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ACCEPTED MANUSCRIPT

On Active Redundancy Allocation for Coherent Systems – from the Viewpoint of Minimal Cut Decomposition

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Abstract

This paper deals with coherent systems with one active redundancy. For systems with the subclass of minimal cuts associated with one component covering that of another, assigning the redundancy to the former component is proved to bring forth a more reliable redundant system. As for symmetric systems with lower tail permutation decreasing component lifetimes, allocating the redundancy to the less reliable component results in a longer system lifetime. Several numerical examples are also presented to illustrate the new findings.

Keywords Arrangement increasing; Copula; LTPD; Minimal cut; Stochastic order

1 Introduction and summary

A reliability system is said to be coherent if (i) it contains no component whose operating status is irrelevant to the system status, and (ii) replacing a failed component with a working one cannot make the system worse. As the most popular class, the coherent structure includes almost all practical systems in industrial engineering, take for example, a series system functions if and only if all components are working, a parallel system operates unless all components fail, a k-out-of-n fault tolerant system is operative if at least $n-k+1$ of the components are working.

In engineering practice, it is an eternal aim to pursue a more reliable system. Due to the feature of coherent systems, engineers are suggested to either better design the structure or improve the component reliability. Since it is usually very difficult to significantly upgrade the

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