Knowledge-Driven Optimization and its applications to Industrial Systems Engineering

**SPEAKER**  
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**TIME**  
10:30 am - 11:30 am

**VENUE**  
CS Seminar Room, Y6405, 6th Floor  
Yellow Zone, Academic 1  
City University of Hong Kong  
83 Tat Chee Avenue  
Kowloon Tong

**ABSTRACT**

This talk presents some recent advances in combining simulation, multi-objective optimization and data mining. The innovations lie on how these technologies can be synergistically integrated and used interactively to address problems in some new, promising manners.

Unlike ordinary optimization approaches which several design objectives are linearly combined into a single mathematical function, multi-objective optimization can generate multiple design alternatives and sort their performances into an efficient frontier. With the multiple optimal design alternatives generated, they constitute an optimal data set that can be fed into some data mining algorithms for extracting the salient knowledge about the relationships among the design variables and the optimal objectives, automatically or semi-automatically. Furthermore, if the knowledge can be extracted in some explicit representations, like rules, they can be incorporated readily into the optimization algorithm to enhance its performance through adaptation of the parameters or guiding/restraining the optimization towards the user-preferred regions. We call this new research direction as Knowledge-Driven Optimization, which when applied with real-world simulation models, has successfully solved a number of real-world industrial problems, particularly related manufacturing and supply-chain systems design, analysis and improvement. This talk will address the specific challenges posed by the design/analysis of systems with discrete variables for this integrated simulation, optimization and data mining approach and then present some new interactive data mining algorithms developed to meet these challenges, illustrated with real-world examples. While the talk will put some focus on applications within industrial systems engineering, it is believed that the methodologies and framework developed are highly applicable to other application domains.

**BIOGRAPHY**

Professor Amos H.C. Ng is the research leader of the Production & Automation Group at the School of Engineering Science, University of Skövde, and a guest professor in simulation and optimization at the School of Engineering, Jönköping University, Sweden. As the principal investigator of a list of industrial-based research projects, he is an expert in the areas of modelling, simulation, optimization and decision support of production/supply-chain systems. His research in simulation-based optimization has attracted substantial funding/support over the last 12 years, not only from major automotive companies, but also other manufacturing and logistics firms in Sweden. He is the chief architect of OPTIMISE, an internet-based distributed computing platform, as well as FACTS Analyzer, a factory conceptual design and analysis software, which are being used by Swedish automotive companies. Knowledge-Driven Optimization for production systems design, analysis and improvement is his currently active research area. The technology and software developed that use an integration of multi-objective optimization and data mining to help companies to not only seeking optimal solutions but gaining deeper understanding of the systems under design/improvement for confident decision-making has earned him a Volvo Car Technology Award in 2013 and two best conference paper awards (Sweden and Italy) in 2012-13.

All are welcome!

In case of questions, please contact Prof Qingfu Zhang at Tel: 3442 8632, E-mail: qingfu.zhang@cityu.edu.hk, or visit the CS Departmental Seminar Web at http://www.cs.cityu.edu.hk/news/seminars/seminars.html.