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Comparative study between a single unit system and a two-unit cold standby system with varying demand

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Abstract

The concerned paper illustrates the comparison of two stochastic models of a cable manufacturing plant with varying demand. Here, it shows the comparison between a single unit system (Model 1) and a two-unit cold standby system (Model 2). In Model 1, the system is either in working state on some demand or put to shut down mode on no demand. In Model 2, at initial stage, one of the units is operative while the other is kept as cold standby. At times when the operative unit stops working due to some breakdown/failure, the standby unit instantaneously becomes operative while the repairman repairs the failed unit. In this working model, only one unit remains operative at a time. However, there may be a state when both the units fail. The comparison of systems is done by means of MTSF (mean time to system failure), steady state availability and profit function using Laplace transforms and software package Code-Blocks 13.12. Different graphs have been plotted to discover which model is superior to the other model under the given conditions. The system is analysed by making use of semi-Markov processes and regenerative point technique.

Keywords: Stochastic model, Cable manufacturing plant, Single unit system, Two unit cold standby, Varying demand, Semi-Markov process, Regenerative point technique

Mathematics Subject Classification: 97K60, 90B25, 60K10

Background

The manufacturing of tools and special equipments is an inevitable part of our modern society. When equipment fails, production falls instantaneously. To maintain production, one has to keep tools/equipment available at all times, in order to run the systems. Since this can be expensive, availability and profit of an industrial system are becoming increasingly important. Indeed, profit will increase when the availability of a system increases.

System reliability has also been one of the major factors in most of the system performance-related studies. Though many researchers made meaningful contributions a lot in the field of system reliability modelling, fewer studies have reported the comparative analysis of different types of systems. Tuteja et al. (1991), Alidrisi (1992), Mokaddis et al. (1994), Pan (1997), Chandrasekhar et al. (2004) and Xu et al. (2005) analysed the reliability and availability of standby systems by studying various parameter viz. partial failures,