Computer simulation is a popular method that is often used as a decision support tool in industry to estimate the performance of systems too complex for analytical solutions. It is a tool that assists decision-makers to improve organizational performance and achieve performance objectives in which simulated conditions can be randomly varied so that critical situations can be investigated without real-world risk. Due to the stochastic nature of many of the input process variables in simulation models, the output from the simulation model experiments are random. Thus, experimental runs of computer simulations yield only estimates of the values of performance objectives, where these estimates are themselves random variables.

Most real-world decisions involve the simultaneous optimization of multiple, and often conflicting, objectives. Researchers and practitioners use various approaches to solve these multi-objective problems. Many of the approaches that integrate the simulation models with the stochastic multiple objective optimization algorithms have been proposed, many of which use the Pareto-based approaches which generate a finite set of compromise, or tradeoff, solutions. Nevertheless, identification of the most preferred solution can be a daunting task to the decision-maker and is an order of magnitude harder in the presence of stochastic objectives. However, to the best of this researcher’s knowledge, there has been no focused efforts and existing work that attempts to reduce the number of tradeoff solutions while considering the stochastic nature of a set of objective functions.

In this research, two approaches that consider multiple stochastic objectives when reducing the set of the tradeoff solutions are designed and proposed. The first proposed approach is an a posteriori approach, which uses a given set of Pareto optima as input. The second approach is an interactive-based approach that articulates decision-maker preferences during the optimization process. A detailed description of both approaches is given, and computational studies are conducted to evaluate the efficacy of the two approaches. The computational results show the promise of the proposed approaches, in that each approach effectively reduces the set of compromise solutions to a reasonably manageable size for the decision-maker. This is a significant step beyond current applications of decision-making process in the presence of multiple stochastic objectives and should serve as an effective approach to support decision-making under uncertainty.

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The public is welcome to attend.