A Series System Redundancy Problem with Multiple-Choice and Resource Constraints Incorporated

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Abstract

This paper considers a redundancy optimization problem with multiple-choice and resource constraints incorporated. Various component type alternatives may have to be evaluated for choosing the best set of component types for the subsystem, which provides the motivation for the paper which is to consider the multiple-choice constraints. For each component, various resource types such as cost, weight, volume etc. are also considered. The problem is characterized as an NP-hard problem, for which a solution space reduction procedure is to be developed. Therefore, the problem is analyzed first to characterize some solution properties. An iterative solution space reduction procedure is then derived using those solution properties. Finally, the iterative reduction procedure is used to derive an efficient branch-and-bound solution algorithm. Experimental tests are performed to show how dramatically the reduction procedure can work on removing any intermediately-found unnecessary decision variables from further consideration in solution search and how efficient the proposed branch-and-bound algorithm is.