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# NASA TECH BRIEF

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## Reliability Computation From Reliability Block Diagrams

**The problem:**

Given a reliability block diagram and the failure rates for each of the blocks in the diagram, it is often useful to calculate the reliability of the system. These calculations can become tedious except when the simplest of block diagrams is used.

**The solution:**

A computer program has been developed to compute system reliability for a very general class of reliability block diagrams.

**How it's done:**

Four factors are considered in calculating the probability of system success from reliability block diagrams: active block redundancy, standby block redundancy, partial redundancy, and the presence of equivalent blocks in the diagram.

1. Active Block Redundancy: The probability of successful operation for a system involving active redundancy can be found, using the probability tree method. In this method, one starts at the output block and works toward the inputs, searching out success paths. The probability of a particular success path occurring is simply the product of the probabilities in that path. The system reliability is then the sum of the probabilities for each of the success paths. The algorithm for developing the probability trees is related to reverse Polish notation.
2. Standby Block Redundancy: The principle used in computing standby redundancy is simple, but difficulty occurs in applying the principle to complex systems. Complex systems are handled by computing the time-dependent probability for a set of blocks. Numerical integration and probability trees are then used repeatedly to compute the system reliability.
3. Partial Redundancy: Partial redundancy is handled by manually setting up the problem in terms of equivalent blocks. Thus, from a computational viewpoint, partial redundancy is an application of the equivalent-block feature.
4. Equivalent Blocks: Equivalent blocks occur when the same piece of physical hardware appears several times in the reliability block diagram. When this occurs, conditional probabilities are used in the probability trees.

**Notes:**

1. The program is written to be used on a UNIVAC 1108 time-sharing system with a 65K core storage and a UNIVAC 1108 FORTRAN V compiler. The program has variable dimensions which allow maximum efficiency in using all of the 65K core storage. The program can be run in either batch or interactive mode.
2. Inquiries concerning this program should be directed to:
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