CHAPTER 8

CONCLUSION

8.1   SUMMARY

The finding in literature on various issues related to reliability, availability and maintainability aspects of engineering systems have been studied. The literature available has been classified into various categories such as reliability concept and development, Markov approach, common causes of failure in systems and steady state availability, maintainability and availability studies in process industries. Methodologies such as Markov approach, genetic algorithm and fuzzy logic technique etc. have been attempted in the present research work.

The study has been carried out at Tamil Nadu Newsprint and Paper Limited (TNPL) plant situated in Kagithapuram, Karur District of Tamil Nadu. The nature and behavior of each subsystem is monitored and discussed with the plant personnel who helped in providing comprehensive classification of causes related to anomalous performance of the subsystems. After identification of the critical subsystems, the data relating to failure and maintenance history of these subsystems are collected from log records of the paper plant.

The performance models for some operating systems, stock preparation unit, digesting system of paper plant, scheduling of maintenance, cost analysis and decision support system etc. of the paper plant have been studied. The steady state availability conditions have been developed for analyzing the

behavior and to evaluate performance using the Markov process. The behavior of the system is represented in the form of availability matrices and analyzed in different situations of working environment. The performance level is predicted and utilized in determining the various failure and repair rates for some operating systems of a paper plant. The effects of behaviour of each subsystem, steady state availability have also been analyzed through availability matrices and plots on the system performance.

The performance optimization for some operating systems of a paper plant is done using the genetic algorithm technique to provide the optimum system availability levels for different combinations of failure and repair rates of the subsystems of all the systems for improving the overall performance of the paper plant concerned.

Developed models in this research work are found to yield more realistic results as failure rates of various subsystems increased, followed by a decrease in system availability. But, on the other hand, with an increase in repair rates of subsystems, the system availability increases. Besides, a desired level of performance has been established and the feasible combinations of failure and repair rates have also been determined.

8.2 SCOPE FOR FURTHER RESEARCH

The research work and the method of analysis reported in this thesis can be extended further as given below:

a) Performance models can be developed for various process industries assuming simultaneous failures among the various systems of a particular plant.

b) The present research work can be extended, where time dependent failure and repair rates would be considered. Then, the performance model seems to be an appropriate one because most of the subsystems/systems in the paper plant are exposed to continuous wear.

c) Similar studies can be applied for evaluating the performance of other process industries such as petroleum, food processing and textile etc. by using reliability block diagram (RBD), failure mode effect analysis (FMEA) and Petri-nets (PN) etc.

d) Genetic algorithm can be further utilized in optimizing the system performance while considering the availability, maintenance cost and life cycle costs as the criteria for optimization.

e) The present research work can be extended to arbitrary repairs and failure time distribution. Resource allocation can also be carried out by taking multi constraint objective function of manpower, material, money and inventory constraints etc.