ABSTRACT

SOME APPLICATIONS OF RELIABILITY ANALYSES OF STANDBY REDUNDANT SYSTEMS WITH REPAIR

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Some applications are discussed concerning reliability analyses of a standby redundant system with repair. The system consists of a series subsystem composed of N identical units and n spares. Failed units are assumed to be repaired by r repair facilities and repaired units join the spares. For this system, two cases which can be analyzed by means of the semi-Markov process method are considered. The first case is the system with $N = 1$ in which the failure time distribution of a unit is general and the repair time distribution is exponential. The second one is the case with $r = 1$ where a unit has an exponential failure time and a general repair time distribution.

An application of the first model to an ion source system for a particle accelerator is investigated. The second model is applied to a centrifuge uranium enrichment plant, error correcting terminals for an automatic newspaper editing system, and an autobus system. The general distribution is assumed to be a gamma distribution in the applications. For a proton synchrotron, a proposal to use a redundant ion source system in a design study reported in 1965, when the life time of a duoplasmatron ion source was not long enough, is investigated. Concerning a cascade system of uranium enrichment centrifuges, a production plant composed of 100,000 centrifuges is proposed to be divided into 20 groups, each of which consists of 5,000 centrifuges, and to have n spare groups. An example of a bus company office possessing $N+n+2$ $(=61)$ buses is discussed, where N, n and 2 of them are in operation, spares, and in regular maintenance, respectively. A failed bus which is substituted by a spare one is repaired in temporary maintenance.

The number of spares needed to attain to a target value of the mean time to system failure (MTSF) is obtained for a given repair capacity.

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