CHAPTER VI

FURTHER SCOPE

1. INTRODUCTION

A customary way to conclude a thesis is to reflect on possible scopes for further work continuing on the lines initiated in our results reported in the thesis and the other cognate works. In this chapter our attempt is to perform this task. A basic theme underlying the results is to evolve optimal methods for replacement policies based on MTTF performance as well as some relevant cost considerations for parallel reliability systems comprised not necessarily of identical components in terms of their varying probabilities of failures. Also, optimal policies in terms of optimal replacements for more complex systems like a K-out-of-N system (however comprised of identical units) with some practical considerations like repair-provision, are also developed. It was observed that research for reliability systems must be closely linked with practical and operational viewpoints and this motivation led to the results in the thesis. For example, fluctuating market conditions and other R & D trends in research and technology, may
lead to dynamical changes in a systems design. Specially
when systems comprised (out comprised) of non-identical
components, these may be more useful to study. Again
approaches based on repair-stages may be operationally
superior to approaches based on repair-times, an idea
explored in Chapter-III. While these efforts are initia-
ted for parallel systems subjected to shock processes
and failure laws that are well known and relatively
easy to handle analytically, one must recognise the
other practically important situations when many underly-
ing laws that govern the probabilistic structures of
the reliability systems could either be very complicated
(like for example, the Weibull and Raleigh laws) or
even unknown in the sense that these laws and the related
probabilities may not be estimable all that readily
atleast within an analytic and closed-form solution
set-up.

We thus recognise some scopes for improving the
applicational potentialities of the ideas to more compli-
cated and real-world practical situations, if one wishes
to go close to the massive and complicated real world
problems.

In the following we indicate some scopes for work
from this viewpoint.
2. SOME FURTHER LINES AND OPEN PROBLEMS

When systems are comprised up of non-identical units, it was already seen in Chapter-II, how lengthy the expressions are, even for a simple general system comprised of 4 units. It could thus easily be imagined the messy and laborious expressions if the system is massive with large \( n \)'s. It therefore is worthwhile to initiate works whether economy of labour could be brought in through some new approaches based on computer use by not exactly using the analytic expressions (or results), yet using the ideas explained above. For example in the numerator of \( c(k)'s \) in Chapter II, we notice the term \( \sum_{m=k+1}^{n} B_m(k) \). If this is interpreted as a partial expectation for a \( k \)-replacement policy which again perhaps could be obtained in terms of 'tail survivor probabilities' and if these could be simulated for various cases, then the search for \( k^* \) (optimal replacement policy) may be delegated to a computer by evolving suitable algorithms. Here, we repeat that the idea in the analytic work is retained but for applicational use in practice, computer-oriented research may well prove rewarding.

Again, for more complicated systems like \( k \)-out-of-\( N \) or series-parallel or parallel-series systems, it is worthwhile to develop results when the systems are not necessarily comprised of identical units. Little work is available in literature for such general systems.
and we have focused this point right at the beginning of this thesis. However, we believe that there still exists a large scope for further work for general systems, awaiting exploration.

Reliability systems suffering Common cause failures (CCF's) is another area full of promise for useful work. Some lines of work were presented in this connection in Chapter-V, but again there, though we dealt with some complex random laws to govern failure patterns, we considered reliability systems comprised of identical units. Here again, the ramification of "non-identical unit composition" may be tried with some good success.

Primarily, perhaps due to simplicity of analytic treatment, systems with identical components are dealt with so far in literature. However, if results, basically computer-oriented in their content and approach are evolved, then undoubtedly more complex, massive and real-life systems could be satisfactorily tackled.

3. CONCLUDING REMARKS

In conclusion, we observe that 'Unification' could be brought into reliability and other storage systems with the help of point process approach and use of product densities (see [1], [2] and [3]). It is possible that some practically useful redundant systems (that is systems equipped with buffers or stand-by components) could
be handled, the results derived for which systems could also be interpreted and used for other storage systems like models for 'Waiting lines' and 'dams'. Again here, the 'non-identical' concept was not introduced and it would be useful if this approach is supplemented to the 'unified perspection' evolved in Venugopal and Meenakshi Bai [3]. Similar works with other useful ramifications are also suggested in Venugopal [1].

References


3 ------------------ (1990) "A unified approach through point processes to storage and reliability models", IAPQR transactions, Vol.15, No.1, pp.21-34.