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Reliability of *k*-out-of-*n* systems with phased-mission requirements and imperfect fault coverage

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Abstract

In this paper, an efficient method is proposed for the exact reliability evaluation of *k*-out-of-*n* systems with identical components subject to phased-mission requirements and imperfect fault coverage. The system involves multiple, consecutive, and non-overlapping phases of operation, where the *k* values and failure time distributions of system components can change from phase to phase. The proposed method considers statistical dependencies of component states across phases as well as dynamics in system configuration and success criteria. It also considers the time-varying and phase-dependent failure distributions and associated cumulative damage effects for the system components. The proposed method is based on the total probability law, conditional probabilities and an efficient recursive formula to compute the overall mission reliability with the consideration of imperfect fault coverage. The main advantages of this method are that both its computational time and memory requirements are linear in terms of the system size, and it has no limitation on the type of time-to-failure distributions for the system components. Three examples are presented to illustrate the application and advantages of the proposed method.

Keywords

Imperfect fault coverage; Phased-mission system; *k*-out-of-*n* redundancy; Reliability analysis

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Table 1. Phase-dependent requirements and parameters.

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Table 4. Results for example 3.

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