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RELIABILITY ANALYSIS FOR REMOVING SHORTCOMINGS USING STOCHASTIC MODELING AND APPLY FOR MAINTENANCE IN INDUSTRY

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ABSTRACT
In this paper reliability is the main concern discussed by the authors; the concept is very much linked with quality. First we work on the reliability of the system, if we achieve this only then we can check the parameters regarding quality. There are so many methods to work on reliability; some are discussed in this paper. Also the objectives for a reliable system are discussed however need of the reliable system is discussed. More and more research work needed in this field, the quantitative analysis is the demand of the present time.

KEYWORDS: Reliability, Stochastic Model, Markov Model, Monte Carlo.

INTRODUCTION
The reliability is the concept on which researchers are working from last many years. The work on this field is limitless, every time after achieving a goal in this field, new target are there to find and do research on that. The growth and development of reliability have strong links with quality control and its development in the first quarter of the century. The importance of reliability and quality control was born out of the demands of the modern technology used in the World War II. The study develops general methods of quality evaluation of a system from known components behaviour and it analyze the regularity conditions that are necessary to maintain the performance level and to increase the efficiency of the system is known as reliability theory. However the concept of reliability is an old as man himself since he develops any machine or technique he has concerned with the problem of unreliability of the products. As the science and technology, the methods to analyze the performance of the system are going on. The reliability in its simplest form is defined as the reliability of a unit is the probability that the unit performs its intended function adequately for a given of time under the stated operating conditions or environment. The process of identifying maintenance of significant items and classifying them with respect to malfunction on safety, environmental, operational, and economic consequences, the possible failure mode of an item is identified and an appropriate maintenance policy is assigned to counter it. Support methods include failure mode, effect, and criticality analysis (FMECA), fault tree analysis (FTA), risk analysis, and hazardous operations (HAZOP) analysis. If the proper reliability is done then many wastage of energy resources can be saved for example many industrial units will be more reliable and more production will be done by these units.

Need of Analysis
The reliability analysis can be used for public development in many ways:
(i) If the proper reliability was checked in Bhopal plant, the Gas Kaand may be not happen, which was responsible for the death of Lakhs of persons.
(ii) Risk to the public can be minimized by reliability analysis when new equipments are checked by proper
(iv) If the proper reliability analysis of all electricity producing plants is done then the electricity problem will not be there in any state like Haryana.

LITERATURE REVIEW
"Reliability Distribution of an Industrial Process" by M. Kaur, A. K. Lal and S. S. Bhatia, International Journal of Research in Advent Technology, Dec 2013 explained that most prominent approach used by researchers to study the behavior of the process industry systems is through stochastic process.

"Reliability Analysis and Mathematical Modeling of Washing System in Paper Industry" by Satyavati, Vol. 2, No. 2, February 2011, pp. 119-128 ISSN 2219-7184 ICSRS Publication explained that Reliability Analysis can

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benefit the industry in terms of higher productivity and lower maintenance cost. This can also help the management to understand the effect of increasing/decreasing the repair rate of a particular component or subsystem on the overall system.

"Understanding Reliability and Validity in Qualitative Research" by Nahid Golafshani University of Toronto, Toronto, Ontario, Canada 2003 explained that The use of reliability and validity are common in quantitative research and now it is reconsidered in the qualitative research paradigm.

"Application of Monte Carlo Simulations to System Reliability Analysis" by Dennis Alaxander 2003, explained how this technique is an important tool for analysis of reliability and proper application of this is used to quantify the reliability.

"An Instructor's Guide to Understanding Test Reliability" by Craig S. Wells and James A. Wollack, University of Wisconsin, USA, Nov 2003, explained that reliability provides a measure of the extent to which an examinee's score reflects random measurement error.

"Reliability, Maintainability and Risk" by David J. Smith (Sixth edition 2001), Butterworth-Heinemann Linacre House, Jordan Hill, Oxford explained that no human activity can enjoy zero risk, and no equipment a zero rate of failure, there has grown a safety technology for optimizing risk. This attempts to balance the risk against the benefits of the activities and the costs of further risk reduction.

"Assessing Reliability as the Electric Power Industry Restructures" by Marija D. Ilic, Energy Laboratory, Massachusetts Institute of Technology, Cambridge, MA USA Nov. 2000 explained that the criteria and methods for reliability assessment and provision underlying current industry practices.

“An Overview of Software Reliability Models” by Latha Shanmugam explained that software Reliability is an useful measure in planning and controlling the resources during the development process so that high quality software can be developed.

“Log-Logistic Software Reliability Growth Model” by Swapna S. Gokhale explained that finite failure NHPP models proposed in the literature exhibit either constant, monotonic increasing or monotonic decreasing failure occurrence rates per fault, and are inadequate to describe the failure process underlying certain failure data sets.
“Understanding Reliability and Validity in Qualitative Research” by Nahid Golafshani explained that the use of reliability and validity are common in quantitative research and now it is reconsidered in the qualitative research paradigm. Since reliability and validity are rooted in positivist perspective then they should be redefined for their use in a naturalistic approach.

“Failures Analysis and Reliability” by M. Mirzai explained that failures of transformers in sub-transmission systems not only reduce reliability of power system but also have significant effects on power quality since one of the important components of any system quality is reliability of that system.

“Improving the Efficiency and Reliability of Digital Time-Stamping” by Dave Bayer explained that to establish that a document was created after a given moment in time, it is necessary to report events that could not have been predicted before they happened.

“Reliability of Complex Services” by Sergey Alexandrov explained that the relatively young history of computers, their capability has grown at an exponential rate both in hardware (see Moore’s Law), and in software. Naturally, along with the increased potential came the greater magnitude of complexity.

“Cloud Service Reliability: Modeling and Analysis” by Yuan-Shun Dai explained that cloud computing is a recently developed new technology for complex systems with massive scale service sharing, which is different from the resource sharing of the grid computing systems.

“Failure Correlation in Software Reliability Models” by Katerina Goseva-Popstojanova explained that perhaps the most stringent restriction in most software reliability models is the assumption of statistical independence among successive software failures.

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RESEARCH METHODOLOGY

The differential equations can be solved using well known integrating factor techniques.
The effects of failure and repair rates of different subsystems on long run availability have been studied through tables and graphs.
Some simulation software like Matlab are used to simulate the processes.

Objectives

Some major objectives in obtaining reliability data include:
(i) Obtaining early identification of failure modes and understanding and removing their root causes and thereby improving reliability.
(ii) To check to maximize the reliability
(iii) To check the availability of proper resources
(iv) Determining how long each unit should be run prior to shipment in order to avoid likely premature field failures.
(v) Quantifying reliability to determine whether or not a product is ready for release.
(vi) To check how cost and reliability related
(vii) Quantifying reliability so that the equipments will be more reliable in the maintenance phase

Different Methods for Calculation

Stochastic Process

In probability theory, a stochastic process or sometimes random process (widely used) is a collection of random variables, representing the evolution of some system of random values over time. This is the probabilistic counterpart to a deterministic process (or deterministic system). Instead of describing a process which can only evolve in one way (as in the case, for example, of solutions of an ordinary differential equation), in a stochastic or random process there is some indeterminacy: even if the initial condition (or starting point) is known, there are several (often infinitely many) directions in which the process may evolve.

A stochastic process X={X(t),t £T}is a collection of random variables i.e. for each t in the index set T,X(t)is a random variable. We call X a discrete time stochastic process, and if T is a continuum, we call it a continuous time process.

A continuous time stochastic process {X(t), t £T} is said to have independent increments if for all $t_0<t_1<t_2.....<t_n$, the random variables

$X(t_1)-X(t_0),X(t_2)-X(t)-X(t_1),.....X(t_n)-X(t_{n-1})$ are independent. It is said to possess stationary increments if X(t+s)-X(t) has the same distribution for all t i.e. it possesses independent increments if the changes in the processes value over non-overlapping time intervals are independent and it possesses stationary increments if the increments if the distribution of the change in the between any two points depends only on the distance between any two points depends only on the distance between those points.

Markov process

In probability theory, a Markov model is a stochastic model used to model randomly changing systems where it is assumed that future states depend only on the present state and not on the sequence of events that preceded it (that is, it assumes the Markov property). Generally, this assumption enables reasoning and computation with the model that would otherwise be intractable.

Definition 1.1 (Markov process) A continuous-time stochastic process $\{X(t) : t \geq 0\}$ on a countable state space S is called a Markov process.

Monte Carlo

The Monte Carlo method of reliability prediction is useful when system complexity makes the formulation of exact models essentially impossible. The characteristics of the Monte Carlo method make it ideal for estimating the reliability of software systems. Unlike many other mathematical models, system complexity is irrelevant to the method. Not only can the structure of the system be dynamic, but the precise structure of the software system need not even be known. Instead, system components need only be tested for failure during operation, which ensures that components which are used more often contribute proportionally more to the overall reliability

estimate. Combined with self-checking algorithms which respond to randomly generated inputs, the method obviates the need for valid, nontrivial input data and an external oracle

CONCLUSION

We can apply many models while the concept of reliability is there but different models have their own disadvantages and disadvantages, so the researcher can work on a particular depending upon the area of work. The stochastic model is used by many researchers to work on their projects. Also the quantitative models are very much preferred in comparison of qualitative methods. The work in terms of quantitative approach is clearer and we can understand them easily.

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