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Review on Design Analysis & Development of Fixture for Engine Block

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Abstract: ***The Design, Analysis & Development of the Fixture described in this project is to convert Three fixtures for three different components into One fixture for three components, that is Three in one fixture. The three-in-one fixture will be a milling fixture used for the secondary operation of three different casted engine blocks. It will reduce the cycle time, and cost of manufacturing, also the cost of fixtures will be reduced as compared to the manufacturing cost of three fixtures.***
Keywords: Fixture, Analysis, Engine Block, Operation, Cost.

I. INTRODUCTION

A fixture is a work-holding or support device used in the manufacturing industry. Fixtures are used to securely locate (position in a specific location or orientation) and support the work, ensuring that all parts produced using the fixture will maintain conformity and interchangeability. Using a fixture improves the economy of production by allowing smooth operation and quick transition from part to part, reducing the requirement for skilled labor by simplifying how workpieces are mounted, and increasing conformity across a production run.

A fixture's primary purpose is to create a secure mounting point for a workpiece, allowing for support during operation and increased accuracy, precision, reliability, and interchangeability in the finished parts. It also serves to reduce working time by allowing quick set-up, and by smoothing the transition from part to part. It frequently reduces the complexity of a process, allowing unskilled workers to perform it and effectively transferring the skill of the tool maker to the unskilled worker. Fixtures also allow for a higher degree of operator safety by reducing the concentration and effort required to hold a piece steady.

Fixtures should be designed with economics in mind; the purpose of these devices is often to reduce costs, so they should be designed so that the cost reduction outweighs the cost of implementing the fixture. It is usually better, from an economic standpoint, for a fixture to result in a small cost reduction for a process in constant use, than for a large cost reduction for a process used only occasionally.

II. LITERATURE REVIEW

This study and observation are focused on the existing system. The literature survey has been pioneered effort in this regard. Various design concepts and CAD/CAE concepts from the literature help to establish a comparative study between existing and new experimentation. The terminologies referred from literature for designing are discussed as follows:

1) *Setup Planning Methodology for Prismatic Parts Considering Fixturing Aspects (Deb Sankha):* Setup planning is an important part of process planning that has been widely investigated by various researchers. However, the output of the traditional setup planning approaches is limited and insufficient for the upstream process planning activity, and fixture design. In this work, a setup planning system is developed that provides sufficient inputs to the fixture designer in terms of recommended depth of cut and feed, fuzzy clamping forces, near-optimal locator and clamp layout, and sizes of the locators and clamps. The fixture designer can further optimize the fixture plan by taking these inputs.
2) *Computer-Aided Fixture Design Verification. Part 3. Stability Analysis (Yiming Kang):* In fixture design, a workpiece is required to remain stable throughout the fixture and machining processes in order to achieve safety and machining accuracy. This requirement is verified by a function of the computer-aided fixture design verification (CAFDV) system. This paper presents the methodologies of fixturing stability analysis in CAFDV. A kinetic fixture model is created to formulate the stability problem, and a fixture stiffness matrix (FSM) is derived to solve the problem. This approach not only verifies fixturing stability, but also finds the minimum clamping forces, fixture deformation, and fixture reaction forces. The clamping sequence can also be verified with this approach.

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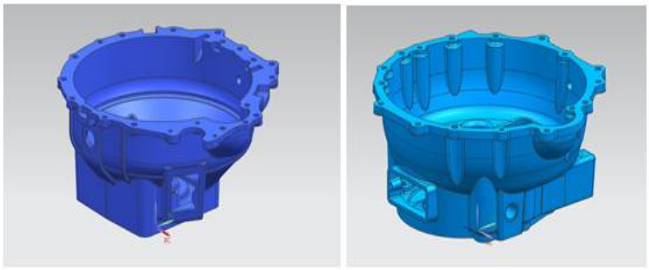
3) *IJFTET Vol.1, Issue 1: A Study on Fixture Design for Complex Part:* The fixture designing and manufacturing is considered a complex process and requires knowledge of different areas, such as Geometers, Dimensions, Tolerances, Procedures, and manufacturing processes. This study is about the 3-2-1 principle of fixture design and the different approaches which are used in the related fixture design are explained. The main concentration of the study gives us the idea and path that what are the further steps and work plan for the fixture design
4) *Sheldon Levine:* [1], highlighted the importance of the rigidity of fixture. The paper addresses the vibration response of the fixture, to get the fixture as rigid as possible within the allowance weight limits & fixture should therefore have no resonances within the frequency range. That is, the first resonant frequency should be above the maximum specified tested frequencies.
5) *Eiji Nabata & Yuji Terasaka:* In their paper proposed that large vibrations can occur in tools and workpieces during machining. This vibration causes problems in machine accuracy, efficiency, tool life, and safety. One of the causes of vibration is the lack of sufficient dynamic rigidity to stability of parts in a dynamic cutting force. In this case, parts are forced by a jig to supplement inadequate rigidity. This report describes the development of vibration analysis technology for analyzing of an entire system including jigs achieved through the utilization of recent 3D CAD

III. PROBLEM IDENTIFICATIONS



1) Manufacturing cost of three fixtures will be high.
2) Loading and unloading fixtures on the machine takes time.
3) Setting the fixture needs a high amount of accuracy each time, and the chances of errors are higher.

IV. OBJECTIVES

1) Design and analysis and Development of Fixture
2) To reduce the cycle time and manufacturing cost.

V. SCOPE OF WORK

1) Designing a single fixture, which can be used for all three Engine blocks.
2) Checking of provisions of best possible location of Engine blocks.
3) Provision of easy Loading and unloading

VI. METHODOLOGY

The complete study of the Design, Analysis & Development of the Fixture will be done.

1) Through the CAD Software Unigraphics 12.
2) Study of components.
3) Fixture design consideration.
4) Design calculations.
5) Geometrical dimensional consideration.
6) Modelling using Unigraphics 21 software.
7) Stress Analysis using Ansys.

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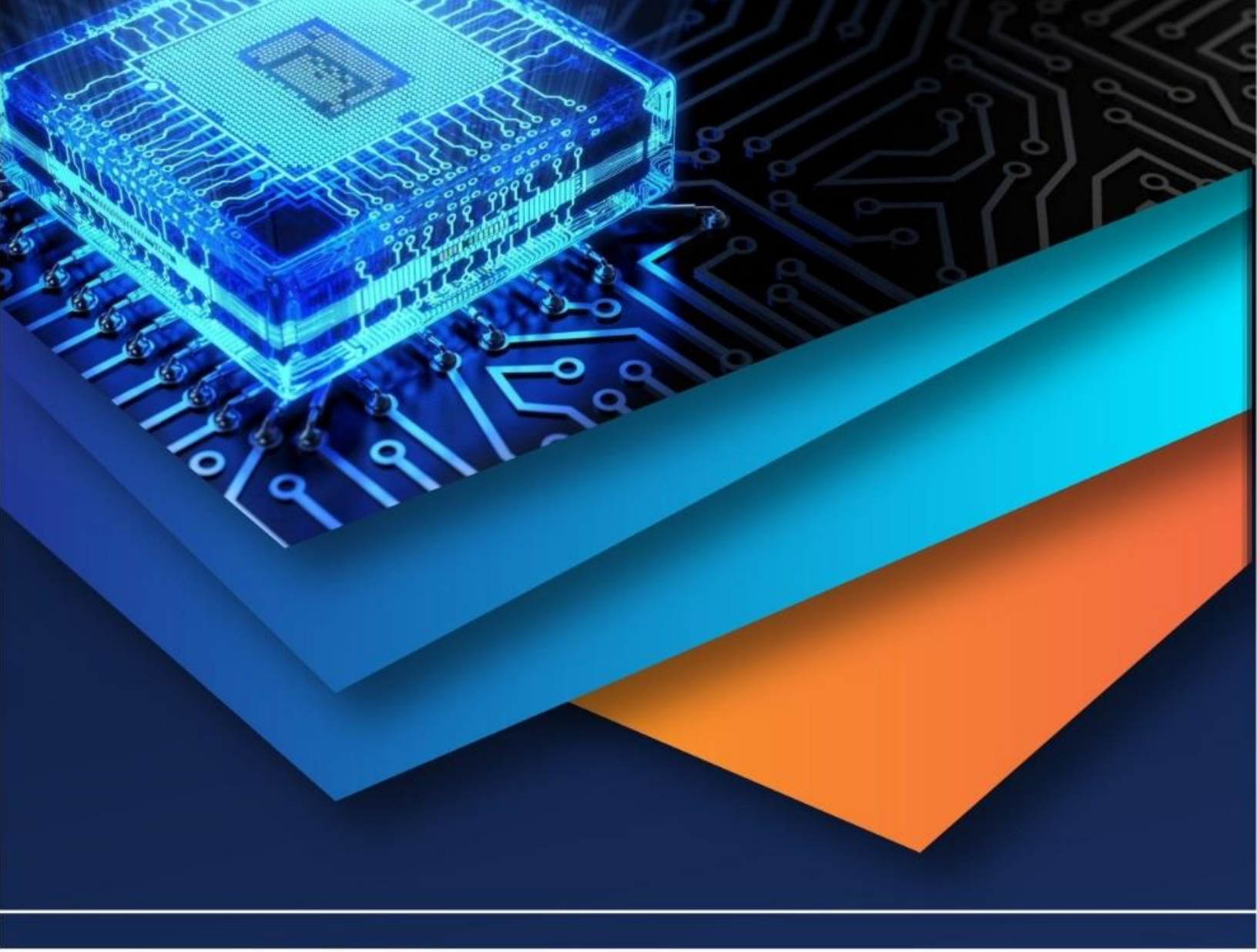

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