Syed Ali Asad Rizvi

Assistant Professor, Electrical and Computer Engineering
Tennessee Technological University
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Education

University of Virginia — Charlottesville, Virginia
Ph.D. in Electrical Engineering — Aug. 2015 – Dec. 2019

National University of Sciences and Technology — Karachi, Pakistan
M.S. in Electrical Engineering, *summa cum laude* — Sep. 2012 – Jul. 2014

NED University of Engineering and Technology — Karachi, Pakistan
B.E. in Industrial Electronics Engineering, *summa cum laude* — Jan. 2008 – Dec. 2011

Professional Experience

Tennessee Technological University — Cookeville, Tennessee
Assistant Professor, Department of Electrical and Computer Engineering — Aug. 2021 – Present

National Institute of Standards and Technology (NIST) — Gaithersburg, Maryland
Postdoctoral Fellow, Energy and Environment Division — Feb. 2020 – Jul. 2021

Data Communication and Control (Pvt.) Ltd. — Karachi, Pakistan
Design and Research Engineer — Feb. 2012 – Jul. 2015

Research Areas

Control theory, reinforcement learning, and **optimization** with applications in **autonomous vehicles, energy systems, rotordynamics with magnetic bearings, HVAC systems,** and **electric drives.**

Sponsored Research

- Principal Investigator (Subaward with Zongli Lin), "Design Optimization and Validation of a Machine-Learning-Based Integrated JB/AMB Supported Rotor for Energy Applications," National Academy of Sciences (NAS), Amount: $200,000 (50% share) 2023 – 2025
- Principal Investigator, "A Game-Theoretic Reinforcement Learning Control Framework for Multi-Agent Control of Building HVAC Systems," National Institute of Standards and Technology (NIST), Amount: $120,000 (100% share) 2022 – 2024
- Principal Investigator,"A Stabilizing Reinforcement Learning Control Framework for Handling Real-World Constraints," Office of Research at Tennessee Technological University, Amount: $5,000 (100% share) 2022 – 2023
- Senior Personnel (PI: Syed Hasan, co-PIs: Nan Guo, Doug Talbert),"Cybersecurity for Autonomous Ground Vehicles: Towards Hardware in the Loop Simulation for Autonomous Vehicles' Cybersecurity," Applied Research Associates (ARA), Amount: $1,812,925 (6% share) 2023 – 2025
- Senior Personnel (PI: Pingen Chen, co-PIs: Joseph Ojo, Nan Chen),"Second-Life Battery in Mobile EV Charging Application for Rural Transportation (SMART)," U.S. Department of Energy (DOE), Amount: $4,531,642 (5% share) 2023 – 2025

Publications

Books

1. **S. A. A. Rizvi** and Z. Lin, *Output Feedback Reinforcement Learning Control for Linear Systems*, 2022. Birkhäuser, Springer.

Book Chapters

1. **S. A. A. Rizvi**, Y. Wei and Z. Lin, "Reinforcement learning for optimal adaptive control of time delay systems," in *Handbook of Reinforcement Learning and Control*, pp. 215–242, 2021. Springer.

Journals

1. **S. A. A. Rizvi**, A. Pertzborn and Z. Lin, "Development of a bias compensating Q-learning controller for a multi-zone HVAC facility," *IEEE CAA Journal of Automatica Sinica*, vol. 10, no. 8, pp. 1704–1715, 2023. IEEE.
2. D. Zhang, J. Anwar, **S. A. A. Rizvi** and Yusheng Wei, "Deep learning for continuous-time leader synchronization in graphical games using sampling and deep neural networks," *ASME Letters in Dynamic Systems and Control*, vol. 3, no. 3, pp. 031004(1–6), 2023. ASME.
3. **S. A. A. Rizvi** and Z. Lin, "A note on state parameterizations in output feedback reinforcement learning control of linear systems," *IEEE Transactions on Automatic Control*, vol. 68, no. 10, pp. 6200–6207, 2022. IEEE.
4. **S. A. A. Rizvi**, A. Pertzborn and Z. Lin, "Reinforcement learning based optimal tracking control under unmeasurable disturbances with application to HVAC systems," *IEEE Transactions on Neural Networks and Learning Systems*, vol. 33, no. 12, pp. 7523–7533, 2021. IEEE.
5. **S. A. A. Rizvi** and Z. Lin, "Output feedback adaptive dynamic programming for linear differential zero-sum games," *Automatica*, vol. 122, 2020. Elsevier.
6. **S. A. A. Rizvi** and Z. Lin, "Adaptive dynamic programming for model-free global stabilization of control constrained continuous-time systems," *IEEE Transactions on Cybernetics*, vol. 52, no. 2, pp. 1048–1060, 2020. IEEE.
7. L. Guo, **S. A. A. Rizvi** and Z. Lin, "Optimal control of a two-wheeled self-balancing robot by reinforcement learning," *International Journal of Robust and Nonlinear Control*, vol. 31, no. 6, pp. 1885–1904, 2020. Wiley.
8. **S. A. A. Rizvi** and Z. Lin, "An iterative Q-learning scheme for the global stabilization of discrete-time linear systems subject to actuator saturation," *International Journal of Robust and Nonlinear Control*, vol. 29, no. 9, pp. 2660–2672, 2019. Wiley.
9. **S. A. A. Rizvi** and Z. Lin, "Experience replay–based output feedback Q-learning scheme for optimal output tracking control of discrete-time linear systems," *International Journal of Adaptive Control and Signal Processing (Special Issue on Learning from Adaptive Control under Relaxed Excitation Conditions)*, vol. 33, no. 12, pp. 1825–1842, 2019. Wiley.
10. **S. A. A. Rizvi** and Z. Lin, "Output feedback reinforcement learning based optimal output synchronization of heterogeneous discrete-time multi-agent systems," *IET Control Theory & Applications (Special Issue on Distributed Optimization and Learning for Networked Systems)*, vol. 13, no. 17, pp. 2866–2876, 2019. IET.
11. **S. A. A. Rizvi** and Z. Lin, "Reinforcement learning based linear quadratic regulation of continuous-time systems using dynamic output feedback," *IEEE Transactions on Cybernetics*, vol. 50, no. 11, pp. 4670–4679, 2019. IEEE.
12. **S. A. A. Rizvi** and Z. Lin, "Output feedback reinforcement Q-learning control for the discrete-time linear quadratic regulator problem," *IEEE Transactions on Neural Networks and Learning Systems*, vol. 30, no. 5, pp. 1523–1536, 2018. IEEE.

13. **S. A. A. Rizvi** and Z. Lin, "Output feedback Q-learning for discrete-time linear zero-sum games with application to the H-infinity control," *Automatica*, vol. 95, pp. 213–221, 2018. Elsevier.
14. **S. A. A. Rizvi** and A. Y. Memon, "An extended observer-based robust nonlinear speed sensorless controller for a PMSM," *International Journal of Control*, vol. 92, no. 9, pp. 2123–2135, 2018. Taylor & Francis.
15. B. Weaver, T. Tsukuda, **S. A. A. Rizvi**, et al., "Experimental measurements of turbomachinery rotordynamics, component performance, and dynamic control at ROMAC–a review," *Journal of the Gas Turbine Society of Japan*, vol. 45, no. 4, pp. 235–242, 2017.

Conferences

1. M. H. Zaheer, S. Y. Yoon and **S. A. A. Rizvi**, "Derivative feedback control using reinforcement learning," *62nd IEEE Conference on Decision and Control (CDC)*, 2023, Marina Bay Sands, Singapore. IEEE.
2. U. A. Mughal, M Ismail and **S. A. A. Rizvi**, "Stealthy false data injection attack on unmanned aerial vehicles with partial knowledge," *2023 IEEE Conference on Communications and Network Security (CNS)*, 2023, Orlando, USA. IEEE.
3. J. Anwar and **S. A. A. Rizvi**, "Bias compensating reinforcement learning control with feedforward adaptation for HVAC systems," *41st American Control Conference (ACC)*, 2023, San Diego, USA. IEEE.
4. **S. A. A. Rizvi** and Z. Lin, "Compensation of disturbance induced estimation bias in adaptive dynamic programming based optimal control," *SIAM Conference on Control and Its Applications*, 2023, Philadelphia, USA. SIAM.
5. D. Zhang, J. Anwar, **S. A. A. Rizvi** and Yusheng Wei, "Deep learning for continuous-time leader synchronization in graphical games using sampling and deep neural networks," *2023 Modeling, Estimation and Control Conference (MECC)*, 2023, Lake Tahoe, USA. IEEE.
6. **S. A. A. Rizvi** and A. Pertzborn, "Experimental results of a disturbance compensating Q-learning controller for HVAC systems," *40th American Control Conference (ACC)*, 2022, Atlanta, USA. IEEE.
7. **S. A. A. Rizvi**, Y. Wei and Z. Lin, "Reinforcement learning for optimal stabilization of magnetically suspended balance beam subject to input delay," *17th IEEE International Conference on Control and Automation (ICCA)*, 2022, Naples, Italy. IEEE.
8. A. Pertzborn and **S. A. A. Rizvi**, "Implementation of structured reinforcement learning for supply air temperature control," *ASHRAE Annual Conference*, 2022, Toronto, Canada. AHSRAE.
9. L. Guo, **S. A. A. Rizvi** and Z. Lin, "Optimal control of a two-wheeled self-balancing robot by reinforcement Q-learning," *16th IEEE International Conference on Control and Automation (ICCA)*, 2020, Sapporo, Japan. IEEE.
10. **S. A. A. Rizvi** and Z. Lin, "Model-free global stabilization of continuous-time linear systems with saturating actuators using adaptive dynamic programming," *58th IEEE Conference on Decision and Control (CDC)*, 2019, Nice, France. IEEE.
11. **S. A. A. Rizvi**, Y. Wei and Z. Lin, "Model-free optimal stabilization of unknown time delay systems using adaptive dynamic programming," *58th IEEE Conference on Decision and Control (CDC)*, 2019, Nice, France. IEEE.
12. **S. A. A. Rizvi** and Z. Lin, "Model-free global stabilization of discrete-time linear systems with saturating actuators using reinforcement learning," *57th IEEE Conference on Decision and Control (CDC)*, 2018, Miami, USA. IEEE.

13. **S. A. A. Rizvi** and Z. Lin, "Output feedback reinforcement learning control for the continuous-time linear quadratic regulator problem," *36th American Control Conference (ACC)*, 2018, Milwaukee, USA. IEEE.
14. **S. A. A. Rizvi** and Z. Lin, "Output feedback optimal tracking control using reinforcement Q-learning," *36th American Control Conference (ACC)*, 2018, Milwaukee, USA. IEEE.
15. **S. A. A. Rizvi** and Z. Lin, "Output feedback reinforcement Q-learning control for the discrete-time linear quadratic regulator problem," *56th IEEE Conference on Decision and Control (CDC)*, 2017, Melbourne, Australia. IEEE.
16. A. Y. Memon and **S. A. A. Rizvi**, "Robust output feedback linearizing speed sensorless control of PMSM," *Multi-Conference on Systems and Control (MSC) and Conference on Control Applications (CCA)*, 2015, Sydney, Australia. IEEE.
17. **S. A. A. Rizvi**, M. Faisal, H. Aftab, S. Ahmed and A. Y. Memon, "A robust observer and controller design for a DC motor with a low-resolution encoder," *27th IEEE Chinese Control and Decision Conference*, 2015, Qingdao, China. IEEE.
18. **S. A. A. Rizvi** and A. Y. Memon, "Robust output feedback control of PMSM using cascaded sliding mode and high gain observers," *40th Annual Conference of the IEEE Industrial Electronics Society*, 2014, Dallas, USA. IEEE.
19. **S. A. A. Rizvi** and M. B. Kadri, "Online adaptation of rotor parameters using fuzzy logic in indirect field oriented vector control of AC induction drives," *9th IEEE International Conference on Emerging Technologies (ICET)*, 2013, Islamabad, Pakistan. IEEE.
20. **S. A. A. Rizvi** and M. B. Kadri, "Sensorless temperature estimation for thermal protection of vector controlled AC drives using fuzzy MRAS," *International Conference on Modeling & Simulation (ICOMS)*, 2013, Islamabad, Pakistan.
21. **S. A. A. Rizvi**, S. Sunder, F. Haroon and A. Mirza, "Humidity control with interactive web monitoring: a cost-optimal solution for printing industries," *10th IEEE International Conference on Frontiers of Information Technology (FIT)*, 2013, Islamabad, Pakistan. IEEE.
22. **S. A. A. Rizvi**, S. Sunder, F. Haroon and A. Mirza, "Virtual instrumentation for control applications," *Emerging Trends and Applications in Information Communication Technologies: International Multi-Topic Conference*, 2012, Jamshoro, Pakistan. Springer.

Honors & Awards

- **TTU Wings Up 100 Award**, Tennessee Technological University 2023
- **TTU Scholastic Research Award**, Tennessee Technological University 2023
- **PREP Fellowship Award**, National Institute of Standards and Technology 2019
- **Louis T. Rader Graduate Research Award**, University of Virginia 2019
- **Student Travel Award**, American Control Conference 2018
- **Russel Graduate Fellowship Award**, University of Virginia 2017
- **Student Travel Award**, IEEE Conference on Decision and Control 2017
- **ECE Annual Poster Session Award**, 3rd place, University of Virginia 2017
- **NICTA Research Project Award**, National ICT Australia 2015
- **Travel Scholarship**, IEEE Industrial Electronics Society 2014

- **President's Gold Medal**, National University of Sciences and Technology 2014
- **B.E. Gold Medal**, NED University of Engineering and Technology 2012
- **Full Tuition Scholarship**, Institute of Industrial Electronics Engineering 2008 – 2012
- **IEEE Quiztronic Award**, 2nd place, IEEE NUST PNEC Chapter 2010

Invited Talks

- "Time Delay Machine Learning for AMB Systems," *Calnetix Technologies*, Cerritos, CA, Oct. 13, 2023.
- "Recent Developments in Reinforcement Learning and Optimal Control: Theory and Applications," *University of New Hampshire*, Durham, NH, Sept. 22, 2023.
- "Reinforcement Learning and Control in Real-World Environments," *Tennessee Technological University*, Cookeville, TN, Oct. 18, 2021.
- "Reinforcement Learning and Control in Real-World Environments: From Individual Systems to Networked Systems," *University of Florida*, Gainesville, FL, Mar. 1, 2021.
- "Reinforcement Learning and Control in Real-World Environments: From Individual Systems to Networked Systems," *California State University*, Long Beach, CA, Mar. 26, 2021.
- "Reinforcement Learning for Model-Free Adaptive Optimal Control," *National Institute of Standards and Technology*, Gaithersburg, MD, Apr. 15, 2020.
- "Model-Free Global Stabilization of Continuous-Time Linear Systems with Saturating Actuators Using Adaptive Dynamic Programming," *IEEE CDC*, Nice, France, Dec. 11, 2019.
- "Reinforcement Learning Based Optimal Control of AMBs with Time Delays," *ROMAC Annual Meeting*, Charlottesville, VA, Jun. 13, 2019.
- "Model-Free H-infinity Control Using Reinforcement Learning," *ROMAC Annual Meeting*, Charlottesville, VA, Jun. 7, 2018.
- "Reinforcement Q-learning LQR Control and its Application to AMBs," *ROMAC Annual Meeting*, Staunton, VA, Jun. 22, 2017.
- "Reinforcement Learning for Adaptive Optimal Control," *National University of Sciences and Technology*, Karachi, Pakistan, Sep. 19, 2017.

Teaching Experience

Tennessee Technological University Cookeville, Tennessee
Teaching Aug. 2021 – Present

- ECE 6900/7970 - Learning and Adaptive Control (Fall 2023)
- ECE 6200 - Linear Systems Analysis (Spring 2023, Spring 2022)
- ECE 6280 - Nonlinear Automatic Control (, Spring 2024, Fall 2022)
- ECE 3210 - Control Systems Analysis (Fall 2023, Fall 2022, Fall 2021)
- ECE 4933 - Research Topics (Spring 2024, Fall 2022)

University of Virginia Charlottesville, Virginia
Teaching Assistant Aug. 2016 – May 2018

- ECE 6502 - Intro to Control Systems (Spring 2018)
- APMA 3080 - Linear Algebra (Fall 2016, Spring 2017)

Professional Service

- Member, *IEEE Control Systems Society (CSS)* Conference Editorial Board 2023 – Present
- Associate Editor, *63rd IEEE Conference on Decision and Control (CDC)* 2024
- Session Organizer, *6th International Conference on Industrial Artificial Intelligence (IAI)* 2024
- Associate Editor, *42nd American Control Conference* 2023
- Session Chair, *2023 SIAM Conference on Control and its Applications* 2023
- Program Committee, *17th International Conference on Control and Automation* 2022
- Session Co-Chair, *36th American Control Conference* 2018
- Presented short courses annually on "Rotordynamics and Magnetic Bearings" for industry members of *Rotating Machinery and Controls (ROMAC) Lab, University of Virginia* 2017 – 2019
- Reviewer of over 120 submissions in premier journals and conferences including *IEEE Transactions on Automatic Control, Automatica, IEEE Transactions on Neural Networks and Learning Systems, IEEE Transactions on Cybernetics, IEEE Conference on Decision and Control (CDC), American Control Conference (ACC), IFAC World Congress, etc.*

University Service

- Member (Present Chair) of ECE Scholarships and Student Awards Committee 2021 – Present
- Member of ECE Graduate Program Committee 2021 – Present
- Member of CoE Spectrum Awards Committee 2024
- Faculty Judge in TTU's Research and Creative Inquiry Day 2023
- Member of ECE Robotics, Automation, and Controls Focus Group 2021 – Present
- ECE Faculty Representative in TTU's Student Recruitment Events 2021 – Present

Professional Trainings

- **Tomorrow's Professor Today**, University of Virginia 2020
- **FPGA Based Digital System Design using Verilog HDL**, IIEE 2010
- **Xpedient Certified Embedded Systems Engineer**, Xpedient Technologies 2010

Societies & Affiliations

- Member, IEEE 2012 – Present
- Member, IEEE Control Systems Society 2012 – Present
- Registered Engineer, Pakistan Engineering Council 2014 – Present