Optimization of Production Cycle Time of Spacer Component

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Abstract: *Today's economical world, increased demand in terms of quantity and verities from customer. It is unable to fulfill customer requirement due to high cycle time. The cycle time plays vital role improving customer demand. Today's competitive world, technology take leap of development. This article describe Design of experiment technique and Minitab software. In Design of experiment technique some methods are available, but in this article we describe Factorial method. In this method two parameters, one is operating and another is response parameter, which is gives the change as a speed and feed. The response variables are as like a cycle time, flatness, spindle load, tool life etc. The data given by Minitab software. Which is used to analyze the cycle time. Cycle time optimization is the point of view of economic progress of an organization. The time required for performing various machining operation. The machining operation carries by HMC and VMC machine. Cycle time is the time required to completed product. The main aim is to optimization of cycle time and improving the productivity.*

Keywords: *Optimization cycle time, design of experiment technique, Minitab, HMC machine, VMC machine, Pareto.*

INTRODUCTION

In early days in the company the customer demand for spacer component has been in but this requirement is increasing the company is unable to fulfil the requirement of the customer because, of their higher cycle time of spacer component.

The company decided to increase the production rate of the company which satisfy the customer requirement. We approached to the company to get their problem so that they could get their solution to fulfil the customer requirement.

We suggest to company to optimize the production cycle time were to change the coolant foe smooth and rapid operation at time simultaneously, but company suggest to use the (DOE) Design of Experiments technique by adjusting some parameter like speed and feeding machine program. We suggest the some solution to get the production target for fulfil the customer requirement.

Methods of reducing cycle time:

1. Using DOE Technique.
2. Using combine tool and advance tool technologies to reduce cutting time.
3. Improve in cutting parameters.
4. Change in process layout.
5. Using more tool magazine capacity of machine

We got known the problem of the company and the company had told us that they are unable to fulfill the requirement of the costumer on time because they have low production time and name of that component is spacer which is purchased by the India Company. Spacer is a tractor component. We had seen the scope of the project and we selected the project of optimization of production cycle time of the spacer.

In our work to reduce the cycle time of the production of spacer component we used the design of experiments technique which gives the changes in the operating parameters and response parameters as the Speed and feed. This is the data taken by us with the help of software called Minitab. This gives the control parameter and response variables which depend on the control parameters. Here the control parameters are the Speed and the feed. And accordingly we are changing the data program of the machine with the help of data given by the Minitab software using factorial method.

The customer requirement is about 300 to 350 components per month and company can produce only 250 to 270 components per month that's why they want to increase the production rate to get the target production per month. These solutions for optimizing of the cycle time of spacer component to change the coolant of the HMC and VMC machine also we change the tool magazine as their old tool magazine is about capacity 24 tools to the tool magazine of the 29 tool. We also suggest to work on the clustering of the operation which can done simultaneously on the component.

The company suggested to work on (DOE) design of experiment technique which can more useful the than the other solutions. It is also effective solution over other than solution hence we choose the method of (DOE) design of experiments in which we can change the parameter of machining operation of the production process such as speed and feed in the CNC machine program control.

In our project to reduce the cycle time of the spacer component we used the design of experiment technique which gives the change in operating

parameter and response parameter as speed and feed. This is data used to taken by with help of Minitab software. The control parameter and response parameter which depend on control parameter. The control parameter are speed and feed accordingly we are changing the data of program of machine with help of data given by Minitab software.

Machining operation of component:

We are going to optimize cycle time of Carraro Spacer for operation I,II and III from 23 min , 41 min and 23 min to 19min, 30 min and 19 min respectively for improving productivity. For first operation on VMC machine and second and third operation will be on HMC machine. In this operation experimentation we are going to take two variable speed and feed using various factors such as speed, feed. With four trails which were got on design of experiments (DOE) with response variables cycle time, flatness, spindle load, tool life.

EXPERIMENTATION

In this article we learn about the design of experiment techniques to reduce the cycle time of component. In the DOE there are 4-5 methods are available. Methods are;

DOE Methods:

1. Best–guess Approach
2. One-factor–at-a-time-Approach
3. Statically designed experiment

DOE steps:

1. Define problem
2. Establish the objectives
3. Select the KPOV and response
4. Choose factor level
5. Select experiment design and number of replication
6. Collect data
7. Analysis the design
8. Interpret the result of analysis
9. Evaluate the benefit

Out of 4-5 method the best suitable and useful method is Factorial Approach method. In this article we use Factorial Approach method. For this method two parameters are needed for getting experiment. These parameters are Speed and Feed.

Using this method we are getting four experiment of each tool

(I.e. High speed and High feed, High speed and Low feed, Low speed and High feed, Low speed and Low feed). From above four experiment one suitable experiment is selected which is better than other three experiment or corresponding to the response variable like Cycle time, Spindle load, Flatness, Roughness etc.

After Completion of all experiment of each and every tool the analysis phase comes. All this analysis is done using Minitab software. In that analysis the variation of the selected experiment is checked. Using Minitab software the various Graphs and charts are produced whether to check the selected experiment is corrected or not after analysis we are getting better values or readings of speed and feed for each operation. In this way customer demands and need is fulfilled by small scale industries using this Design of experiment technique and Minitab software.

METHODOLOGY

Problem has been defined as weekly demand is not satisfied and operates idle time is high by analyzing the detailed study of housing line and the objective are conclude in brainstorming session as to eliminate the learn waste from the manufacturing processes to improve productivity and also improve. The man utilization by line balancing data collection was done by using step which analysis. For this purpose we choose one method that is DOE (Design of Experiment) in that we are going with the factorial approach method in that only two factorial approach method used. There are many parameter are used to optimize cycle time.

For this purpose the Minitab software was used. In that software the DOE sheets will be done in that sheet there are response parameter and variable parameter are speed and feed are variable parameter while flatness, roughness, tool life are the response parameter with the help of historical data we select the tool which has high cycle time for the operation with the help of Pareto chart using Minitab software. By changing the variable parameter like speed and feed.

We conclude the response parameter like spindle speed, roughness, flatness, tool life etc. in Minitab software we using factorial method i.e. every tool has four reading of speed and feed out of this is efficient readings selected with minimum cycle time and great tool life roughness and flatness value which is given by customer. Taking 10 reading of efficient reading and taking variation of each reading and finalize. The reading which has minimum cycle time. This operation are done on the HMC machine and VMC machine. This is done with the help of Minitab software. This is done with the help of Minitab software in that process sheet, Pareto chat, counter plot etc.

PARETO CHART

A Pareto chart is a bar graph. The lengths of the bars represent frequency or cost time and are arranged with longest bars on the left and the shortest to the right. In

this way the chart visually depicts which situations are more significant. This cause analysis tool is considered one of the seven basic quality tools. The left vertical axis is the frequency of occurrence, but it can alternatively represent cost or another important unit of measure.

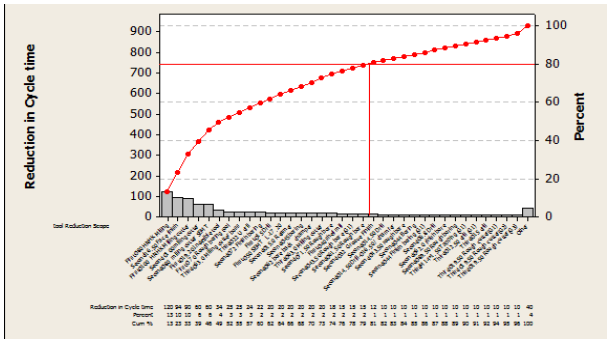

Figure 1: Pareto chart of spacer operation

In that pareto chart we have selected the maximum value of cycle time of operation. In that operation we have to select 21 tools of operation. This 21 tools are maximum value of cycle time. With the help of Minitab software this chart will be very helpful of optimizing the cycle time of spacer component.

RESULT:

1. The data is taken from the Minitab software worksheet prepared by factorial method into that by entering the variable parameters and analyzing the data. The worksheet table gives the modified time required to process an operation and this will gives the improved time required to production of a spacer component by changing the program of CNC machine accordingly.

2. So as a result we reduced the production cycle time as per the required target and then it is able to fulfil the costumer requirement.

CONCLUSION

1. To reduce the cost associated in manufacturing of component and hence to increase the productivity.

2.We achieved the target production time of 18min, 29min and 19 min with respect to first, second and third stage respectively which is our main objective to achieve.

3. To carry out required operations with less no of tools to reduce cycle time.

4. To improve the productivity of spacer component.

5. To fulfill the customer need.

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