ISSN (Online) : 2348 - 2001

International Refereed Journal of Reviews and Research
Volume 3 Issue 2 March 2015
International Manuscript ID : 23482001V3I2032015-45
(Approved and Registered with Govt. of India)

PRAGMATIC REVIEW ON THE FACTORS ASSOCIATED WITH DEFECTS PER VEHICLE IN THE AUTOMOBILE INDUSTRY

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ABSTRACT

The Monte Carlo method uses repeated random sampling to generate simulated data to use with a mathematical model. This model often comes from a statistical analysis, such as a designed experiment or a regression analysis. To design a better process, you could collect a mountain of data in order to determine how input variability relates to output variability under a variety of conditions. However, if you understand the typical distribution of the input values and you have an equation that models the process, you can easily generate a vast amount of simulated input values and enter them into the process equation to produce a simulated distribution of the process outputs. You can also easily change these input distributions to answer "what if" types of questions. That's what Monte Carlo simulation is all about. In the example we are about to work through, we'll change both the mean and standard deviation of the simulated data to improve the quality of a product. Today, simulated data is routinely used in situations where resources are limited or gathering real data would be too expensive or impractical. This paper underlines the literature and preamble aspects of the factors associated with the defects per vehicle in automobile industry. In this proposed research task, the defects per vehicles shall be measured and optimized using monte carlo simulation. The base work mentioned in the earlier work shall be improved using suitable algorithmic approaches.

Keywords – Automobile Industry, Defects per Vehicle, Quality Aspects

FOREWORD AND INTRODUCTION

Amassing techniques are significant in all parts of our lives, so much that we consistently don't comprehend or think of it as. From the automobiles we drive, the holders our support comes in, the TV's, PCs and diverse devices we use, power devices, warmers, ventilation frameworks, the channels that pass on our water and the summary proceeds with everlastingly to join practically everything describing our ebb and flow society. These things are all manufactured or developed from created parts. Creating equipment itself ought to similarly be manufactured. The collecting methodology used is controlled by a blended pack of components. The real considered collecting or era is to make, (or produce), something that has an accommodating structure. This structure is without a doubt fated and discovered, with a certain physical geometry. Regularly this geometry has remarkable strengths that it must meet with a particular final objective to be seen as sufficient. A strength graphs the geometric exactness that must be refined in the gathering methodology. The "snugness" of the resistances, or as being what is indicated the allowed contrast between the made thing and the ideal thing, is a component of the particular usage of the thing.

PREVENTIVE MAINTENANCE (PM)

1. The care and servicing by personnel for the purpose of maintaining equipment and facilities in satisfactory operating condition by providing for systematic inspection,detection, and correction of incipient failures either before they occur or before they develop into major defects.

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2. Maintenance, including tests, measurements, adjustments, and parts replacement, performed specifically to prevent faults from occurring.

The primary goal of maintenance is to avoid or mitigate the consequences of failure of equipment. This may be by preventing the failure before it actually occurs which Planned Maintenance and Condition Based Maintenance help to achieve. It is designed to preserve and restore equipment reliability by replacing worn components before they actually fail. Preventive maintenance activities include partial or complete overhauls at specified periods, oil changes, lubrication and so on. In addition, workers can record equipment deterioration so they know to replace or repair worn parts before they cause system failure. The ideal preventive maintenance program would prevent all equipment failure before it occurs. There is a controversy of sorts regarding the propriety of the usage "preventative." Preventive maintenance can be described as maintenance of equipment or systems before fault occurs. It can be divided into two subgroups:

PLANNED MAINTENANCE

Planned Preventive Maintenance ('PPM') or more usual just simple Planned Maintenance (PM) or Scheduled Maintenance is any variety of scheduled maintenance to an object or item of equipment. Specifically, Planned Maintenance is a scheduled service visit carried out by a competent and suitable agent, to ensure that an item of equipment is operating correctly and to therefore avoid any unscheduled breakdown and downtime.

Together with Condition Based Maintenance, Planned maintenance comprises preventive maintenance, in which the maintenance event is preplanned, and all future maintenance is preprogrammed. Planned maintenance is created for every item separately according to manufacturers recommendation or legislation. Plan can be based on equipment running hours, date based, or for vehicles distance travelled. A good example of a planned maintenance program is car maintenance, where time and distance determine fluid change

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requirements. A good example of Condition Based Maintenance is the oil pressure warning light that provides notification that you should stop the vehicle because failure will occur because engine lubrication has stopped.

Planned maintenance has some advantages over Condition Based Maintenance such as:

- Easier planning of maintenance and ordering spares,
- Costs are distributed more evenly,
- No initial costs for instruments used for supervision of equipment.

Disadvantages

- Less reliable than equipment with fault reporting associated with CBM
- More expensive due to more frequent parts change
- Requires training investment and ongoing labor costs

Parts that have scheduled maintenance at fixed intervals, usually due to wearout or a fixed shelf life, are sometimes known as time-change interval, or TCI items.

- Condition-based maintenance.

Condition-based maintenance (CBM), shortly described, is maintenance when need arises. This maintenance is performed after one or more indicators show that equipment is going to fail or that equipment performance is deteriorating.

This concept is applicable to mission critical systems that incorporate active redundancy and fault reporting. It is also applicable to non-mission critical systems that lack redundancy and fault reporting.

Condition-based maintenance was introduced to try to maintain the correct equipment at the right time. CBM is based on using real-time data to prioritize and optimize maintenance

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resources. Observing the state of the system is known as condition monitoring. Such a system will determine the equipment's health, and act only when maintenance is actually necessary. Developments in recent years have allowed extensive instrumentation of equipment, and together with better tools for analyzing condition data, the maintenance personnel of today are more than ever able to decide what is the right time to perform maintenance on some piece of equipment. Ideally condition-based maintenance will allow the maintenance personnel to do only the right things, minimizing spare parts cost, system downtime and time spent on maintenance.

Challenges

Despite its usefulness, there are several challenges to the use of CBM. First and most important of all, the initial cost of CBM can be high. It requires improved instrumentation of the equipment. Often the cost of sufficient instruments can be quite large, especially on equipment that is already installed. Wireless systems have reduced the initial cost. Therefore, it is important for the installer to decide the importance of the investment before adding CBM to all equipment. A result of this cost is that the first generation of CBM in the oil and gas industry has only focused on vibration in heavy rotating equipment.

Secondly, introducing CBM will invoke a major change in how maintenance is performed, and potentially to the whole maintenance organization in a company. Organizational changes are in general difficult.

Also, the technical side of it is not always as simple. Even if some types of equipment can easily be observed by measuring simple values as vibration (displacement or acceleration), temperature or pressure, it is not trivial to turn this measured data into actionable knowledge about health of the equipment.

Value potential

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As systems get more costly, and instrumentation and information systems tend to become cheaper and more reliable, CBM becomes an important tool for running a plant or factory in an optimal manner. Better operations will lead to lower production cost and lower use of resources. And lower use of resources may be one of the most important differentiators in a future where environmental issues become more important by the day.

A more down to earth scenario where value can be created is by monitoring the health of your car motor. Rather than changing parts at predefined intervals, the car itself can tell you when something needs to be changed based on cheap and simple instrumentation.

It is Department of Defense policy that condition-based maintenance (CBM) be "implemented to improve maintenance agility and responsiveness, increase operational availability, and reduce life cycle total ownership costs".

CBM has some advantages over planned maintenance:

- Improved system reliability
- Decreased maintenance costs
- Decreased number of maintenance operations causes a reduction of human error influences

Its disadvantages includes

- High installation costs, for minor equipment items often more than the value of the equipment
- Unpredictable maintenance periods cause costs to be divided unequally
- Increased number of parts (the CBM installation itself) that need maintenance and checking

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Today, due to its costs, CBM is not used for less important parts of machinery despite obvious advantages. However it can be found everywhere where increased reliability and safety is required, and in future will be applied even more widely.

The main difference of subgroups is determination of maintenance time, or determination of moment when maintenance should be performed.

While preventive maintenance is generally considered to be worthwhile, there are risks such as equipment failure or human error involved when performing preventive maintenance, just as in any maintenance operation. Preventive maintenance as scheduled overhaul or scheduled replacement provides two of the three proactive failure management policies available to the maintenance engineer. Common methods of determining what Preventive (or other) failure management policies should be applied are;OEM recommendations, requirements of codes and legislation within a jurisdiction, what an "expert" thinks ought to be done, or the maintenance that's already done to similar equipment, and most important measured values and performance indications.

In a nutshell:

- Preventive maintenance is conducted to keep equipment working and/or extend the life of the equipment.
- Corrective maintenance, sometimes called "repair," is conducted to get equipment working again.

Corrective maintenance is a maintenance task performed to identify, isolate, and rectify a fault so that the failed equipment, machine, or system can be restored to an operational condition within the tolerances or limits established for in-service operations.

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A French official norm defines "corrective maintenance" as maintenance which is carried out after failure detection and is aimed at restoring an asset to a condition in which it can perform its intended function (NF EN 13306 X 60-319 standard, June 2001).

Corrective maintenance can be subdivided into "immediate corrective maintenance" (in which work starts immediately after a failure) and "deferred corrective maintenance" (in which work is delayed in conformance to a given set of maintenance rules).

Operational maintenance is the care and minor maintenance of equipment using procedures that do not require detailed technical knowledge of the equipment’s or system’s function and design. This category of operational maintenance normally consists of inspecting, cleaning, servicing, preserving, lubricating, and adjusting, as required. Such maintenance may also include minor parts replacement that does not require the person performing the work to have highly technical skills or to perform internal alignment.

As the term implies, operational maintenance, is performed by the operator of the equipment. Its purpose is threefold: (1) to make the operator aware of the state of readiness of the equipment; (2) to reduce the delays that would occur if a qualified technician had to be called every time a simple adjustment were needed; and (3) to release technicians for more complicated work

This form of preventative maintenance can be performed in any setting where machines, equipment, or vehicles are used. This may include manufacturing plants and factories, as well as automotive shops. In many commercial buildings, heating and cooling engineers perform operational maintenance tasks on furnaces, boilers, and air conditioners.

Some operational maintenance responsibilities can be as simple as inspecting the machine to spot any changes or issues. This allows the operator to detect a potential danger, such as loose

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fasteners or debris that could contribute to an accident. Basic cleaning, including removing debris or excess grease from a machine, is also considered part of operational maintenance.

Depending on the type of equipment in use, operators may also be responsible for replacing worn out filters or cartridges, or removing and replacing a worn belt, cutting tool, orgrinding stone. Operational maintenance may entail keeping machinery well lubricated to reduce the risk of friction or failure. Many basic machine adjustments needed during the course of operation also fall within this category of preventative maintenance.

DIFFERENCE BETWEEN PREVENTIVE AND PREDICTIVE MAINTENANCE

Predictive maintenance tends to include direct measurement of the item. Example, an infrared picture of a circuit board to determine hot spots while Preventive Maintenance includes the evaluation of particles in suspension in a lubricant, sound and vibration analysis of a machine.

Examples

- An individual bought an incandescent light bulb. The manufacturing company mentioned that the life span of the bulb is 3 years. Just before the 3 years, the individual decided to replace the bulb with a new one. This is called preventive maintenance.
- On the other hand, the individual has the opportunity to observe the bulb operation daily. After two years, the bulb starts flickering. The individual predicts at that time that the bulb is going to fail very soon and decides to change it for a new one. This is called predictive maintenance.
- The individual ignores the flickering bulb and only goes out to buy another replacement light bulb when the current one fails. This is called corrective maintenance.

MONTE CARLO METHODS

ISSN (Online) : 2348 - 2001

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Monte Carlo methods are a broad class of computational algorithms that rely on repeated random sampling to obtain numerical results. They are often used in physical and mathematical problems and are most useful when it is difficult or impossible to use other mathematical methods. Monte Carlo methods are mainly used in three distinct problem classes: optimization, numerical integration, and generation of draws from a probability distribution.

In physics-related problems, Monte Carlo methods are quite useful for simulating systems with many coupled degrees of freedom, such as fluids, disordered materials, strongly coupled solids, and cellular structures (see cellular Potts model). Other examples include modeling phenomena with significant uncertainty in inputs such as the calculation of risk in business and, in math, evaluation of multidimensional definite integrals with complicated boundary conditions. In application to space and oil exploration problems, Monte Carlo–based predictions of failure, cost overruns and schedule overruns are routinely better than human intuition or alternative "soft" methods.

The modern version of the Monte Carlo method was invented in the late 1940s by Stanislaw Ulam, while he was working on nuclear weapons projects at the Los Alamos National Laboratory. Immediately after Ulam's breakthrough, John von Neumann understood its importance and programmed the ENIAC computer to carry out Monte Carlo calculations.
Monte Carlo methods vary, but tend to follow a particular pattern:

1. Define a domain of possible inputs.
2. Generate inputs randomly from a probability distribution over the domain.
3. Perform a deterministic computation on the inputs.
4. Aggregate the results.

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For example, consider a circle inscribed in a unit square. Given that the circle and the square have a ratio of areas that is π/4, the value of π can be approximated using a Monte Carlo method:

1. Draw a square on the ground, then inscribe a circle within it.
2. Uniformly scatter some objects of uniform size (grains of rice or sand) over the square.
3. Count the number of objects inside the circle and the total number of objects.
4. The ratio of the two counts is an estimate of the ratio of the two areas, which is π/4. Multiply the result by 4 to estimate π.

In this procedure the domain of inputs is the square that circumscribes our circle. We generate random inputs by scattering grains over the square then perform a computation on each input (test whether it falls within the circle). Finally, we aggregate the results to obtain our final result, the approximation of π.

There are two important points to consider here: Firstly, if the grains are not uniformly distributed, then our approximation will be poor. Secondly, there should be a large number of inputs. The approximation is generally poor if only a few grains are randomly dropped into the whole square. On average, the approximation improves as more grains are dropped.

Applications

Monte Carlo methods are especially useful for simulating phenomena with significant uncertainty in inputs and systems with a large number of coupled degrees of freedom. Areas of application include:

At the point when distinctive assembling procedures and routines are thought of it as, is key to build up a comprehension of the relationship between the procedure utilized and the properties of the completed item. For this it is critical to realize what conditions a specific

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procedure will subject a material to and how distinctive assembling materials react to diverse conditions, (ie. anxiety, heat).

Fabricating Materials - Every produced item are produced using a material. Like the geometric resistance, the properties of the material of the last made item are of most extreme significance. Thus, the individuals who are keen on assembling ought to be exceptionally concerned with material choice. An amazingly wide mixture of materials are accessible to the maker today. The producer must consider the properties of these materials concerning the wanted properties of the made products. All the while, one must additionally consider assembling procedure. In spite of the fact that the properties of a material may be extraordinary, it will most likely be unable to adequately, or monetarily, be handled into a helpful structure. Likewise, since the tiny structure of materials is frequently changed through diverse assembling procedures -subordinate upon the procedure varieties in assembling method may yield distinctive results at last item. Thusly, a consistent input must exist between assembling procedure and materials enhancement.

LITERATURE REVIEW

Huang, S. H., & Pan, Y. C. (2015) - Automated visual inspection is an image-processing technique for quality control and production line automation. This paper reviews various optical inspection approaches in the semiconductor industry and categorize the previous literatures by the inspection algorithm and inspected products. The vision-based algorithms that had been adopted in the visual inspection systems include projection methods, filtering-based approaches, learning-based approaches, and hybrid methods. To discuss about the practical applications, the semiconductor industry covers the manufacturing and production of wafer, thin-film transistor liquid crystal displays, and light-emitting diodes. To improve the yield rate and reduce manufacturing costs, the inspection devices are widely installed in the design, layout, fabrication, assembly, and testing processes of production lines. To achieve a high robustness and computational efficiency of automated visual inspection, interdisciplinary knowledge between precision manufacturing and advanced image-processing techniques is required in the novel system design. This paper reviews multiple defect types of various inspected products which can be referenced for further implementations and improvements.

Al Bulushi, I., Edwards, J., Davey, J., Armstrong, K., Al Reesi, H., & Al Shamsi, K. (2015) - In recent years, Oman has seen a shift in the burden of diseases towards road accidents. The main objective of this paper, therefore, is to describe key characteristics of heavy vehicle crashes in Oman and identify the key driving behaviours that influence fatality risks. Crash data from January 2009 to December 2011 were examined and it was found that of the 22,543 traffic accidents that occurred within this timeframe, 3,114 involved heavy vehicles. While the majority of these crashes were attributed to driver behaviours, a small proportion was attributed to other factors. The results of the study indicate that there is a need for a more thorough crash investigation process in Oman. Future research should explore the reporting processes used by the Royal Oman Police, cultural influences on heavy vehicle operations in Oman, and improvements to the current licensing system.

Wang, H. (2015) - In order to resolve the disadvantages such as poor appearance quality, poor tightness, low efficiency of resistance spot welding of stainless steel rail vehicles, partial penetration lap laser welding process was investigated widely. But due to the limitation of processing technology, there will be local incomplete fusion in the lap laser welding seam. Defect rate is the ratio of the local incomplete fusion length to the weld seam length. The tensile shear strength under different defect rate and its effect on the car body static strength are not clear. It is necessary to find the biggest defect rate by numerical analysis of effects of different defect rates on the laser welding stainless steel rail vehicle body structure strength ,and tests of laser welding shear tensile strength. © (2015) COPYRIGHT Society of Photo-Optical Instrumentation Engineers (SPIE). Downloading of the abstract is permitted for personal use only.

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Li, W. B., Zhang, Q. Z., Sun, J. L., Liu, L., & He, S. L. (2015) - With the increase of requirement for the quality of raw materials in industry, surface defect inspection of steel bar has been an essential part of industrial production. The characteristics of vision-based detection technology for steel bar surface defect and the newest research development were introduced. The working principle of vision inspection technology and key issues were analyzed. Finally, the current domestic research emphases and development trends were proposed.

METHODOLOGY

The proposed work is based on the following parameters and paradigms for the effective and overall performance base results in the automotive industry

- Random Number Generators
- Monte Carlo Simulation
- Dynamic Data Sets Generation

Monte Carlo methods (or Monte Carlo experiments) are a broad class of computational algorithms that rely on repeated random sampling to obtain numerical results. They are often used in physical and mathematical problems and are most useful when it is difficult or impossible to use other mathematical methods. Monte Carlo methods are mainly used in three distinct problem classes: optimization, numerical integration, and generating draws from a probability distribution.

In physics-related problems, Monte Carlo methods are quite useful for simulating systems with many coupled degrees of freedom, such as fluids, disordered materials, strongly coupled solids, and cellular structures. Other examples include modeling phenomena with significant uncertainty in inputs such as the calculation of risk in business and, in math, evaluation of multidimensional definite integrals with complicated boundary conditions. In application to space and oil exploration problems, Monte Carlo–based predictions of failure, cost overruns and schedule overruns are routinely better than human intuition or alternative "soft" methods.

In principle, Monte Carlo methods can be used to solve any problem having a probabilistic interpretation. By the law of large numbers, integrals described by the expected value of some random variable can be approximated by taking the empirical mean (a.k.a. the sample mean) of independent samples of the variable. When the probability distribution of the variable is too complex, we often use a Markov Chain Monte Carlo (MCMC) sampler. The central idea is to design a judicious Markov chain model with a prescribed stationary probability distribution. By the ergodic theorem, the stationary probability distribution is approximated by the empirical measures of the random states of the MCMC sampler.

In other important problems we are interested in generating draws from a sequence of probability distributions satisfying a nonlinear evolution equation. These flows of probability distributions can always be interpreted as the distributions of the random states of a Markov process whose transition probabilities depends on the distributions of the current random states. In other instances we are given a flow of probability distributions with an increasing level of sampling complexity (path spaces models with an increasing time horizon, Boltzmann-Bibbs measures associated with decreasing temperature parameters, and many others). These models can also be seen as the evolution of the law of the random states of a nonlinear Markov chain. A natural way to simulate these sophisticated nonlinear Markov processes is to sample a large number of copies of the process, replacing in the evolution equation the unknown distributions of the random states by the sampled empirical measures. In contrast with traditional Monte Carlo and Markov chain Monte Carlo methodologies these mean field particle techniques rely on sequential interacting samples. The terminology mean field reflects the fact that each of the *samples (a.k.a. particles, individuals, walkers, agents, creatures, or phenotypes)* interacts with the empirical measures of the process. When the size of the system tends to infinity, these random empirical measures converge to the

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deterministic distribution of the random states of the nonlinear Markov chain, so that the statistical interaction between particles vanishes.

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4. Aggregate the results.

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