ABSTRACT

Reliability engineering has progressed widely over the years, since Second World War with a prominent contribution by defense personnel. This has led to more reliable products. Recently it has gained momentum among practicing engineers and researchers. By mixing reliability concepts in all phases of the product life cycle from design to manufacture, which has resulted in manufacturing cost effective systems that result in better performance. Reliability is very closely connected with Failure Modes Effects and criticality Analysis. Most of the earlier works were confined to an analysis of certain performance aspects of an operating system. One of the goals of the reliability engineer is to find the best way to increase the system reliability. As systems are becoming more complex, the consequences of their unreliable behavior have become severe in terms of cost, effort and so on. The interest in accessing the system reliability and the need to improve the reliability of products has become more and more important. The primary objective of reliability optimization is to find the best way to increase the system reliability. The literature regarding optimization of Integrated Reliability Model (IRM) for Redundant Systems with Multiple Constraints is sparse in nature.

The approach of this work is to optimize a class of Integrated Reliability Model (IRM) for redundant systems with weight and volume as additional constraints apart from the basic cost constraint using the Lagrangian Multiplier method, followed by the Dynamic Programming approach (to fine
tune the results) and supported by the Failure Modes Effects and criticality Analysis (to ensure the Reliability optimization).

In the present work the Lagrangian Multiplier method indicates the very fact that the number of components required at each stage which in turn help in optimizing the system reliability to be real/fraction values. This is not in a feasible form for practical execution in real life problems. This flaw has been totally eliminated by using the Dynamic Programming, by treating the values that are derived from the Lagrangian approach as the inputs. The results have pointed out the very fact that the number of components required at each stage as integer values and therefore most conducive in real life problems. The novel approach of the Failure Modes Effects and Criticality Analysis (FMECA) is that FMECA not merely compliments but further reinforces/assures the results obtained through the Dynamic Programming. The model has matched actual reliability very well and provided better accuracy.