Imperial College London

Centre for Process Systems Engineering

Seminar

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A new design paradigm to address demand response objectives in process systems

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Abstract: With the continuing penetration of renewable sources into the power grid, the energy picture presented to the process industries has changed dramatically within the last 10 years. The most visible consequence is the ability to offer real-time electricity pricing by the grid operators as they manage a number of distributed power sources including renewables. If power is available directly from the renewables such as solar and wind, their intermittency challenges the operation of process systems as the available energy varies during the day. This leads to the use of hybrid systems where renewable sources are complemented with storage systems (batteries) and the process has the flexibility to draw energy from the grid or sell back to it when appropriate. The variations on the supply side both in terms of price and availability result in a search for optimal allocation of loads (demand) during the day. Accordingly, demand response (DR) is defined as the ability of the operators to modify process conditions in real-time to take advantage of and respond to such variations and to formulate load shifting strategies. In this talk, I will summarize our ongoing work towards the goal of developing demand responsive process designs. Such designs are not only expected to accommodate variations in price and availability by modifying (scheduling) process steady-states but also consider re-configuring the process flowsheet in real-time for a more holistic DR strategy. The formulation of the design problem leads to a mixed integer nonlinear programming (MINLP) problem in which the objective function quantifies the capital and operating costs (CAPEX and OPEX) subject to recourse constraints that express scenario-dependent costs. Our recent studies include both deterministic and stochastic versions which present significant algorithmic challenges and these will be briefly discussed. The methodology will be illustrated by examples of process networks.

Bio: Professor Professor Palazoglu has received his BS degree in chemical engineering from the Middle East Technical University (Turkey) in 1978 and his MS degree in chemical engineering from Bogazici University (Turkey) in 1980. His PhD degree, also in chemical engineering, is from Rensselaer Polytechnic Institute (USA). Immediately after graduation in 1984, he joined the University of California, Davis where he currently holds the title of Distinguished Professor of Chemical Engineering. He has served as the Vice-Chair and Chair of the Department of Chemical Engineering and Materials Science at UC Davis in 2008-2014. He had visiting appointments at the University of the South (Argentina), Bogazici University (Turkey), University of Stuttgart (Germany) and Koc University (Turkey). He is currently the Otto Mønsted Visiting Professor at the Technical University of Denmark. Professor Palazoglu has more than 130 publications in refereed journals and offered several short courses to academic and industrial audiences on process monitoring applications. He has co-authored two books, *Chemical Process Performance Evaluation* (with A. Cinar and F. Kayihan) in 2007 and an undergraduate textbook, *Introduction to Process Control* (with J.A. Romagnoli) in 2006 with a second edition having appeared in 2012. Both books were published by CRC Press. His current research interests are in design and operation of demand responsive chemical processes, process monitoring and statistical modeling. Professor Palazoglu is a fellow of the American Institute of Chemical Engineers (AIChE).