RECENT RESEARCHES IN SIMULATION OPTIMIZATION

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Abstract

With the prevalence of computers in modern organizations, simulation is receiving more attention as an effective decision-making tool. Simulation is a computer-based numerical technique which uses mathematical and logical models to approximate the behavior of a real-world system. However, optimization of dynamic stochastic systems often defy analytical and algorithmic solutions. Although a simulation approach is often free of the limiting assumptions of mathematical modeling, cost and time considerations make simulation the analyst's last resort. Therefore, whenever possible, analytical and algorithmic solutions are favored over simulation.

This paper discusses the issues and procedures for using simulation as a tool for optimization of stochastic complex systems that are modeled by computer simulation. Its emphasis is mostly on issues that are specific to simulation optimization instead of concentrating on the general optimization and mathematical programming techniques. A simulation optimization problem is an optimization problem where the objective function, constraints, or both are response that can only be evaluated by computer simulation. As such, these functions are only implicit functions of decision parameters of the system, and often stochastic in nature as well.

Most of optimization techniques can be classified as single- or multiple-resonses techniques. The optimization of single-response functions has been researched extensively and consists of many techniques. In the single-response category, these strategies are gradient based search techniques, stochastic approximate techniques, response surface techniques, and heuristic search techniques. In the multiple-response category, there are basically five distinct strategies for treating the responses and finding the optimum solution. These strategies are graphical techniques, direct search techniques, constrained optimization techniques, unconstrained optimization techniques, and goal programming techniques. The choice of the procedure to employ in simulation optimization depends on the analyst and the problem to be solved.

For many practical and industrial optimization problems where some or all of the system components are stochastic, the objective functions cannot be represented analytically. Therefore, modelling by computer simulation is one of the most effective means of studying such complex systems. In this paper, after discussion of simulation optimization techniques, the applications of above techniques will be presented in the modelling process of many flexible manufacturing systems.

Keywords Simulation, Optimization, Stochastic, Single- or Multiple-Resonses