Discrete Event Optimization: Theory, Applications And Future Challenges

Andrea Matta
Shanghai Jiao Tong University
School of Mechanical Engineering, Dept. of Industrial Engineering and Management
800 Dong Chuan Road, Shanghai
200240, P.R. China
E-mail: matta@sjtu.edu.cn

ABSTRACT

Optimization of discrete event systems is often time consuming and also requires specific approaches due to the fact that general methodologies cannot be successfully applied to any kind of system. Conventional approaches use simulation as a black-box oracle to estimate performance at design points generated by a separate optimization algorithm. This decoupled approach fails to exploit an important advantage: simulation codes are white-boxes, at least to their creators. In fact, the full integration of the simulation model and the optimization algorithm is possible in many situations.

The methodology Discrete Event Optimization (DEO) is presented. DEO allows the development of integrated simulation-optimization models for queueing systems by means of the ERGLite formalism, a subclass of ERGs (Entity Relationships Graphs). Furthermore, DEO provides a formal way to map ERGLs into mathematical formulations for optimization of queueing systems. In case the obtained model is a MILP (Mixed Integer Linear programming), DEO also provides a formal way to approximate the obtained models based. The analytical properties of the obtained models are analyzed in the frameworks of Sample Path Optimization and Mathematical Programming. Several examples will be presented to show the applicability of DEO and to point out its strengths and drawbacks. Research challenges will also be identified.