RESEARCH

Inside IISE Journals

This month we highlight two articles from *IISE Transactions*. The first proposed a decision-making process for capacity planning for a container terminal via integrating advanced simulation-based optimization techniques. The paper develops new methodologies of multifidelity simulation optimization for multiobjective problems, which are able to find the optimal solutions among multiple options. The second article develops a unified analytic method for analyzing SSALT (step-stress accelerated life tests) data obtained from multiple test chambers and manufacturers. The method is built upon a generalized linear mixed model and is demonstrated successfully in analyzing the SSALT data of insulation materials for power cable. These articles will appear in the September 2017 issue of *IISE Transactions* (Volume 49, No. 9).

An innovative capacity planning approach for next-generation ports

To retain its leading position and to deliver world-class service to its customers, the Port of Singapore and its governing agency, the Maritime and Port Authority of Singapore, have put in place the Next Generation Port 2030 initiative with new technologies and techniques. Major components include the next generation Tuas Terminal with a capacity of 65 million TEUs, making it the largest single mega-container terminal in the world. Due to the land constraint and the high expectations for productivity, innovative ideas are needed to design, construct and operate the terminal.

Capacity planning is a fundamental decision process when designing a container terminal. Outputs can be the configurations of resources, the numbers of quay cranes, yard cranes and vehicles. Although using simulation is a well-known approach to represent the system behaviors with uncertainty, it requires extensive time and resources to model and only evaluates a single scenario at each run. This is insufficient for finding the optimal solution. Therefore, there is a need for an efficient framework to conduct simulations for various candidate solutions and find the optimal choice.

Co-authors Ek Peng Chew (from left), Loo Hay Lee, Byung Kwon Lee, Haobin Li and Chenhao Zhou gather at the National University of Singapore alumni house.

This capacity planning problem is investigated in "Capacity Planning for Mega Container Terminals with Multi-Objective and Multi-Fidelity Simulation Optimization" by Haobin Li from the Institute of High Performance Computing, A*STAR Singapore (IHPC), Chenhao Zhou and Byung Kwon Lee from the National University of Singapore (NUS), professor Loo Hay Lee (NUS), professor Ek Peng Chew (NUS) and Goh Rick Siow Mong (IHPC). They proposed a decision-making process for the capacity planning for a container terminal via integrating advanced simulation-based optimization techniques.

Since the simulation results can depend on the level of simulation details, the use of multifidelity simulation models needs to be incorporated. When designing the framework, the authors consulted with the port operators to ensure actual requirements and constraints are considered.

Then, the decision-making process was proposed that used the recent developments on the methods of multifidelity simulation optimization for multiobjective problems. Numerical results showed the advantages of applying the proposed methods with benchmarking to the default procedures.

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