A REVIEW PAPER ON DESIGN OPTIMIZATION AND ANALYSIS OF MILLINF FIXTURE

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Abstract :
The manufacturing industry of small scale provides wide range of products to fulfill the market needs. To face many challenges of market these industries should increase their production rate with good quality and accuracy. The manual production is of low production rate and long throughput time. Moreover, standardization of manual processes is difficult and also its difficulty in maintenance, thus fixtures is used on the machines. Therefore, this study aims to design a Fixture. Basically, Fixture is a work holding device to guide the tool. The main purpose of making this fixture is to perform the milling operation without any need of shifting the job regularly. This results in reduction of production time and increase in production rate. This will lead to decreasing manufacturing time and also the machining cost. In this work the Milling fixture is designed and analyzed for the stresses and deformation that occur during the machining process. The CAD modeling Software is used to model the Milling fixture and analysis work will be carried out by using ANSYS Workbench Software.

Keywords: FEA, Fixture, Analysis.

1. Introduction

A fixture is a production tool that locates, holds and supports the work securely so the required machining operations can be performed. A fixture holds the successive work piece in identical positions. Also its massive and heavier construction than a jig, and it's fixed or bolted to table of machine to ensure proper rigidity. Fixtures vary in design from relatively simple tools to expensive, complicated devices. It designed to hold work piece for various operations on most of the standard machine tools.

From a layout point of view, fixtures have six basic functional requirements:

(1) Stable resting,
(2) accurate localization,
(3) support reinforcement,
(4) stable clamping,
(5) foreclosure
(6) Quality performance.

The functions have strong precedence conditions. The first five functions are required at the fixturing stage, and sequentially. When a work piece is placed into a fixture, it must first assume a stable resting against the gravity. Then, the locators should provide accurate localization.

Supports are moved in place, and finally clamps are activated for the part immobilization process of instantiating clamps without work piece lift- off. The

performance of the fixture is ultimately defined as work piece geometric error during the manufacturing stage. The geometric error is mainly determined by the fixture localization accuracy and the work piece static and elastic deformation during manufacturing. There are additional constraints to be satisfied such as interference-free and easy loading and unloading. Modular fixture is nothing but fixture to hold work piece for multiple operations on a single clamping and a same machine. The various types of fixtures are Plate fixture, angle-plate fixtures, Vise-jaw fixtures, Indexing fixtures multistation fixtures, profiling fixtures. The different operations that use fixtures are boring, drilling, milling, turning, facing, etc. According to KSB standard, the product namely HG3 and HG4 i.e., suction and discharge casing manufacturing required fixture which is use for all operations on product like turning, facing, boring, drilling, milling, etc. on DMU mill-turn center. The machine is 5-axis machine

2. Objectives

The aim of the first part of the thesis is to calculate the cutting forces from the milling tool on the work piece, i.e. the tail wing, import the CAD model of the tail wing into ABAQUS, study the stress distribution on the CAD model and evaluate the results by considering factor of safety as the criterion.

The aim of the second part of the thesis work is to estimate the loads acting on the baseplate when it is lifted off the ground, study the stress distribution.

on the CAD model of the baseplate and verify the designstrength by comparing maximum stress on the plate with yield strength of the materialFixture are used to locates and constrain work piece during a machining operations, minimizing work piece and fixture tooling deflections due to clamping and cutting forces are critical to ensuring accuracy of the operations. Machining fixtures are mostly designed and manufactured through trial and error method which proves to be expensive and time consuming to the manufacturing process. For proper manufacturing of work piece, it must be appropriate located.

The main aim of this paper is to minimize the setup time and increasing the productivity by continuous product manufacturing operations on single machine. The design and FEA analysis has done on modular fixture which is used in manufacturing suction and discharge casing of pumps. Jigs and Fixtures are special purpose tools which are used to facilitate production (machining, assembling and inspection operations) when the work piece are to be produced on a mass scale. The

purpose of the fixture is to holds, locates and supports the work piece securely. Modular fixture is nothing but fixture to hold work piece for multiple operations on a single clamping and a same machine. A fixture is bolted or clamped to the machine table. Our research aim is to minimize the setup time and increasing the productivity by continuous product manufacturing operations on single machine.

3.Design

To analyze the maximum and minimum dimensions of the work piece and understand the concept we design two dimensional design of require specifications in CAD software. Because we design for maximum as well as for minimum, so we overlap HG3 and HG4 all specifications separately.

4.Method Overview

We can design few fixture as per requirement like shown below but there is some problem in tool layout or manufacturing process or capacity of stable work piece. So few solutions are cancelled but we still work on other. We want to save their time so design a fixture in that only clamp change but the work piece one side and flange manufacturing with one setup and remaining side manufacture in other setup. But we didn't find any perfect solution for two setups. Now we are designing for three setup which will save their time but our aim is to design the fixture for two set-up only once three set-up is properly designed we are going to reduce one set-up from it according to their requirements.

Just one problem while designing fixture that is milling on feet, cancelled some of the solutions. Other operations are done very properly but while milling the tool layout touches to clamping device. After that, design of fixture with internal clamping is consider. Also there is slot give to fixture for flange side, so that while machining flange the tool will not touch to fixture. Analyze the design with the tool layout; the tool is not while machining any operation.

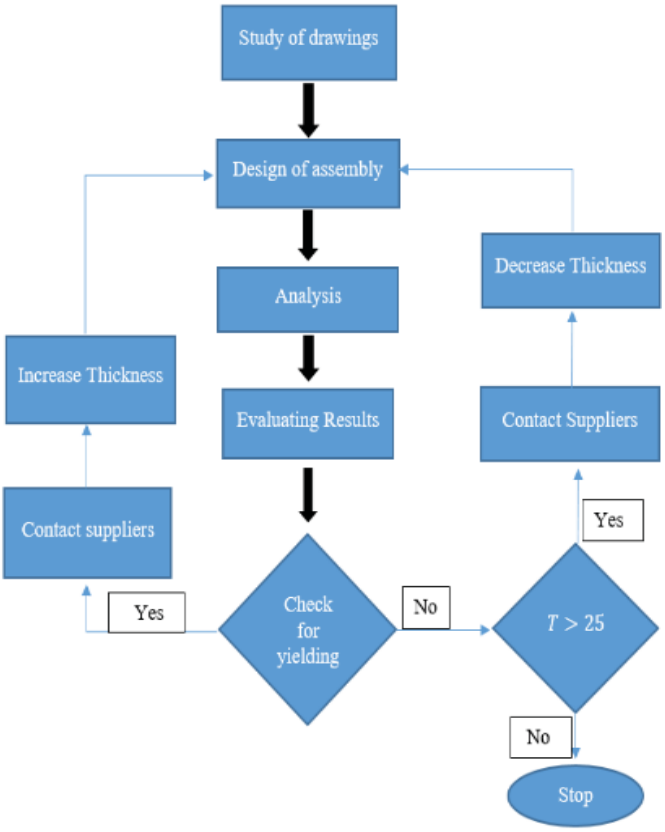


Figure 1 Method Overview

5 Design Model

This section is related to the second part of the thesis work. The company denied sharing the design of the tail wing. The design procedure of Jig-Fixture is according to the design guidelines and is as follows. The truss structure is designed initially followed by the top plate and the base plate at the end. The entire assembly is re-designed in Solid-works after the final check. The designs presented are re-designed as per the instructions and allowances provided by CAD engineers and supervisor at the Industry.

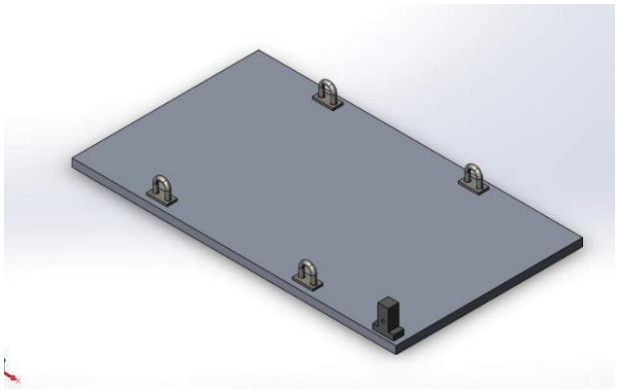
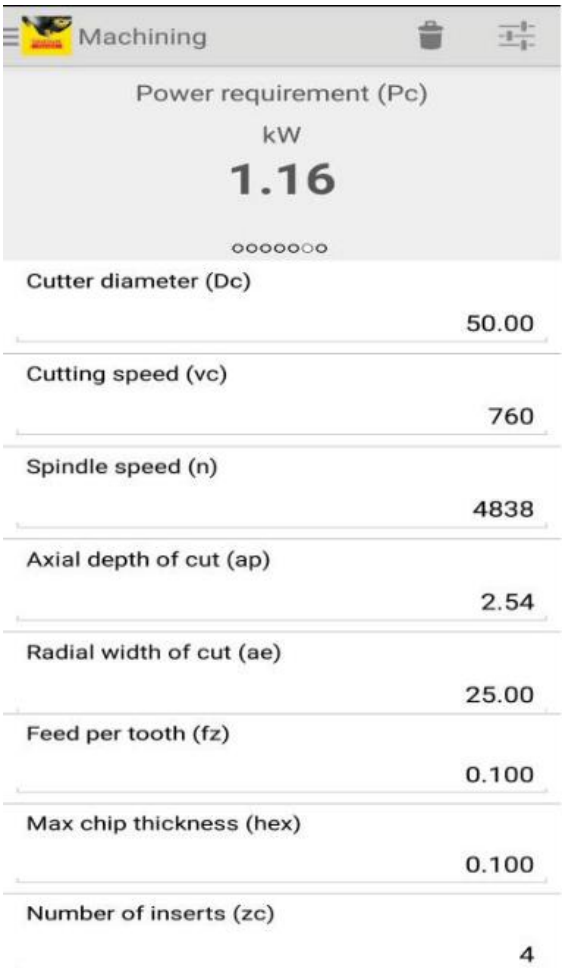


Figure 2 Base Plate Design

6.Truss

The truss structure is designed in such a way that it supports the top plate which is holding the work-piece, i.e. the tail wing of the Apache. The truss is inclined at an angle with vertical to make the Tail wing's face perpendicular to the ground for face milling. Figure 5.1 and Figure 5.2 show the design and dimensions of the Structure in inches scaled 1:10 respect

Figure 3 Power Requrements



7. Conclusions

The efficiencies and reliability of fixture design has enhanced by the system and the result of the fixture design has made more reasonable. To reduce cycle time required for loading and unloading of part, this approach is useful. To fulfill the multi-functional and high performance fixturing requirements optimal design approach can be used to provide comprehensive analyses and determine an overall optimum design.

There is no need of changing machine for operations, so time required for loading and unloading is saved. The time required for all setup is minimum 60 minutes.

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