

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

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In this issue of the Student Corner Column, we interview Zicong Xia, co-author of the paper “Distributed Nonconvex Optimal Resource Allocation via a Momentum-Based Multiagent Optimization Approach” published in IEEE Transactions on Systems, Man, and Cybernetics: Systems, DOI: 10.1109/TSMC.2025.3539232, 2025.

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

*I am currently a second-year Ph.D. student in the Department of Systems Science, School of Mathematics, Southeast University, under the guidance of Professor Wenwu Yu. My research focuses on the intersection of systems science, mathematics, and artificial intelligence, particularly in distributed optimization, game theory, multi-agent systems, and optimal control. My work aims to address challenges in emerging AI-driven fields such as unmanned autonomous systems, smart grids, intelligent transportation, and smart cities, with the focus on developing scalable and efficient algorithms for real-world applications and tasks.*

2. How did you become interested in your field?

*My interest in systems science and optimization was sparked during my undergraduate studies, where I was fascinated by the power of mathematical models to solve real-world problems. During my Master's degree supervised by Prof. Yang Liu, I delved deeper into optimization theory and its applications, which further solidified my passion for the field. Joining Prof. Yu's team at Southeast University provided me with the opportunity to explore the interdisciplinary nature of systems science and AI, particularly in distributed optimization and multi-agent systems. The technology potential to transform industries continues to drive my research.*

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

*I joined the IEEE SMC Society because its mission aligns closely with my research on distributed optimization, game theory, and multi-agent systems. The Society's focus on systems science, human-machine systems, and cybernetics, along with its conferences and publications, provides an excellent platform for collaboration and growth. I am inspired by its commitment to interdisciplinary research and innovative solutions for real-world challenges. Additionally, I appreciate the Society's inclusive community, which encourages diverse perspectives and fosters a global outlook, enriching my research and professional development.*

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

*I chose IEEE Transactions on Systems, Man, and Cybernetics: Systems for its high-quality research and interdisciplinary scope, which perfectly aligns with my work. My supervisors recommended it as a leading platform for cutting-edge research in systems science. My previous positive submission experience with the journal, where I received highly professional and constructive feedback from reviewers as well as editors, motivating me to submit again. Besides, publishing here allows me to contribute to advancing knowledge in my field and reach a global audience of researchers.*

5. What is the main innovation in your paper titled “Distributed Nonconvex Optimal Resource Allocation via a Momentum-Based Multiagent Optimization Approach” and its importance to IEEE Transactions on Systems, Man, and Cybernetics: Systems?

*The main innovation of our paper lies in the development of a momentum-based multi-agent optimization approach for distributed nonconvex resource allocation problems. Unlike traditional methods that rely on convexity assumptions, our approach introduces a momentum term and dual timescales to ensure convergence in nonconvex settings. We also propose a hybrid multi-agent optimization framework that combines distributed average tracking with a meta-heuristic rule to seek global minimizers. This work has the significance for IEEE SMC authors as it addresses a challenge in distributed optimization and provides a robust, scalable solution with applications in energy systems, smart grids, and so on. Our results demonstrate enhanced stability, faster convergence, and improved optimality compared to existing methods, making a contribution to the field of systems science and engineering.*

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

*In the next five years, I aim to complete my Ph.D. and pursue a career in academia, where I hope to contribute to the optimization theory and its applications. My research will focus on addressing practical challenges in areas such as unmanned autonomous systems and energy systems. I am eager to collaborate with fellow researchers and learn from their expertise to develop sustainable and efficient solutions. Additionally, I aspire to actively contribute to the IEEE SMC community by participating in conferences, workshops, and other activities that promote the exchange of ideas and advancements in systems science and engineering. Beyond academia, I plan to engage with industry and policymakers to explore how my research can be applied to real-world problems. While I have much to learn, I am committed to making meaningful contributions to the field and supporting the growth of AI-driven technologies.*

### **Biography:**



Zicong Xia received the B.Sc. and M.Sc. degree in mathematics from Zhejiang Normal University, Jinhua, China, in 2019 and 2023, respectively. He was a research assistant in City University of Hong Kong, Hong Kong in 2022. He is currently pursuing his Ph.D. at the School of Mathematics, Southeast University, Nanjing, China. His current research interests include distributed optimization, game theory, multi-agent systems, and optimal control. He is a member of IEEE/CAA/CICC, and he was the recipient of the Excellent Master Thesis Award from the Chinese Association of Automation and Zhejiang Province.