Abstract

Nowadays, people demand more and more reliable systems. Several techniques have been developed to model and improve the reliability of a system. One of them is to equip the system with cold standby components (called it by cold standby sparing). This thesis investigates the effect of adding cold standby components to a coherent system. These studies include evaluating lifetime characteristics of the system such as reliability function, mean residual life function, and stochastic ordering results associated with the system lifetime.

This thesis consists of eight chapters where the first chapter is introductory and covers the literature survey along with the motivation behind the work done. Chapters 2-3 focus on a particular type of coherent systems. Here, the remaining active components are connected in parallel when the coherent system fails.

In Chapter 2, we investigate the restart of such a coherent system using a single cold standby component. Chapter 3 extends Chapter 2, which observes the restart of the coherent system using two cold standby components. In Chapter 2 (Chapter 3), we obtain the reliability function and mean residual life functions of the considered coherent system which is equipped with one (two) cold standby component(s). In Chapter 4, we focus on reliability properties of a k-out-of-n system equipped with two cold standby components. In Chapters 3-4, standbys are not placed into action simultaneously. They are put into action one by one. In addition, we show that when we use a stronger standby component (in the sense of failure rate order) at first, we get a longer system lifetime. In Chapter 5, we focus on a particular type of coherent system which may fail either on the failure of its first component or on the failure of its second component. We investigate the renewal of such a coherent system using two cold standby components. We obtain the reliability function of the considered coherent system which is equipped with two cold standby components. In Chapter 6, we consider a k-out-of-n system with n exchangeable components and a single cold standby component. The simultaneously working components are assumed to be dependent and this dependence is modeled by a copula function. First we obtain the residual lifetime distributions of the surviving components at the time of the failure of the k-out-of-n system. We also compute the mean time to failure of the considered system in terms of copula function. In Chapter 7, we consider a k-out-of-n system consisting of n exchangeable components equipped with a single cold standby component when all the components including standby are assumed to be dependent and this dependence is modeled by a copula function. By using the concept of conditional probability, an exact expression of the reliability function of the system, in terms of copula functions, is obtained. We also compute different mean residual life functions of the system. Finally, in Chapter 8 we give the concluding remarks and provide some future scope of study along this direction.

Keywords: Coherent system; Cold standby component; Copula function; Exchangeable components; k-out-of-n system, Mean residual life; Reliability; Signa-

ture; Stochastic ordering.