

## SMC eNewsletter's Student Corner Column (March 2025 Issue)

*Chun Sing Lai and Anderson Avila*

In this issue of the Student Corner Column, we interview Chengguo Liu, co-author of the paper “Fuzzy Adaptive Predefined Time Control with Global Prescribed Performance for Robotic Manipulator Under Unknown Disturbance” published in IEEE Transactions on Systems, Man, and Cybernetics: Systems, DOI: 10.1109/TSMC.2025.3540777, 2025.

1. Please tell us a bit about your background and your research area.

*I am Chengguo Liu, and I received my M.Eng. degree in mechanical engineering from Chongqing University, China, in 2022, where I am currently pursuing a Ph.D. degree in mechanical engineering with the College of Mechanical and Vehicle Engineering. Additionally, I have had the opportunity to be a joint Ph.D. student at the Bristol Robotics Laboratory, U.K., in October 2023 and October 2024. My research interests focus on robot control, prescribed performance control, and adaptive control.*

2. How did you become interested in your field?

*My interest in robotic control and adaptive systems stems from my passion for intelligent automation and the challenge of designing precise, efficient, and robust control strategies for complex robotic systems. During my undergraduate and master's studies, I was drawn to the mathematical and engineering aspects of advanced control methodologies, which ultimately led me to pursue research in this field.*

3. What motivated you to join the IEEE SMC Society?

*IEEE SMC Society provides an excellent platform for researchers to exchange ideas and advancements in systems science, cybernetics, and human-machine systems. I was particularly motivated to join due to its strong community of experts and its high-impact publications, which have significantly contributed to my research development and professional growth.*

4. What motivated you to publish in the IEEE Transactions on Systems, Man, and Cybernetics: Systems?

*IEEE Transactions on Systems, Man, and Cybernetics: Systems is a highly reputable journal that publishes cutting-edge research in the field of intelligent systems and control. The rigorous peer-review process and the journal's focus on high-impact and innovative research made it the ideal venue for sharing my findings with a broader academic and professional audience.*

5. What is the main innovation in your paper titled “Fuzzy Adaptive Predefined Time Control With Global Prescribed Performance for Robotic Manipulator Under Unknown Disturbance” and its importance to IEEE Transactions on Systems, Man, and Cybernetics: Systems?

*1). We introduce a novel predefined time error transformation function (PTETF) integrated with a barrier function, allowing global performance constraints to be embedded directly into the control design. This significantly simplifies controller design and ensures predefined-time convergence.*

2). *We develop a fuzzy logic system (FLS) with a single-parameter update to estimate manipulator uncertainties, avoiding over-parameterization and reducing computational burden compared to traditional approaches.*

3). *We propose an FxTDOB-based compensation mechanism to effectively handle nonparametric disturbances, further enhancing tracking accuracy. Unlike purely theoretical studies, our method is validated through extensive real-world experimental tests on robotic manipulators, demonstrating its superior practical applicability and control performance under unknown disturbances.*

6. Where would you see yourself in 5-years' time career wise?

*In the next five years, I aim to deepen my expertise in intelligent control and robotic automation, contributing to both theoretical advancements and practical applications in robotics. I aspire to collaborate with leading research institutions and industry partners to develop next-generation robotic systems with enhanced adaptability and precision. Additionally, I hope to take on a research or academic position where I can contribute to the growing field of intelligent control systems.*

### **Biography:**



Chengguo Liu received the M.Eng. degree in mechanical engineering from Chongqing University, Chongqing, China, in 2022, where he is currently pursuing the Ph.D. degree in mechanical engineering with the College of Mechanical and Vehicle Engineering. In October 2023 and October 2024, he was a joint Ph.D. student with the Bristol Robotics Laboratory, Bristol, U.K. His research interests cover robot control, prescribed performance control, and adaptive control.