Fasteners Defects Identification and Analysis by Using Computer Assistance

[1]R. P. Dalavi, [2]Dr. Chitresh Nayak, [3] N. J. Rathod
[1]Student, [2]Associate Professor, [3]Assistant Professor
[1]Department of Mechanical Engineering,
[1]Oriental Institute of Science and Technology , Bhopal, India

Abstract: A fastener is a hardware component used universally for joints with two or more objects non-permanently. Fasteners are used in many sector such as automobile, manufacturing, and infrastructure. Fasteners are manufactured in mass production by cold heading process. Fasteners manufacturers suffer from common defects like across corner under fill, across corner round/cut/damage, shank damage, and head damage. The objective of this paper is to investigate the various fasteners defects that cause high rejection. This paper also describes the remedial measures which reduce these defects in the fasteners. In industry, fasteners defects identification and analysis is complex and multi task activity need involvement of multi-functional team. So an attempt is made to identify and analyze fasteners defects using computer assistance. It is observed that time required finding out possible cause and remedial action for any defect is very much less time in case of the Computer Assistance as compared problem solving by cross functional team.

Key Words - Pareto analysis, Root cause analysis, Computer assistance, Identification of fasteners defects.

1. INTRODUCTION

A fastener is a hardware component used universally for affixing joints with two or more objects non-permanently. In general fasteners are temporary in nature where they can be fastened or unfastened repeatedly without causing damage to the piece work. Fastener holds the joints of fixtures form holding the chairs and tables to automobile parts. Fasteners are main components used in many sector such as automobile, manufacturing, infrastructure and others in which different types of items are produced that require assembling of machinery or vehicle parts. These features have led to the popularity of fasteners which are available in different shape and dimensions. Varieties of fastener are available at the market these days each with specific are available at the market these day each with specific purpose, made with different metal, non-ferrous and ferrous. The most common fastener used in industry. The type of fastener is used Screws, Bolts, Studs, Set Screws, Tapping screws. These are very important because each components or machinery or vehicle needs these to hold it together. Considering the fastener are key eliminate member in the very industrial products and they play equally important role in the function of parts. So it is essential to study various fastener manufacturing techniques with and intention of quality improvement through defect identification and analysis. Now a day's every activity in industry demands fast and efficient solution for every problem. The objective fastener quality improvement through defects identification and analysis is done using Computer assistance. These studies contain study and development of Computer assistance.

2. REVIEW OF LITERATURE

The literature review is done to identify the extent of work done by research community and contribution of different researchers in the field of Dynamic behavior analysis. This attempt was made to get up to date information / work done & future scope in this field. Major findings of work done by them are discussed as given below.

International standard (2003) presented "Technical standard condition for steel fasteners"this paper is work on Destructive test any product is fund with forging cracks, bursts, laps, vids , tool mark and damages the shall be subject to rejection. Khaefa A. Esaklul, Tawfik M Ahmed (2009) presented ""Prevention of failure of high strength fasteners in use offshore and subsea application" this paper is work on Cathodic protection provides sufficient corrosion protection and high strength nickel have high resistance to hydrogen emrittlement.. Several other materials have the resistance and good candidate for consideration of subsea application. Vartha Venkateswarvu, debashish Tripathy(2013) presented "3D EC-GMR sensor system for detection of subsurface defects at steel fasteners sites" this paper is work on The experimental and simulation c-scan images of tangential field component were used to demonstrate the validity of EC-GMR. Ting-ping chang, Shyh-chourhuang, Te-Fu Hung (2015) presented "A study of optimal mold geometric parameters during the cold preforming of hollow fasteners with a thin flange" this paper is work on FE analysis results the proposed approach can accurately predict the metal forming process forming defects. This methodology is used for Finite Element analysis and Taguchis.

3. PROBLEM DEFINATION

On the manufacturing floor, fasteners operators or engineers sometimes find defects during or after the processes and try to guess when, how or why they appeared. They can only guess, because they do not actually witness the process in which the defects were formed. Usually they need some information to estimate the causes, such as the type of parts, location of the defects. The more information they have, the more accurately they can estimate the correct cause. This computational inference requires the same type of information as needed by human experts. The study of defect related with fastener concluded that defects must be minimized. In this work "Fasteners quality improvement through defects identification and analysis using Computer Assistance." is selected.

4. OBJECTIVE OF STUDY

The main objectives of this study are as follows.
1. To study existing fasteners manufacturing process.
2. To review all potential fastener defects, their cause and remedies.
3. To study present defect identification and analysis techniques.
4. To design and develop Computer Assistance for fasteners defects.
5. To apply and compare Computer Assistance results with manual techniques.

5. STUDIES AND FINDING

The quality assurance department made remarks after conducting various tests to analyze the defects caused to the components that fastener within the company. We have studied fasteners defect and potential cause. The following is a table of defects identified, its potential causes.

Table 1. Studies and Finding Defects and their Potential Causes

Sr No	Defects	Potential Cause
1	Across corner under fill	1.Cut Off length minimum.(Short Feeding)
		2.Cone Punch Pin Break
		3.heading Punch break
		4.All Punches Out
		5.Cone Punch Angle increase or decrease

6. DEFECT IDENTIFICATION AND ANALYSIS TECHNIQUES

As per this study there were several defects seen in data. Among those defects was the potential defect so we studied this defect thoroughly and we could found out the potential cause for this defect. Defect analysis is done as per the industry standards which have been followed by analysis techniques: Pareto analysis, Root Cause analysis etc. More details regarding defect will be explained.

6.1 PARETO ANALYSIS

The pareto chart shows the frequencies of occurrence of the various categories problems encountered in order to determine which of the existing problems occurs most frequently. The problem categories or causes are as shown on the X-axis of the bar graph and the cumulative percentage is shown on the Y-axis of the graph. From the pareto chart, it is understood that 80% of the defect are falling under the category and defect type. These across corner under fill defects are very more rejected parts. These across corner under fill defects should be given higher priority.

Table 2 Pareto Chart

Defects	Quantity	Cumulative	Cumulative Percentage
Across corner under fill	123	123	44.09
Across Corner round	108	231	82.80
Head Damage	48	279	100.00
Shank Damage	10	289	100.00

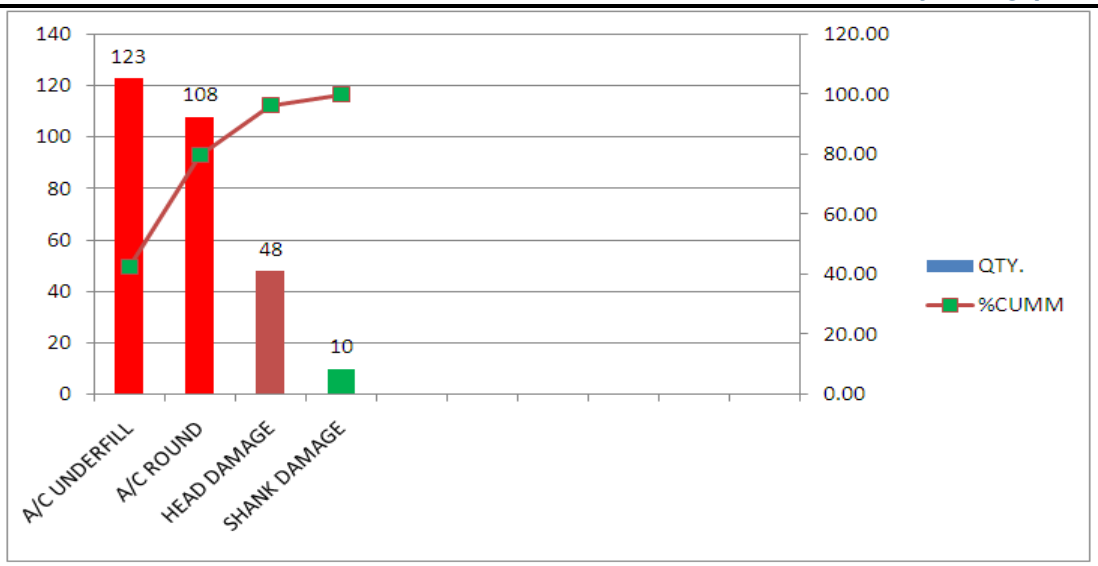

Fig.1 Pareto chart

6.2 ROOT CAUSE ANALYSIS

Root-cause analysis is the process of finding the activity or process which causes the defects and find out ways of eliminating or reducing the effect of that by providing remedial measures. Defects are analyzed to determine their origins. A collection of such causes will help in doing the root cause analysis. One of the tools used to facilitate root cause analysis is a simple graphical technique called cause-and-effect diagram/ fishbone diagram which is drawn for sorting and relating factors that contribute to a given situation. These across corner under fill defects should be given higher priority. Across corner under fill cause-and-effect diagram, as shown fig. 2

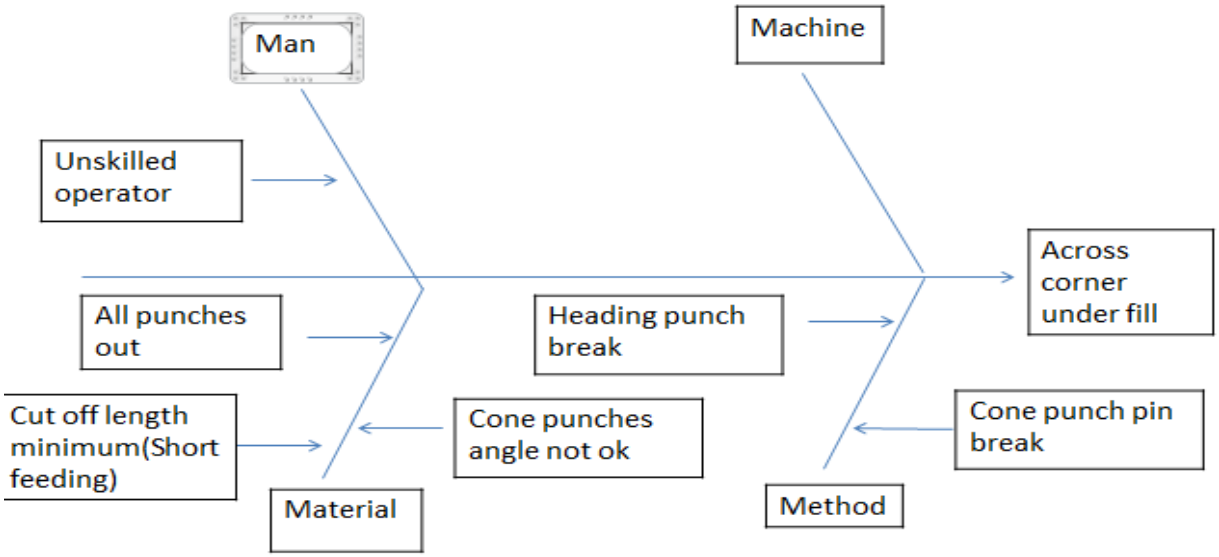

Fig.2 Fishbone diagram of across corner under fill

7. COMPUTER ASSISTANCE IN DEFECT IDENTIFICATION

Defects are found by preplanned activities specifically intended to uncover defects. In general, defects are identified at various stages of Computer Assistance which the identification of types of failure will be much easier and will require less time. Computer Assistance will be used for Identification, analysis and remedies for defects of fasteners. We are going to develop such a tool which will be identifying causes and location of forging defects in fasteners. As we observed, there are lots of defects in forging method. As it become time consuming to recommend the action in manual way and to find problem defects solution. To find the defects, its cause and recommendation
Action we are going to develop Computer Assistance.

The steps followed in our Computer Assistance are as follows
Step 1: First we select the process we need from the given list of processes.
Step 2: once the process is selected, a list of potential failure mode in that process will come up. We have to select a potential failure mode for our problem.
Step 3: When we select the potential failure mode a list of its effects in the application will be generated. A rank of severity will also be generated in this step. The higher the severity, the higher will be the rank.

Step 4: In the potential causes table a cause of the failure will be generated for each effect. The occurrence will be dependence on the causes. If the rejection is less, then the rank of occurrence will be high.

Step 5: When an effect is made valid, a recommendation action will be suggested. A risk priority number (RPN) will be calculated for the problem.

RPN is calculated as:

RPN= Severity X Occurrence X Detection

By selecting the process and the effects for our problem, we get the appropriate recommendation to solve that problem. A Risk Priority Number will also be generated. By Risk Priority Number we can identify the risk level of the problem. The higher the Risk Priority Number value, the higher is the Risk.

7.1 ARCHITECTURE OF COMPUTER ASSISTANCE

The knowledge data base was created expertise of the defects of fasteners. The team of experts specialized knowledge, judgment and Extensive industrial experience. The principle role of Computer Assistance is defects identification. The Computer Assistance for identification of fasteners defects is created in the information system. The information system can be initialized on a personal computer of a user. The system contains as follow.

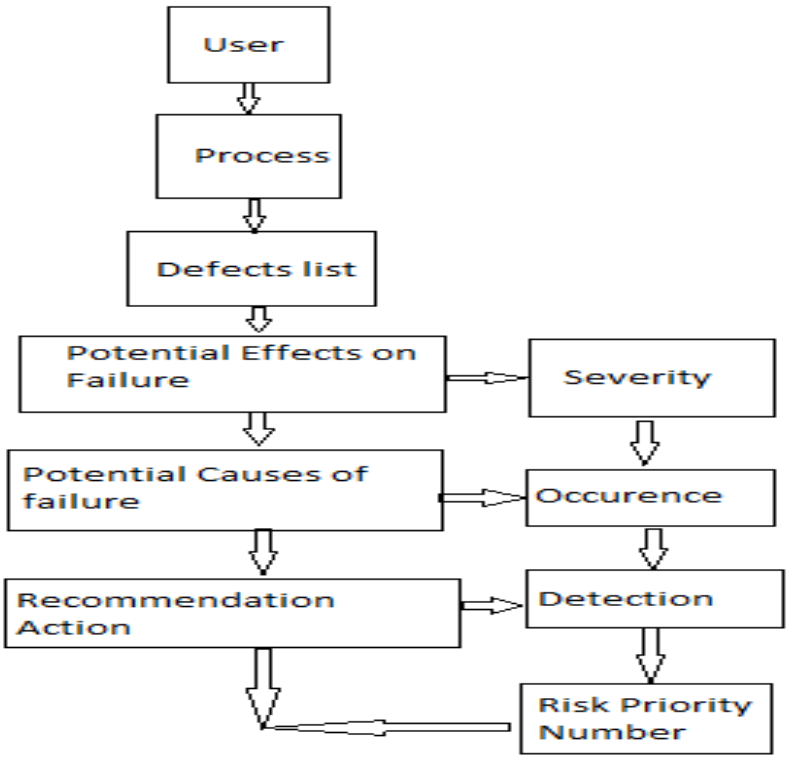

Fig 3 Architecture of Computer Assistance

7.2 CASE STUDY OF THE USE OF KNOWLEDGE BASED COMPUTER ASSISTANCE

Defect Analysis is using defects as data for continuous quality improvement. Defect analysis generally seeks to classify defects into categories and identify possible causes in order to direct process improvement efforts. Root Cause Analysis (RCA) has played useful roles in the analysis of defects. The goal of RCA is to identify the root cause of defects and initiate actions so that the source of defects is eliminated. To do so, defects are analyzed, one at a time. The analysis is qualitative and only limited by the range of human investigative capabilities. The qualitative analysis provides feedback to the developers that eventually improve both the quality.

In cold forging process the major defects found during initial study. At initial study 10000 parts has been checked on various visual analysis. Found total defects 289 no's were rejected in cold forging process. In that across corner under fill possesses major contribution, 123 no's rejected due to across corner under fill. These across corner under fill defects are very more rejected parts. These across corner under fill defects should be given higher priority. Due to across corner under fill, the fitment for the bolt or screw during assembly is not proper .It may cause the slipping of torque gun during fitment on assembly line at customer end, may cause major failure at customer end. Across corner under fill defects contribute to the most number of rejections. Hence we have done a survey on the rejection and found the root cause analysis for corner under fill.

Fig.4 Defects of across Corner Under fill

Fig 5 Multistage process

These across corner under fill defects should be given higher priority. The potential causes are Minimum cut off length (Short Feeding), Cone punch pin break, breaking of forth station hex forming punch, Breaking of Nib second station, first station Punch out, Cone punch angle not proper. In manufacturing industries defect analysis is to be carried out for final component.

This analysis is done by studying root cause of certain defects. In that process we select single defect for study, then we discuss that defect with the appointed cross functional team and it is studied thoroughly to analysis the root cause. This is the manual approach towards the analysis of component which is very lengthy and time taking process. So, we are introducing a computer assistance system we took trails an different defects seen in fasteners in a systematic approaches which is helpful and fast process to analysis the defect in fasteners. The flow of the identification of defects, their causes and recommendation action is discussed as followed.

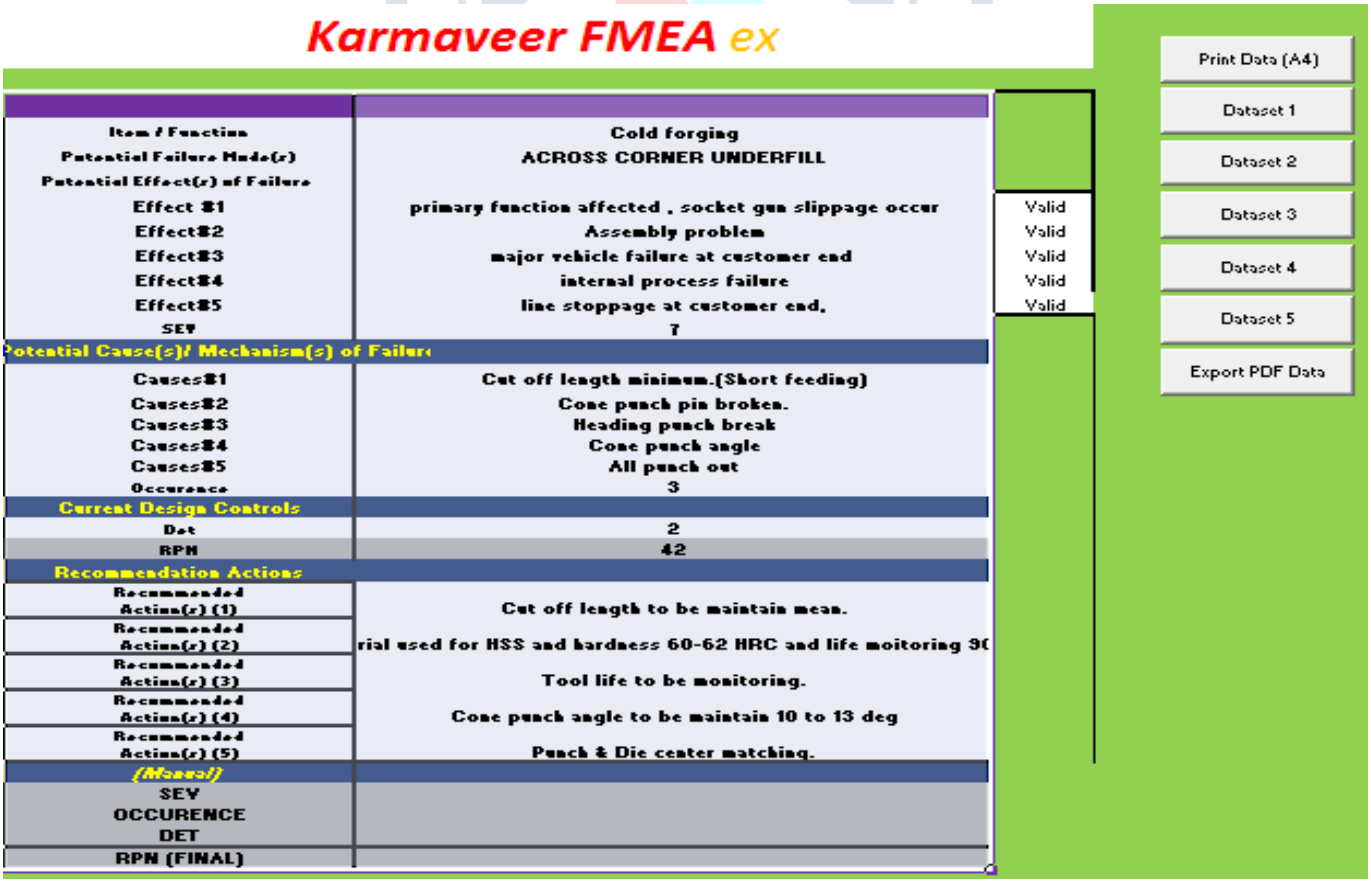

Fig 6 Complete screen shot of Karmaveer FMEA$_{ex}$

8. CONCLUSIONS

In this study the defects occurring in fasteners and their cause and remedies are identified. Computer assistance is developed to get the possible cause and remedial actions of any defects. The performance of the system compared with manual process. It is observed that time required finding out possible cause and remedial action for any defect is very much less time in case of the Computer Assistance system as compared manual problem solving problem.

9. REFERENCES

[1] Technical standard condition for steel fasteners. International standard (2003).
[2] Khelfa A. Esaklul and Tawfik M. Ahmed 2009. prevention of failure of high strength fasteners in use in offshore and subsea application. Journal of engineering failure analysis, 16 11951202.
[3] G. Yang and Z. Zeng 2013. 3D EC–GMR Sensor System for Detection of Subsurface Defects at Steel. Journal of NDT & E international, 50: 20-28.

[4] Ting-ping chang, Shyh-chourhuang and Te-Fu Hung 2015. A study of optimal mold geometric parameters during the cold preforming of hollow fasteners with a thin flange. 11(3): 379-390.