

## Distinguished Lecturer Visit by Prof. Haibin Zhu at Sun Yat-sen University, Guangzhou, China, April 28, 2026

Prof. Haibin Zhu visited Sun Yat-sen University, Guangzhou, China on April 28, 2026, where he delivered an IEEE Distinguished Lecture (of IEEE Systems, Man and Cybernetics Society) titled " **E-CARGO/RBC: Enabling Research Innovations in the Era of AI**", organized by Professors. Weineng Chen and Nong Xiao. The lecture attracted many attendees, including students, researchers, and professionals from the fields of engineering and technology (Figs. 1 and 2).



Fig. 1 The audience is listening to Prof. Zhu's lecture.



Fig. 2 Prof. Zhu is summarizing the lecture and promoting the E-CARGO 2026 symposium.

In the era of Artificial Intelligence (AI), advanced AI tools, particularly Large Language Models (LLMs), are rapidly transforming the way people work. These technologies can already perform many routine intellectual tasks, including coding, report writing, information retrieval, and content generation. As a result, many traditional low-level knowledge-based jobs face increasing pressure from automation. To remain effective and competitive, future professionals must move beyond routine implementation skills and master high-level modelling methodologies capable of addressing complex real-world challenges.

Role-Based Collaboration (RBC) and its E-CARGO framework (Environments, Classes, Agents, Roles, Groups, and Objects) provide such a methodology. Rather than focusing on low-level programming details, E-CARGO emphasizes the modelling of systems, organizations, and collaborative processes, enabling researchers and practitioners to design systematic strategies for solving complex problems.

RBC is a computational methodology that uses roles as the fundamental mechanism for organizing and facilitating collaboration. It encompasses a comprehensive set of concepts, principles, models, processes, and algorithms. Over the past two decades, RBC and the E-CARGO framework have evolved into powerful tools for investigating collaboration and complex systems. Research based on E-CARGO has contributed to advances in the design, analysis, evaluation, and management of collaboration systems, service systems, cloud systems, production systems, and administrative systems.

Today, E-CARGO serves as a foundational framework for exploring a broad range of complex-system problems, including collective intelligence, social networking, scheduling, smart cities, the Internet of Things, cyber-physical systems, digital twins, and computational social simulation. The framework enables scientists and engineers to formalize problems that are often poorly defined or difficult to model, transforming them into computable forms that can be analyzed and solved systematically.

The E-CARGO model possesses many desirable properties of a computational model and has been validated through numerous studies on collaboration and complex systems, including the well-known Group Role Assignment (GRA) problem and its extensions. The framework not only supports practical problem solving but also provides opportunities for theoretical innovation. Researchers can extend E-CARGO to formalize new classes of problems, while domain specialists can refine its components to better suit specific application areas.

Looking forward, E-CARGO offers the potential to support the development of next-generation modelling and programming paradigms. By defining appropriate primitive elements for each E-CARGO component, researchers may develop new modelling languages and software engineering methodologies capable of addressing increasingly complex systems in a systematic and scalable manner.

In this lecture, the speaker will examine the growing need for collaboration technologies and complex-system modelling in the AI era; introduce the principles, models, and processes of RBC and E-CARGO; review major research achievements and applications; identify important open problems and future research opportunities; and discuss the relationships between E-CARGO and emerging fields such as AI, collective intelligence, social simulation, digital twins, and human-machine collaboration.

The lecture aims to demonstrate that E-CARGO is a mature and powerful modelling framework with broad applicability across disciplines. Researchers, students, and practitioners are warmly invited to explore, apply, evaluate, extend, and critically examine the framework in pursuit of new scientific discoveries and innovative solutions to complex real-world problems.