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Research Article

Stochastic Analysis of a Two-Unit Cold Standby System Wherein Both Units May Become Operative Depending upon the Demand

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The present paper analyzes a two-unit cold standby system wherein both units may become operative depending upon the demand. Initially, one of the units is operative while the other is kept as cold standby. If the operative unit fails or the demand increases to the extent that one operative unit is not capable of meeting the demand, the standby unit becomes operative instantaneously. Thus, both units may become operative simultaneously to meet the increased demand. Availability in three types of upstates is as follows: (i) when the demand is less than or equal to production manufactured by one unit; (ii) when the demand is greater than whatever produced by one unit but less than or equal to production made by two units; and (iii) when the demand is greater than the produces by two units. Other measures of the system effectiveness have also been obtained in general case as well as for a particular case. Techniques of semi-Markov processes and regenerative processes have been used to obtain various measures of the system effectiveness.

1. Introduction

In the literature of reliability, extensive studies have been made on different types of one-unit or two-unit standby redundant systems owing to their frequent use in modern business and industrial systems. There are two major types of redundancy—parallel and standby. In parallel redundancy, the redundant units form part of the system from the start, whereas in a standby system the redundant units do not form part of the system from the start (until they are needed). Standby units can be classified as *cold, warm, or hot*. A *cold standby* is completely inactive and since it is not hooked up, it cannot fail until it is replacing the primary unit. A *warm standby* has a diminished load because it is only partially energized. A *hot standby* is fully active in the system (although redundant).

A lot of work has been done on reliability and cost analysis of various systems by various researchers including [1–17] who have analyzed these systems by considering various concepts like the Erlangian repair time, operating and rest periods, hardware/software faults, congestion of calls, availability, two types of repair facility, human failure, regenerative point technique, priority repair discipline, instruction, accident, patience time, chances of nonavailability of expert repairman, one big unit and two small identical units with priority for operation/repair to big unit, patience time, partial failures, and optimized maintenance of the diesel system in locomotives. In all such studies, the demand was fixed. There may be situations where demand may vary and hence it affects the operability of the units of a system. The concept of variation in demand has been studied by [18, 19]. This concept of variation in demand was considered for single unit systems, where the system either is in working state on some demand or is put to shut down mode on no demand. However, the demand may be much more than whatever produced by a single unit system and hence there is need of having one additional unit to meet the demand. Study of the concept of variation in demand for the two-unit system thus becomes more important.

Keeping the above observations in view, we, in the present paper, develop a reliability model for a two-unit standby system working in a cable manufacturing plant wherein cold