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Distinguished Seminar Series
數據科學大師講座

(Online) Advances in Nonlinear Mixed-integer and Generalized Disjunctive Programming and Applications to the Optimization of Engineering Systems

Date: 20 October, 2021(Wed)
Time: 10:00am - 11:00am
(Hong Kong Time)

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Online registration:
https://www.cityu.edu.hk/sdsc_web/zoom/

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Abstract

In this seminar, we first review challenging applications of MILP for the long term planning of electric power infrastructures with increasing penetration of renewables. Next, we review recent advances in MINLP (Mixed-Integer Nonlinear Programming) and GDP (Generalized Disjunctive Programing) algorithms. We first describe the quadratic outer-approximation algorithm in which scaled second order approximations that provide valid bounds are incorporated into the master problem in order to reduce the number of major iterations in highly nonlinear convex MINLP problems. Applications are presented in safety layout problems, and in reliability design problems. Here the goal is to determine the number of standby units in serial systems with units that have pre-specified probabilities of failure, with the objectives being to minimize cost and to maximize availability. We apply the proposed models to the design of reliable air separation plants. We next address global optimization of nonconvex GDP problems for which bounds of the global optimum are strengthened through basic steps for the convex GDP approximations, and for which a logic based algorithm is proposed that relies on the use of cutting planes to avoid the increased dimensionality due to the use of hull relaxations. We illustrate the application of this algorithm to the optimal multiperiod blending problem for crude oil. We also address a nonconvex GDP problem corresponding to the design of centralized and distributed facilities. Given the number and location of suppliers and markets, the goal is to determine the number of facilities and their location in a two-dimensional space so as to minimize investment and transportation costs. We develop a special purpose method to solve this GDP problem and apply it to the design of biomass network facilities.

Biography

Ignacio E. Grossmann (B.S. Universidad Iberoamericana; M.S., Ph.D. Imperial College) is the R. R. Dean University Professor of Chemical Engineering at Carnegie Mellon, and director of the "Center for Advanced Process Decision-making." A member of the National Academy of Engineering, he has received many awards from AIChE and INFORMS, including the first Sargent Medal by the Institution of Chemical Engineers in 2015, and the distinction of being named “One of the Hundred Chemical Engineers of the Modern Era” by AIChE in 2008. He has honorary doctorates from Technical University of Dortmund, Abo Akademi, University of Maribor, University of Cantabria, Russian Kazan Technological University, University Nacional del Litoral, University of Alicante and RWTH University Aachen. His research interests are in mixed-integer, disjunctive and stochastic programming, energy and power systems, water networks, and planning and scheduling for enterprise-wide optimization. He has authored over 700 papers, and the recent book “Advanced Optimization for Process Systems Engineering.” He has supervised 64 Ph.D. and 21 M.S. students, from which 9 are faculty members in the U.S. and overseas.

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All are welcome

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