Chapter 7

Conclusion

7.1 Summary of the thesis

In our study, different cascade models are considered to estimate the system reliability. For this estimation, several distributions viz. exponential, gamma, Weibull, Rayleigh, Lindley, two-point and uniform distribution are considered. Generally in cascade system the attenuation factor is assumed to be a constant for all the components. But in the 2\textsuperscript{nd} chapter the attenuation factor $K$ is taken to be uniform random variable to evaluate the expressions of the unconditional reliability of a system and exponential, gamma and Weibull distribution have been used to obtain the cascade reliability. It has been observed that when stress-strength follows exponential distribution, reliability decreases with increasing values of the parameters. But for Weibull distribution, increase in the values of shape parameters increases the reliability and increase in the values of scale parameters decreases the reliability.

Cascade reliability can also be obtained if stress and strength are represented by a mixture of two distributions, which is discussed in chapter 3. It has been observed from the numerical values of reliabilities that for fix values of one mix parameter and attenuation factor, reliabilities are decreasing for increased values of another mix parameter and is mentioned in Table 3.1 (cf. Appendix). It is also seen that the increase of one mix parameter increases the reliability.

In chapter 4, an $n$-cascade system with three failure models have been discussed. Using these models marginal reliability and system reliability of $n$-cascade system has been developed and their values are presented graphically. Two distributions viz. exponential and Rayleigh has been used to find out the reliabilities. When exponential
distribution is used for the first failure model then we observed that increase in the parametric values result a corresponding increase of the reliabilities. Similarly in model II we considered \( n \)-cascade system with identical components where \( m \) stresses on the component lie in an interval \((a_j,b_j)\). The component fails even if one of stresses on the component falls outside the specified limits. Here model II and model III are almost similar except that the components are not identical. It is seen from the Table 4.2 (cf. Appendix) and Table 4.3 (cf. Appendix) that keeping all other parameters fixed, reliability can be increased by increasing the upper limits. But sometimes it is seen that reliabilities decrease when any one of the lower limits increases.

In chapter 5, the system reliability of 2-cascade system has been formulated, when the parameters of the stress-strength distributions are considered as random variable. For this purpose, stress and strength are assumed as exponential random variables with certain parameters. Further it is assumed that either stress or strength parameter is a random variable with a known prior distribution. The obtained expressions of the system reliabilities are verified using some numerical values of the parameters. It has been found from Table 5.1(cf. Appendix) and Table 5.2 (cf. Appendix) that when the prior distributions are uniform and two-point type, the reliabilities are steadily increasing with increasing value of the stress parameter and the attenuation factor. But when stress parameter is random then reliabilities are decreasing with increasing value of the strength parameter. In stress-strength model the reliability of a component is defined as the probability that its strength is not less than the stress working on it. But sometimes a component can work only when the stress \( Y \) on it is not only less than certain values, say \( Z \), but must be greater than some other value, say \( X \), i.e. stress is within certain limits, where \( X \) and \( Z \) are identified as lower and upper strengths. This assumptions has been followed in chapter 6, where reliability of \( n \)-cascade system under such process has been obtained using different stress-strength distribution. It has been observed from the numerical values of the reliability that when the attenuation factor increases, marginal reliabilities and system reliability decreases. The results may vary from distribution to distribution.
7.2 Future Works

In this research, the reliability of the cascade system is obtained from the distribution of its strength and that of stress working on it. Cascade reliability can also be evaluated for some truncated stress-strength. Such type of problem is considered as a future research prospect. Again for finding the system reliability of \( n \)-cascade system, we considered one case where stress on the component is subjected to two strengths. But it is also possible to obtain the system reliability where the strength of the components lying between two stresses, which is not included in this research due to mathematical complication and the limited time. Therefore, it may be a new research interest.

In most of the studies of S-S models, stress-strength are taken into consideration in evaluating the reliability of the system, passage of time has no effect on it. So by taking time as an important factor, one time dependent cascade model with different stress-strength distribution will be considered in our next study. We have not come across any study of time dependent cascade model where parameters of the distributions are function of time. So our future research work will be to study such type of models.

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