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# Exact cost minimization of a series-parallel reliable system with multiple component choices using an algebraic method <sup>☆</sup>

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## Abstract

The redundancy allocation problem is formulated minimizing the design cost for a series-parallel system with multiple component choices while ensuring a given system reliability level. The obtained model is a nonlinear integer programming problem with a nonlinear, nonseparable constraint. We propose a method based on the construction of a test set of an integer linear problem, which allows us to obtain an exact solution of the problem. It is compared to other approaches in the literature and standard nonlinear solvers.

*Keywords:* Reliability, Integer programming, Test set

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## 1. Introduction

System reliability is considered an important measure in the engineering design process. A series system is similar to a chain composed of links, each one representing a subsystem. The failure of one of these components means the failure of the whole system. In order to avoid this, it is usual to use redundant components in parallel to guarantee a certain level of reliability. These systems are called series-parallel systems.

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