

# Design and Manufacturing of Multi-Degree Rotation of Fixture For Drilling Operation

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**Abstract-** This research paper aims to provide multi-degree rotation of fixture for taking angles at  $8^\circ$  and  $15^\circ$  respectively. The main purpose of this fixture is to ease the manufacturing of desired component without taking another fixture for various angles and put them into a single rotary fixture having various angles. Analytical calculations are done based on standard results to avoid vibration and to get desired accuracy. Objectives of this research is to provide accurate angle on fixture for drilling operation at  $8^\circ$  and  $15^\circ$  respectively.

## I. INTRODUCTION

The purpose of this project is to design rotary fixture for drilling operation. Fixtures accurately locate and secure a part during machining operations such that the part can be manufactured to design specifications. To reduce design costs associated with fix turing, various Computer aided fixture design (CAFD) methods have been developed through the years to assist the fixture designer.

The machine tool industry has undergone sufficient changes as the requirement of user engineering systems changed; first it started with the manufacture of basic general purpose machine tools. These machines though offered higher flexibility were not suitable for mass production owing to longer set up times and the tedious adjustments of machine and tools besides requiring highly skilled operators.

With growing need of fast production to meet the requirements of industry, mass production machines are conceived. Hydraulic, tracer control machine tool, special purpose automatic and semi-automatic machines were introduced with the advancement of technology. These machines were highly specialized but inflexible. The use of these machines was with a success for mass production and they have considerably reduced the production costs by way of reduced machining times and labor costs.

## II. LITERATURE REVIEW

Design and Manufacturing of Multi-Degree Rotation of Fixture for Drilling Operation we referred various papers:

Nirav P. Maniar, D. P. Vakharia makes the review on Comparative Study of Rotary Fixture Design. They found that Jigs and fixtures are the special production tools which make the standard machine tool, more versatile to work as specialized machine tools. They are normally used in large scale production by semi-skilled operators; however they are also used in small scale production by when interchangeability is important. Though various areas related to design of fixture are already been very well described by various renowned authors, a fixture design process to couple and apply all these research works to an industrial application is not yet formalized. This paper integrates all these aspects and the evolutionary functional approach of present research work is proved from the fact a real industrial knowledge model for fixture designing is developed. Careful review of the literature clearly reveals that methodology for mass balance of rotary fixture developed by investigators mostly act as post-mortem tool; calculating unbalanced mass after fixture is manufactured. A tool that could predict unbalanced mass during fixture design stage has not yet been developed. Hence in the present work, an attempt has been made to develop step by step procedure, which acts like a pre-mortem tool to predict unbalanced mass during fixture design stage well before manufacturing. The paper proposes the integrated approach of rotary fixture design for manufacturing. The innovative approach of use of Pro/Engineer Wildfire 5.0 is proposed to solve the mass balancing problem.

Shivaji Mengawade et al (2016) gives the review on Design and Analysis of Work Holding Fixture. The design of a fixture is a highly complex and intuitive process, which require knowledge. Fixture design plays an important role at the setup planning phase. Proper fixture design is crucial for developing product quality in different terms of accuracy, surface finish and precision of the machined parts. In existing design the fixture set up is done manually, so the aim of this project is to replace with fixture to save time for loading and unloading of component. fixture provides the manufacturer for

flexibility in holding forces and to optimize design for machine operation as well as process function ability.

Shailesh S. Pachbhai and Laukik P. Raut presented A Review on Design of Fixture. In machining fixtures, minimizing work piece deformation due to clamping and cutting forces is essential to maintain the machining accuracy. The various methodology used for clamping operation used in different application by various authors are reviewed in this paper. Fixture is required in various industries according to their application. This can be achieved by selecting the optimal location of fixturing elements such as locators and clamps. The fixture set up for component is done manually. For that more cycle time required for loading and unloading the material. So, there is need to develop system which can help in improving productivity and time. Fixtures reduce operation time and increases productivity and high quality of operation is possible.

Nikhil G. Lokhande and C.K. Tembhurkar study Design of Angular Drilling Fixture and Analysis of Cutting Forces during Drilling on Cylindrical Surfaces Applications such as in defense sector, manufacturing of grenade fuse required angular holes on fuse body, producing holes in turbine blades for the aerospace industry, generating micro-holes in diesel fuel injection nozzles etc requires angular drilling. Trepanning, gun drilling are the operations available for drilling at specific angle, but they can be useful when drilling angle should be less than 10 degree. The job having a cylindrical shape and number of holes are required on it at an angle is challenging task for design engineer and hence Computer Aided Fixture Design (CAFD) is incorporated in manufacturing industry. It deals with the integration of CAD and CNC programming in CAM systems using softwares for fixture design. Except V block, no other option is available to hold cylindrical object and hence special type of fixture is designed for this case, which can be used for angular drilling. In this paper, a literature survey of computer aided fixture design and automation over the past decade is proposed. First, an introduction is given on the fixture applications in industry. Then, significant works done in the CAFD field, including their approaches and customer requirements are discussed.

N. P. Maniar and D. P. Vakharia gives Design & Development of Rotary Fixture for CNC.

Various areas related to fixture are already been described by renowned authors, still there is an urgent need to apply all these research works to an industrial application. This paper presents design and development of rotary fixture for real industrial component. The component is Flow TEE body of petroleum refinery. The operations to be performed are front facing, outside diameter turning, grooving, boring

and back facing. Actually HMC is the best solution for performing the required operations, but HMC costs around 12.5 million rupees whereas CNC turning centre costs only about 2.5 million rupees. A fixture is designed which can be mounted on CNC turning centre and 10 million rupees are saved in installation cost as these operations can now be performed on CNC turning centre using the designed fixture. Methodology for mass balance of rotary fixture developed by investigators mostly act as post-mortem tool; calculating unbalanced mass after fixture is manufactured. In the present work, a pre-mortem tool is developed to predict unbalanced mass well before manufacturing. The present research also proposes alternate methods for mass balancing of rotary fixture. The paper sets the classical example of integrated approach of design for manufacturing.

### III. PROPOSED METHODOLOGY

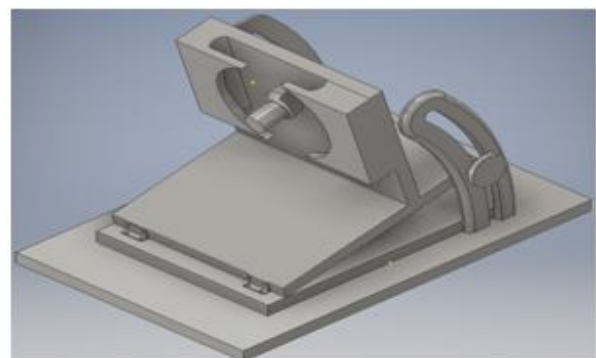
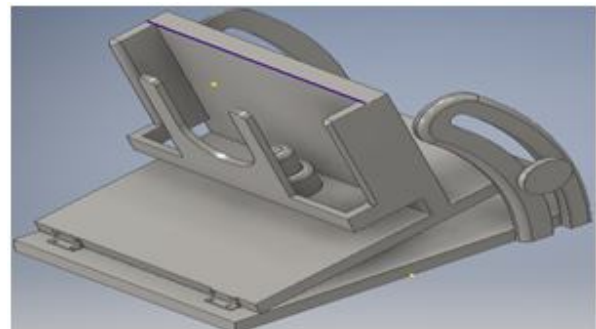


Figure shows proposed CAD model. The construction consists of clamp to hold the work piece horizontally from both the end and projection used to centered the work piece. Autocad Inventor is used as design software for fixture. The plane is provided to rotate the work piece with the help of scale which is located at the both sides of the plane.

#### IV. DISCUSSION

We have referred papers in the literature review. Various views from the study of different topics have been discussed. Nirav P. Maniar, D. P.Vakharia have summarized Comparative Study of Rotary Fixture Design. They performed an integrated approach of design and mass balancing of rotary fixture has been adopted in this work. According to Shivaji Mengawadeet. AI work holding fixture reduces or sometimes eliminates the efforts of marking, measuring and setting of work piece on a machine and maintains the accuracy of performance.

#### V. CONCLUSION

The review paper provides the knowledge model for formalization of design and mass balancing of rotary fixture is developed to enable the researcher to apply principles of fixture designing in shop floor. Work holding fixture reduces the production cycle time so increases production capacity. Simultaneously working by more than one tool on the same work piece is possible. The operating conditions like speed, feed rate and depth of cut can be set to higher values due to rigidity of clamping of work piece by fixtures. Operators working become comfortable as his efforts in setting the work piece can be eliminated. Semi-skilled operators can be assigned the work so it saves the cost of manpower also. There is no need to examine the quality of produce provided that quality of employed fixtures is ensured.

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