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# Development, Fabrication and Analysis of Fixture

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**Abstract:** A fixture is designed, built to hold, support and locate every component to ensure that each is drilled or machined with accuracy and manufactured individually. A fixture can be designed for the particular job using production tools which make the standard machine tool more versatile to work as specialized machine tools. They are normally used in small scale production by semi skilled operators. This dissertation work aims at designing a fixture used for performing machining operations at certain angle (102.5 degree) on the Crank case used in commercial vehicles. The design is proposed so that the required operations are performed properly with the conventional CNC machines to obtain required dimension which includes Design & Structural analysis of fixture is carried out using known and proven methods, i.e., Creo Elements/Direct modelling 17.0 Software.

**Keywords:** CNC's, Design, Structural Analysis, Creo Elements

## I. INTRODUCTION

Fixtures are the tools used to locate and hold the work piece in position during the manufacturing process. Fixtures are used to hold the parts firmly which are to be machined, it is used to produce the duplicate parts accurately. In order to produce parts with required accuracy and dimensions the parts must be firmly and accurately fixed to the fixtures. To do this, a fixture is designed and built to hold, support and locate the work piece to ensure that each work piece is machined within the specified limits. Set blocks, feeler or thickness gauges are used in the fixture to refer the work piece with the cutter tool. A fixture should be securely fastened to the table of the machine upon which the work is to be done. Though largely used on milling machines, fixtures are also designed to hold the work for various operations on most of the standard machine tools. Fixtures vary in design based on the use of relatively simple tools to expensive or complicated devices. Fixture helps to simplify metalworking operations performed on special equipments.

## II. LITERATURE REVIEW

Chen Luo, LiMin Zhu, Han Ding, in his paper Two-Sided Quadratic Model for Work piece Fixturing Analysis, 2011 proposed that presents a novel model for work piece positioning analysis. Existing fixturing models may underestimate the positioning error due to neglect of the curvature of one or both contacting bodies.

S. Kashyap W.R. DeVries in their paper Finite element analysis and optimization in fixture, proposed with minimizing deformation of the work piece due to machining loads about fixturing support positions, especially in thin castings.

Y. Zheng & Y. Rong & Z. Hou in their paper, A finite element analysis for stiffness of fixture units, proposed a systematic finite element model to predict the fixture unit stiffness by introducing nonlinear contact elements on the contact surface between fixture components.

M. Y. Dakhole, Prof. P.G. Mehar, Prof. V.N. Mujbaile, in their paper, Design And Analysis Of Dedicated Fixture With Chain Conveyor, gives a feasible solution on conventional roller chain conveyerised arrangement with dedicated moving fixture with conveyor for the tractor components like rear axle carrier, bull gear and shaft of a tractor model.

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## III. METHODOLOGY

Methodology is a systematic approach for realization of total task. It consists of following details:

- Study of component: The study of component is the most important and the first step for the designer. The component drawings are carefully scrutinized to extract the maximum possible information. The important information available is the critical dimensions, locating and clamps areas.
- Geometric model of component: Geometric modeling of component is done using Co- Create considering all the critical dimensions.
- Step by step design calculations: It is carried out to determine the various design parameters that determine cutting force induced on the component during milling operation.
- Selection of tooling materials: The material used in the manufacturing of fixture varies depending on the applications. Proper material selection and proper combination of alloys in varying percentages are required for finished fixture.
- Solid modeling of tool: 3-D modeling of entire Component is done using Co-Create software. For the better understanding of 2D drawings and visualization, modeling has been done. The required dimensions are determined by calculation, which is used during modeling of the tool.
- Analysis: Structural analysis is carried using ANSYS software to determine the total deformation and the stresses induced in the fixture during operation.

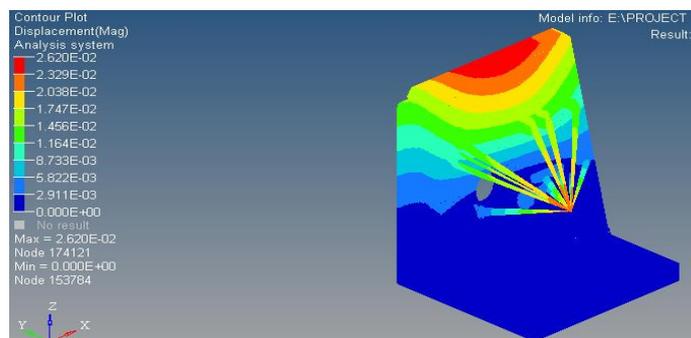


Fig.1 Deformations occurred due to applied loading conditions in ANSYS.

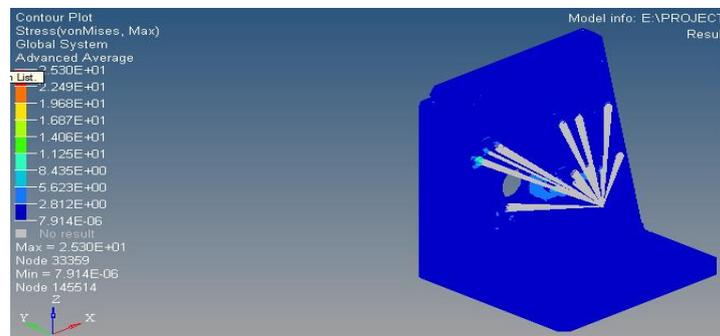


Fig.2 Stresses acting on the fixture due to the applied load.

## IV. CONCLUSION

The design of the fixture is simple, the loading and unloading of component is very easy. At a time all the operations such as milling, boring, drilling, tapping can be done in a single set up which in turn decreases the handling and

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machining time. This fixture is designed in such a way that any operations are supposed to be done at certain angle can be easily performed on this fixture as we can perform the machining action on both the sides. And this fixture is designed with minimum number of parts. Considering the static forces over the component which is in contact with the fixture is analysed, it shows the total deformations and the stresses acting on the fixture during the machining process done on the fixture. Hence these results indicate that the design is well within the safe limits. Hence the design is safe.

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