The Increasing Scope of Optimization in the Oil and Gas Industry

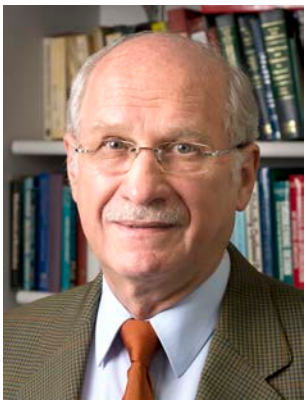
Ignacio E. Grossmann

Center for Advanced Process Decision-making, Department of Chemical Engineering, Carnegie Mellon University, Pittsburgh, 15217, USA

The oil and gas industry has traditionally relied on mathematical optimization, by starting early on using liner programming for optimizing the planning of refineries. Much progress since then has taken place in mathematical programming techniques since they can currently handle discrete variables, nonlinearities, nonconvex functions and uncertainties. We will show that this has led to an increase of the scope that can be handled in the oil and gas industry. We first start by describing mixed-integer nonlinear programming models for the multiperiod planning of refineries with crude sequencing, to the scheduling of crude oil deliveries to refineries, and to multiperiod blending of final products. We next describe mixed-integer models for the design and planning of offshore oil and gas infrastructures, and their extension to account for uncertainties in the size and deliverability of reservoirs, which gives rise to multistage stochastic programming problems. Finally, we show how to optimize design and operating decisions for shale gas production. For the former, we describe a nonconvex optimization model for design and planning of supply chains for shale gas that includes multi-well pads, pipelines, and natural gas plants. For the latter we describe a scheduling model for optimal water management in fracturing operations.

Corresponding author: grossmann@cmu.edu

Biography:



Ignacio E. Grossmann is the R. R. Dean University Professor of Chemical Engineering at Carnegie Mellon, and member of the "Center for Advanced Process Decision-making. A member of the National Academy of Engineering, he has received many awards, including the first Sargent Medal by the Institution of Chemical Engineers. His research interests are in discrete and nonlinear optimization under uncertainty, energy systems, and planning and scheduling. He has authored over 500 papers, and has supervised 58 Ph.D. students.