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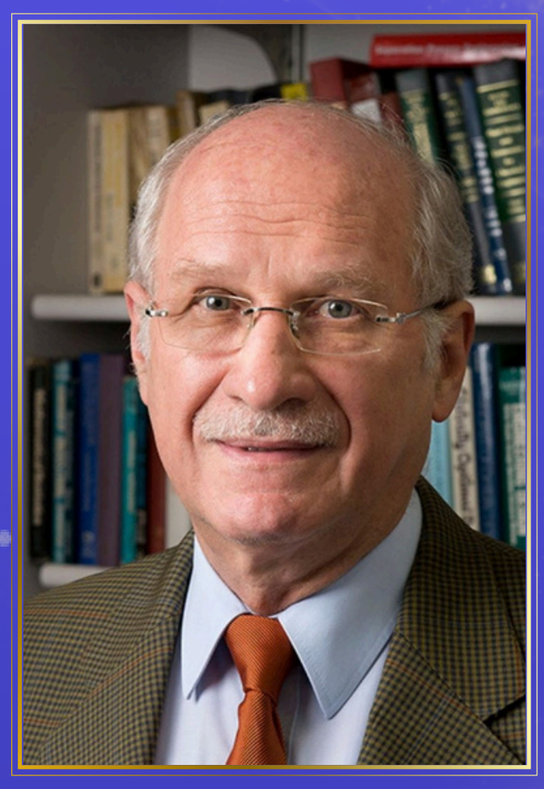
Challenges in the Application of Mathematical Programming Approaches to Industrial Enterprise-wide Optimisation

Speaker

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Venue: MPL1403, 14/F, M+ (Lingnan@WestKowloon)
Mode: Hybrid (Face-to-face or Zoom)

Abstract

Enterprise-wide optimisation (EWO) is an area that lies at the interface of engineering and operations research, and has become a major goal in industry due to the increasing pressures for remaining competitive in the global marketplace. EWO involves optimising the operations of supply, production and distribution activities of a company to reduce costs and inventories. A major focus in EWO is the intelligent manufacturing through the optimisation of manufacturing plants as part of the overall optimisation of supply chains. Major operational items include production planning, scheduling, and control. This talk provides an overview of major modeling and computational challenges in the development of deterministic and stochastic linear/nonlinear mixed-integer optimisation models for planning and scheduling for the optimisation of plants and entire supply chains that are involved in EWO problems. We address the following major challenges in this area: a) multi-scale optimisation, b) linear vs. nonlinear models, c) handling of uncertainty and disruptions, d) expanding scope. We illustrate these challenges in areas such as planning and scheduling of batch plants, optimisation of an integrated ethanol and gasoline supply chain, optimal retrofit decarbonization of petroleum refineries, logistics for carbon capture and sequestration, optimal long-term expansion of power systems, strategic planning for supply chain for shale gas production, optimal design of resilient supply chains. As part of the expanding scope, we describe digital supply chains for integrated material, financial and information flows, and reinforcement learning for production scheduling. The various applications, which have been addressed in collaboration with industry through the Center for Advanced Process Decision-making, have led to substantial economic savings.

Biography

Prof Ignacio E. Grossmann is the Rudolph R. and Florence Dean University Professor in the Department of Chemical Engineering, and former department head at Carnegie Mellon University. He obtained his B.S. degree at the Universidad Iberoamericana, Mexico City, in 1974, and his M.S. and Ph.D. at Imperial College in 1975 and 1977, respectively. He is a member and former director of the Center for Advanced Process Decision-making, an industrial consortium that involves 20 petroleum, chemical, engineering, and software companies. He is a member of the National Academy of Engineering, and Fellow of AIChE and INFORMS. He has received the INFORMS Computing Society Prize and the following AIChE awards: Computing in Chemical Engineering, William H. Walker for Excellence in Publications, Warren Lewis for Excellence in Education, Research Excellence in Sustainable Engineering, Founders Award for Outstanding Contributions to the Field of Chemical Engineering. In 2015 he was the first recipient of the Sargent Medal by the IChemE. In 2025, Prof Grossmann was selected as Foreign Academic of the Chemical and Physical Sciences Section of the Royal Academy of Exact, Physical and Natural Sciences of Spain. He has honorary doctorates from Abo Akademi in Finland, University of Maribor in Slovenia, Technical University of Dortmund in Germany, University of Cantabria in Spain, Russian Kazan National Research Technological University, Universidad Nacional del Litoral, Argentina, Universidad de Alicante in Spain, and RWTH Aachen, Germany. He is a 2019 top cited scientist in Computer Science and Electronics: 53 Worldwide, 38 National. He has authored more than 700 papers, the recent textbook Advanced Optimisation for Process Systems Engineering, and the textbook Systematic Methods of Chemical Process Design, which he co-authored with Larry Biegler and Art Westerberg. He has also organised the virtual library on process systems engineering. Grossmann has graduated 68 Ph.D. and 37 M.S. students. His main research interests are in the areas of discrete/continuous optimisation, optimal synthesis and planning of chemical processes and energy systems, supply chain optimisation, and optimisation under uncertainty.

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