

# Data-Driven Mathematical Modeling and Global Optimization Framework for Integrated Petroleum and Petrochemical Planning Operations

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## Abstract:

In this presentation, we propose the data-driven model development and integration of nonlinear models to predict product yields and properties in production units including a CDU, a vacuum distillation unit, hydrocracking units, catalytic cracking units, ethylene-cracking units, and other processing units present in a large refinery-petrochemical complex. The yield and property prediction models for the crude distillation and vacuum distillation units are developed using swing-cut theory based on crude assay data. Empirical nonlinear models are developed for other processing units, including bilinear, and quadratic terms. Moreover, property indices in blending units are linearly additive and calculated on weight or volume basis, which introduce bilinear and trilinear terms. We also introduce binary variables to denote different operation modes for several production units, or parallel production units. The entire planning model is a non-convex MINLP model, which is solved to e-global optimality using the commercial global optimization solver ANTIGONE. Finally, a user-friendly platform is developed to allow the user to modify the planning model when new data is available, or parameters related to pricing, product demands, specifications, cost parameters, and many more. Several large-scale industrial examples are solved to illustrate the efficiency of our proposed model and global optimization approach.

## Bio:

Dr Jie Li is a Lecturer in the School of Chemical Engineering and Analytical Science, The University of Manchester since January 2016. He received his Ph.D degree from National University of Singapore in 2009. Then, he joined the group of Professor Christodoulos A. Floudas in Princeton University as a Postdoctoral Research Associate, focusing on planning and scheduling, global optimization and robust optimization. In December 2011, Jie Li was selected for the "One-hundred Talents" program from the Institute of Process Engineering, Chinese Academy of Sciences and was appointed as a Professor. In September 2013, he went back to Princeton and was appointed as an Associate Research Scholar, working on some joint projects among Princeton University, Chinese Academy of Sciences, and PetroChina. In January 2015, he moved together with Professor Floudas from Princeton to Texas A&M University and started a position as Research Associate before he came to Manchester.

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CPSE Seminar room, RODH C615, Roderic Hill Bldg, Chemical Engineering department, Imperial College London, SW7 2AZ  
This event is free and open to the public. No registration is required.  
Refreshments before the seminar in CPSE Common room (top floor Roderic Hill Bldg).

