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Increasing the efficiency in integer simulation optimization: reducing the search space through data envelopment analysis and orthogonal arrays. (English) [Zbl 1375.90336](#)
Eur. J. Oper. Res. 262, No. 2, 673-681 (2017).

Summary: The development of various heuristics has enabled optimization in simulation environments. Nevertheless, this research area remains underexplored, primarily with respect to the time required for convergence of these heuristics. In this sense, simulation optimization is influenced by the complexity of the simulation model, the number of variables, and by their ranges of variation. Within this context, this paper proposes a method capable of identifying the best ranges for each integer decision variable within the simulation optimization problem, thereby providing a reduction in computational cost without loss of the quality in the response. The proposed method combines experimental design techniques, discrete event simulation, and data envelopment analysis. The experimental designs called orthogonal arrays are used to generate the input scenarios to be simulated, and super-efficiency analysis is applied in a data envelopment analysis model with variable returns to scale to rank the input scenarios. The use of the super-efficiency concept enables to distinguish the most efficient input scenarios, which allows for the ranking of all the orthogonal array scenarios used. The values of the variables of the two input scenarios that present the highest values of super-efficiency are adopted as the new range of the optimization problem. To illustrate this method's use and advantages, it was applied to real cases associated with integer simulation optimization problems. Based on the results, the effectiveness of this approach is verified because it delivered considerable reductions in the search space and in the computational time required to obtain a solution without affecting the quality.

MSC:

- 90C90 Applications of mathematical programming
- 90C08 Special problems of linear programming (transportation, multi-index, data envelopment analysis, etc.)
- 90C59 Approximation methods and heuristics in mathematical programming

Keywords:

data envelopment analysis; simulation; integer simulation optimization; super-efficiency

Full Text: [DOI](#)

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