Distinguished Lecturer Visit by Prof. Haibin Zhu at Dalhousie University, Halifax, Canada
April 8, 2026

Prof. Haibin Zhu visited Dalhousie University, Halifax, Canada on April 8, 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 Professor Jason Gu. The lecture attracted many attendees, including students, researchers, and professionals from the fields of engineering and technology (Figs. 1-3).

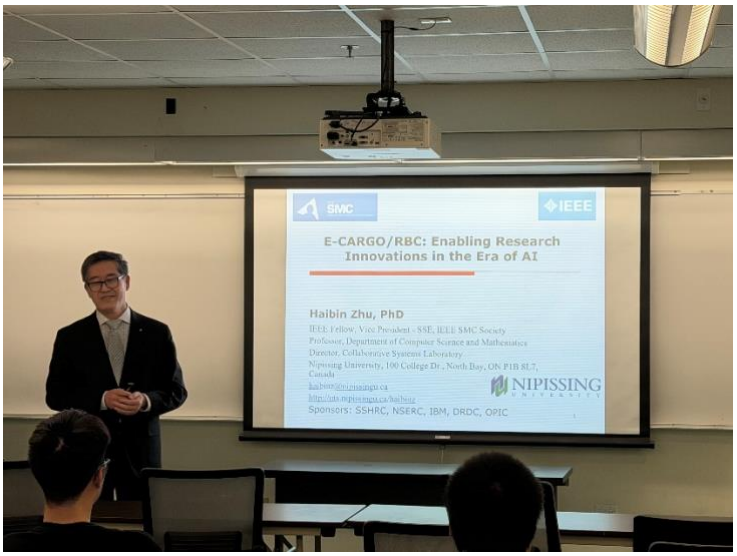

Fig. 1 Prof. Zhu is presenting his lecture.

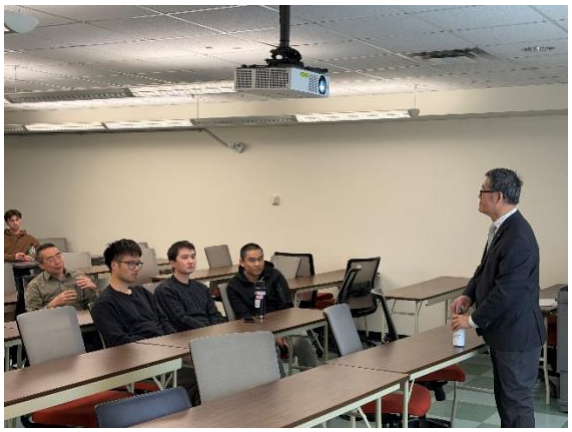

Fig. 2 Prof. Zhu is answering questions.

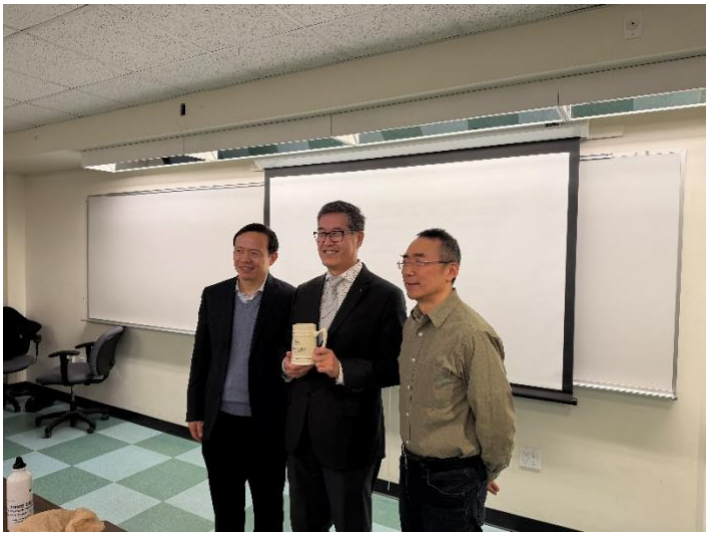

Fig. 2 Profs. Jason Gu Dalhousie University, Canada, and Michael Zhang, St. Mary University, Canada, are presenting a gift to Prof. Zhu.

In the era of Artificial Intelligence (AI), advanced AI technologies, particularly Large Language Models (LLMs), are rapidly transforming the way people learn, work, and innovate. These tools can already perform many routine intellectual tasks, including coding, report generation, information retrieval, data analysis, and content creation. As AI continues to automate low-level cognitive activities, many traditional knowledge-based jobs face increasing pressure from technological replacement. To remain effective and competitive, future professionals must go beyond routine implementation skills and develop the ability to model, analyze, and solve complex real-world problems at a higher level of abstraction.

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

RBC is a computational methodology that employs 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, organizations, and complex systems. Research based on E-CARGO has contributed to advances in the design, analysis, evaluation, optimization, 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 wide spectrum of complex-system problems, including collective intelligence, social networks, scheduling, smart cities, the Internet of Things, cyber-physical systems, digital twins, human-machine collaboration, and computational social simulation. The framework enables scientists and engineers to formalize problems that are often vague,

qualitative, or difficult to define, transforming them into computable forms that can be systematically analyzed and solved.

The E-CARGO framework 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. Beyond practical problem solving, E-CARGO also provides opportunities for theoretical innovation. Researchers may extend the framework to formalize new categories of problems, while domain specialists can refine its components to better suit specific application areas.

Looking ahead, E-CARGO has the potential to support the development of next-generation modelling and programming paradigms. By defining suitable primitive elements and domain-specific extensions for its components, researchers may develop new modelling languages, intelligent design methodologies, and software engineering frameworks capable of addressing increasingly complex systems in a systematic, scalable, and explainable 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, processes, and algorithms 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, organizational intelligence, and human-machine collaboration.

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