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Exact Minimal-State System Reliability Analysis

An important activity associated with the development of complex systems for highly specialized applications is an evaluation of the reliability—the probability that specified set of objectives will be obtained. Methods for approximating the reliability use a subset of the system success states or minimal paths to obtain an upper bound of the reliability; a minimal path is characterized as the shortest path through a success-type logic diagram and is associated with the elements of this path such that the system functions if all of these operate, even if all others fail. The lower bound is obtained with a subset of the failure states, the minimal cuts; a minimal cut is essentially the shortest path through a fault tree and is associated with elements of this path, such that the system fails if all of these fail, even if all others operate. For a system having a finite number of elements a system reliability equation, an exact function of the component reliabilities, has been derived from the minimal states (which are found by logical analysis of the configuration); the numerical value is obtained by substituting the component reliabilities or unreliabilities.

Several other computerized exact procedures were developed in which equations are generated from selected subsets of either minimal paths or minimal cuts. The data processing to implement exact minimal-state analysis was performed with the Scope (System for Computing Operational Probability Equations) computer program.

Note:

Documentation is available from:
Clearinghouse for Federal Scientific
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