



Recent Developments in the Optimisation of Energy and Production Systems

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13 March 2019, 3pm, Lecture Theatre 3 RODH 333

Abstract: Process Systems Engineering (PSE) provides a methodological scientific framework to arrive at realistic integrated solutions to complex production and energy problems, by adopting a holistic, systems-based approach. In this seminar we will present recent advances in the PSE area for the optimisation of complex energy and production systems. The first part will focus on the optimisation of power generation systems. Advanced optimisation techniques that have been well studied by the PSE community are utilized to develop strategic offers in En Bloc cleared energy and balancing market under high penetration of wind power production. Based on Stackelberg hypothesis, conventional power producers are considered exercising their dominant position in an electricity pool with high penetration of wind power production. A novel bi-level optimization framework is used to provide optimal offer strategies for the aforementioned producers in a jointly cleared energy and reserve pool settled through an hourly auction process. The bi-level problem is recast into mathematical programming with equilibrium constraints (MPEC) which is then reformulated into an MILP. The suggested modelling and optimisation framework provides optimal strategic offers and local marginal prices under different levels of wind penetration and network line transmission capacities. Furthermore, the model provides information about how line capacities and network congestions can be used for the benefit of the strategic producer and indicates that wind power production can be used as an instrument of market power mitigation. In the second part of the seminar recent developments in the area of production scheduling and planning will be presented. New techniques for the efficient reactive scheduling, the integration of control and scheduling in multi-product plants will be presented with emphasis on real-life industrial problems from the food and consumer goods sector.

Bio: Michael Georgiadis is Professor in the Department of Chemical Engineering at Aristotle University of Thessaloniki, Greece and head of the process systems engineering laboratory. He holds an M.Sc. (1995) and PhD (1998) both from Imperial College London. He is also a Distinguished Visiting Professor at Tsinghua University, China. His research activities include: (i) techniques for production scheduling and planning, (ii) the integration of process design and control in energy and production systems, (iii) energy systems scheduling planning, (iv) dynamic process modelling, simulation and optimisation of separation systems, (v) Biomedical Systems modelling and optimisation. His research has been supported by various funding organisations including, EU, and industrial companies. He has been involved in over 20 EC-funded collaborative research projects as Principal Investigator and project coordinator in 9 of them. He has authored and co-authored over 100 publications in peer-reviewed international journals, 20 chapters in books, participated in over 130 international refereed conferences, with an index of 37 (Google scholar). He is the co-editor of a 7-volume series on Process Systems Engineering published by WILEY-VCH, co-editor of an Elsevier Book on the integration of design and control and co-author of a reference book on process and energy integration published by Begel House Inc. He has been in the organizing and chairing a committee of many international conferences including FOCAPO, PSE, ESCAPE and PRES. He has organized many workshops for industry and academia.