A Detailed Study on Reliability Engineering

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Abstract

In the present competitive world, the competitiveness between the organizations has increased demands on production systems. The Customer satisfaction depends upon the production systems, capability to deliver the quality goods and services on time. To do so, the systems must be reliable. The advanced technology is very complex and includes different types of components such as software, hardware, human factor. Reliability is principal property of the system, which is an important parameter to decide the life of any biological and human made system. The application of reliability engineering is overviewed in this paper. The paper discusses the performance of the system and explains about the importance of the reliability in evaluating the life of the system. Higher reliability depends on maintainability, availability and testability of the product.
Keywords: Dependability, Maintainability, Fault tree analysis, Availability, Probability, Complexity, industrial automation*,*

I. INTRODUCTION

Reliability engineering is the branch of engineering that deals with the dependability in the product life cycle management. Dependability or reliability, explains the ability of a system or component to work under stated conditions for a specified period. In theoretically, reliability defines the flip-flop of the success. As pointed out by the Martin, developing the reliability models, by considering the strength degradation is an important issue for reliability estimation. . The purpose of reliability testing is to find the problems for the failure of the component and ultimately to provide the confidence that the system should meets its reliability requirement.

II. RELIABILITY AND QUALITY

The concept of reliability is as old as human being He has long been concerned with the problem of unreliability of the product used. However, this reliability science is new concept to the world and it is still under growing stage. [9].

In simple, the reliability means the probability that a failure may not occur in a given interval of time. A more rigorous definition of reliability for given period of time under stated operating condition is as follows, A unit of reliability is the unit probability that the unit will performs its intended function adequately. The reliability of the product depends on four essential segments. [10]:

1. Probability
2. Intended function
3. Time
4. Operating conditions

If T is the failure time occurs, then the given environmental probability time, that it will not fail before its reliability is

$$R\ (t) = P\ (T > t) \qquad (1)$$

Thus, the function of reliability is always depends on time and environmental conditions. Since the

numerical probability, value should always between one and zero, i.e.

$$R_1(0) = 1, R_1(\infty) = 0 \qquad (2)$$

And $R_1(t)$ is a non increasing function between these limits

Quality of a device is the measure of excellence or a state of being free from defects. It is not concerned with elements of time and environment. Equipment, which has undergone all quality tests, may not necessarily be more reliable. Quality is associated with the manufacture where as reliability is primarily associated with the design. In a way reliability is the ability of the unit to maintain its quality under specified conditions for a specified time.

Causes of failures and Unreliability

The specific causes of failures of components and equipment in a system can be many. A few of them are listed below [11]:

a. Poor design
b. Wrong manufacturing technique
c. Lack of total knowledge and experiments
d. Complexity of equipment
e. Poor maintenance policies
f. Organizational rigidity and complexity
g. Human errors

III. Reliability Modeling and Testing

Reliability modeling is the process of estimating and knowing completely about the reliability of a component or a system prior to its implementation. The two types of analysis are often used for modelling the complete system behaviour i.e. Fault Tree Analysis and Reliability block diagram. The sources of input come from many ways. In all cases, the used data should be taken carefully, as predictions are only valid in some cases
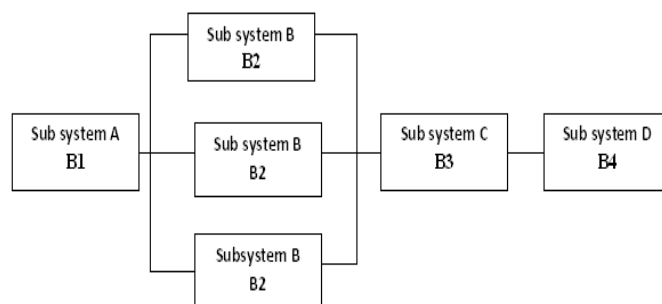

Figure 1. A reliability block diagram

IV. RELIABILITY TEST REQUIREMENTS

The requirement for testing the reliability of the component is first to estimate the probability of failure needs to be justified. Testing reliability requirements is not an easy task due to several reasons. For testing the reliability, by the single test it is not possible to obtain a enough statistical data. However, in case of multiple tests or long duration tests for testing the reliability of the product is not cost effective.

V. CONCLUSION

In this paper, reliability engineering was studied. The application of reliability engineering over viewed to increase the life expectation of the system a theoretical approach of the reliability analysis is attempted by creating reliability models and studying the causes for the failures. A reliability study has brought out the fact that many failures can be possessed by the improper design and over stressing of component.

The paper provides information about why reliability is important, furthermore, they give an overview of all the aspects of reliability engineering, including the need for reliability requirements and other factors that are affected by poor reliability such as safety, competitiveness, goodwill, maintenance costs and ultimately profit.

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