactive Communication (RO-MAN) 2019.
11. de Oliviera, A.C., **Rose, C.G.**, Warburton, K., Ogden, E.M., Whitford, B., Lee, R.K., and Deshpande, A.D. "Exploring the Capabilities of Harmony for Upper-Body Stroke Therapy," Proceedings of the IEEE International Conference on Rehabilitation Robotics (ICORR) 2019.
10. **Rose, C.G.** and O'Malley, M.K. "Design of an assistive, glove-based exoskeleton," Proceedings of the International Symposium on Wearable Robotics and Rehabilitation (WeRob), Houston, TX, 2017, pp. 3-4
9. **Rose, C.G.**, Bucki, N.L., and O'Malley, M.K. "A Ball and Beam Module for a Haptic Paddle Education Platform." Proceedings of the ASME Dynamic Systems and Controls Conference (DSCC). 2017.
8. **Rose, C.G.**, Kann, C., Deshpande, A.D., and O'Malley, M.K. "Estimating Anatomical Wrist Joint Motion with a Robotic Exoskeleton." Proceedings of the IEEE International Conference on Rehabilitation Robotics (ICORR). pgs. 1437-1442. 2017.

7. Pezent, M.E., **Rose, C.G.**, and O'Malley, M.K. "Design and Characterization of the OpenWrist: A Robotic Wrist Exoskeleton for Coordinated Hand-Wrist Rehabilitation." Proceedings of the IEEE International Conference on Rehabilitation Robotics (ICORR). pgs. 720-725. 2017.
6. Pehlivan, A.U., Losey, D.P., **Rose, C.G.**, and O'Malley, M.K. "Maintaining Subject Engagement during Robotic Rehabilitation with a Minimal Assist-as-Needed (mAAN) Controller." Proceedings of the IEEE International Conference on Rehabilitation Robotics (ICORR). pgs. 62-67. 2017.
5. **Rose, C.G.**, Sergi, F., Yun, Y., Madden, K., Deshpande, A.D., and O'Malley, M.K. "Characterization of a hand-wrist exoskeleton, READAPT, via kinematic analysis of redundant pointing tasks." Proceedings of the IEEE International Conference on Rehabilitation Robotics (ICORR). pgs. 205-210. 2015.
4. French, J.A., **Rose, C.G.**, and O'Malley, M.K. "System Characterization of MAHI Exo-II: A Robotic Exoskeleton for Upper Extremity Rehabilitation". Proceedings of the ASME Dynamic Systems and Controls Conference (DSCC). 2014.
3. **Rose, C.G.**, French, J.A., and O'Malley, M.K. "Design and characterization of a haptic paddle for dynamics education." Proceedings of the IEEE Haptics Symposium (HAPTICS). pgs. 265-270. 2014.
2. Zeng, Y. **Rose, C.G.**, Brauner, P. Taha, W. Masood, J. Philippsen, R. O'Malley, M.K. and Cartwright, R. "Modeling Basic Aspects of Cyber-Physical Systems, Part II." Proceedings of the International Workshop on Domain-Specific Languages and models for ROBotic systems (DSLRob). pgs. 550-557. 2013.
1. Pehlivan, A.U., **Rose, C.G.** and O'Malley, M.K. "System Characterization of RiceWrist-S: a Forearm-Wrist Exoskeleton for Upper Extremity Rehabilitation." Proceedings of the IEEE International Conference on Rehabilitation Robotics (ICORR). pgs. 1437-1442. 2013.

PRESENTATIONS AND POSTERS

Co-Chair, IEEE Intelligent Robots and Systems (IROS) 2020 session "Exoskeletons: Control II"

Poster, "Rehabilitation Training Under Gravity Compensation with Harmony Exoskeleton Improves in Movement Quality for Individuals with Chronic Stroke" International Consortium on Rehabilitation Robotics (ICORR) 2021. Sept. 25, 2021.

Poster, "Design and Validation of a Sensorized Physical Human-Robot Interface for Distributed Force Measurement." In IROS 2020 Workshop on Ergonomic Human-Robot Collaboration: Opportunities and Challenges. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). October 30, 2020.

Poster, "Glove based exoskeleton for SCI rehabilitation" Mission Connect Symposium, Houston, TX. 12/17.

Poster, "Towards a next generation of wearable robotic devices for human-oriented assistance and therapy" Workshop at International Conference on Rehabilitation Robotics (ICORR) London, UK. 07/17.

Organizer and Presenter, "Haptics in Education" Workshop at World Haptics, Munich, Germany, 06/17

Poster and Demo, "A Ball and Beam Module for a Haptic Paddle Education Platform" World Haptics, Munich, Germany. 06/17.

Poster, "Glove-based exoskeleton for SCI rehabilitation" ASU Rehabilitation Robotics Workshop, Tempe, AZ. 02/17.

Poster, "Glove based exoskeleton for SCI rehabilitation" Mission Connect Symposium, Houston, TX. 12/16.

Presenter, "Haptic Paddle for Dynamics Education" at NSF Center for Mobile Hands-On STEM, 05/16.

Poster, "Glove based exoskeleton for SCI rehabilitation" Mission Connect Symposium, Houston, TX. 12/15.

Poster, "RiceWrist-S Design Modification and System Characterization" Mission Connect Symposium, Houston TX, 12/13.

INVITED TALKS

"Reflection on System Dynamics Principles Improves Student Performance in Labs with the Haptic Paddle" Rice University Center for Teaching Excellence, 09/18/2017.

"Glove-based Exoskeleton for Rehabilitation" Mission Connect Review of Science, 04/20/2018.

TEACHING EXPERIENCE

Instructor, MECH 5840/6840 (Applied Mechatronics) at Auburn University, (Spring '21, '22 '23, Spring '24)

Instructor, MECH 3140 (System Dynamics and Control) at Auburn University (2020-present)

Technical Advisor, MECH 4240 (Senior Design) at Auburn University (2020-present)

Technical Advisor, ME 366K (Senior Design) at University of Texas (Spring '19)

Guest Lecturer, MECH 488 (Introduction to Robotics) at Rice University (Spring '18)

Guest Lecturer, MECH 343 (Modeling Dynamic Systems) at Rice University (Fall '17)

Teaching Assistant for MECH 420 (Fundamentals of Control Systems) at Rice University (Spring '13, '14, '16)

Teaching Assistant for MECH 488 (Design of Mechatronic Systems) at Rice University (Spring '15)
 Teaching Assistant for MECH 343 (Modeling Dynamic Systems) Lab at Rice University (Fall '12 '13, '14)

RESEARCH EXPERIENCE

Postdoctoral Research in ReNeu Robotics Lab at University of Texas at Austin, advised by Dr. Ashish Deshpande (09/2018-12/2019)

- *Supervised pre-clinical studies of novel bimanual upper extremity exoskeleton on post-stroke neurorehabilitation in collaboration with St. David's Neuroscience & Spine Institute.*
- *Lead interdisciplinary team extending autonomous agent machine learning techniques (curriculum learning) to human motor learning through human-robot interaction mediated by exoskeleton.*

Graduate Research in Mechatronics and Haptic Interfaces Lab at Rice University, advised by Dr. Marcia O'Malley (08/12-08/18)

- *Developed assistive glove-based exoskeletons as framework to investigate assistive technologies for post-spinal cord injury augmentation, soft sensing and actuation, and intent detection for intuitive control.*
- *Designed and validated exoskeletons to provide high-intensity training required to rehabilitate motor function, and the sensitive, accurate measurements needed to track motor function recovery.*
- *Collaboration with University of Texas, TIRR Memorial Hermann Hospital, and TRACLabs on exoskeletons.*
- *Designed hands-on laboratory hardware platform, the Haptic Paddle, to support the development of reflective curriculum for Dynamics, Mechatronics, and Controls courses.*

NASA Space Technology Research Fellow in Wearable Robotics Lab at Johnson Space Center, Houston, TX, advised by Roger Rovekamp and Jonathan Rogers (05/14-07/14, 01/16-08/16, 05/17-07/17)

- *Designed and prototyped soft glove-based exoskeletons towards space and assistive applications*

Graduate Research in the Effective Modeling Group at Halmstad University, Halmstad, Sweden, advised by Dr. Walid Taha (06/13-07/13)

- *Modeled and simulated a wrist exoskeleton as a case study in the development of a domain-specific language for cyber-physical systems, motivating the support of partial differentiation for Lagrangian dynamic modeling.*

HONORS and AWARDS

- NASA Space Technology Research Fellowship (NSTRF, 2013-2016)
- NSF Graduate Research Fellowship Program (GRFP) Honorable Mention (2013)
- ASME Plant Engineering and Maintenance Technical Chapter Scholarship Award (2018)

INVITED REVIEWS

Publication	Type
ASME Journal of Mechanisms and Robotics	Journal
IEEE Transactions on Neural Systems & Rehabilitation Engineering	Journal
IEEE Robotics and Automation Letters (RA-L)	Journal
IEEE Transactions on Haptics	Journal
Cambridge University Press Wearable Technologies	Journal
IEEE Transactions on Mechatronics	Journal
Frontiers in Robotics and AI	Journal
IEEE Transactions on Human-Machine Systems	Journal
Elsevier Current Opinion in Biomedical Engineering	Journal
SAGE Journal of Rehabilitation and Assistive Technologies Engineering (RATE)	Journal
IEEE Transactions on Robotics	Journal
ASME Dynamic Systems and Controls Conference (DSCC)	Conf.
IEEE International Conference on Robotics and Automation (ICRA)	Conf.
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)	Conf.
IEEE International Conference on Rehabilitation Robotics (ICORR)	Conf.
IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics (BioRob)	Conf.
EHS Eurohaptics Conference	Conf.
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)	Conf.
IFAC Modeling, Estimation, and Control Conference (MECC)	Conf.

OUTREACH and SERVICE ACTIVITIES

ASME Bio-Systems and Healthcare Technical Committee

- Publicity Chair 2021
- Secretary 2022-2023
- Chair, 2023-present

Alabama State VEX Robotics Championship 2020 – Judge

Auburn University Council of Engineering Graduate Students 2020 Finish in Five pitch competition -Judge

Regeneron International Science and Engineering Fair (ISEF) April 1, 2021 - Best of Field Judge