



CoCo Seminar Series Fall 2025

Systems Modeling and Analysis for a Sustainable Material Future

**Dr. Sidi Deng, Assistant Professor, Engineering
Design Division, Binghamton University**

Wednesday October 15, 2025 12:15-1:15pm EDT

**Hybrid (EB-T1 & Zoom; meeting link available on
<http://coco.binghamton.edu/>)**



Materials are the building blocks of industrial society, flowing through supply chains that represent complex, interconnected networks. Given this, material sustainability is inherently a systemic challenge that calls for cross-cutting, macro-oriented strategies grounded in systems thinking. This talk presents an interdisciplinary research roadmap for fostering a sustainable, material-centered industrial landscape through the lens of system modeling and analysis. Central to this presentation is how model-based virtual representations of industrial ecosystems, combined with data-driven approaches, inform decision-making to advance key sustainability dimensions, including material circularity, economic feasibility, environmental performance, and supply chain resilience. The talk opens by highlighting the presenter's Ph.D. work on advancing the circular economy of critical materials essential to the clean energy transition, incorporating and synergizing a diverse set of computational tools, including simulation, machine learning, network analysis, and system dynamics. The middle section highlights the presenter's current research on decarbonizing the aluminum industry through the modeling and simulation of supply chains and technology pathways. At its core is an agent-based computational engine that drives Monte Carlo simulation, dynamic material flow analysis, life cycle assessment, and risk-informed scenario analysis using experimental design. The talk concludes with the presenter's future vision for navigating complex industrial systems, highlighting opportunities to integrate geospatial analysis, physics-informed machine learning, and digital twins. Through his research, the presenter seeks to drive the transition toward a smart and resilient industrial landscape rooted in sustainable material systems.

Sidi Deng earned his PhD in industrial engineering from Purdue University in 2023 and completed a postdoctoral fellowship in Mechanical Engineering at the University of Michigan in 2025. He integrates systems engineering, data science, and industrial ecology to advance sustainable manufacturing through macroscopic frameworks. By leveraging complex system modeling, simulation, and statistical learning, Dr. Deng develops both data-driven and physics-informed solutions to foster a more sustainable and resilient industrial landscape.

For more information, contact Hiroki Sayama (sayama@binghamton.edu).

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