DESIGN AND MANUFACTURING OF FUZE SHELL

Pooja Vijay Angolkar, Pratibha Dharmavarapu, Dr. P.Ravikanth Raju
Anurag Group of Institutions,Hyderabad

ABSTRACT- Projectiles that explode, carry chemicals, or carry other payloads are called shells. Projectiles that are completely solid or do not explode are sometimes called shot. Most modern projectiles have many features in common. These features include a fuze, ogive, bourrelet, and rotating band Fuze shell is a part of projectile which is assembled at front. As fuze shell is part of projectile it requires high accuracy in dimension and surface finish. This makes the manufacturing of Fuze shell a tough task. Due to its complicated structure

This project deals with drafting, 3d modeling, process plan and NC program generation and manufacturing of the fuse shell. Drafting and 3d modeling is done using NX-CAD software. Process plan and NC program generation is done using NX-CAM software.

Keywords : **Fuze Shell, Design And Manufacturing, Projectiles, NC Program, 3D Modeling.**

INTRODUCTION

An fuze shell is the type of military weapon fuze used with artillery munitions, typically projectiles fired by guns. A fuze is a device that initiates an explosive function in a munition, most commonly causing it to detonate or release its contents, when its activation conditions are met. This action typically occurs a preset time after firing (time fuze), or on physical contact with (contact fuze) or detected proximity to the ground, a structure or other target (proximity fuze).

Fuze shell are tailored to function in the special circumstances of artillery projectiles, the relevant factors are the projectile's initial rapid acceleration, high velocity and usually rapid rotation, which affect both safety and arming requirements and options, and the target may be moving or stationary. Fuze shell may be initiated by a timer mechanism, impact or detection of proximity to the target, or a combination of these. Fuze shell is a part of rocket hence it requires accurate dimensions and due to its cone type stucture it demands for fixture.

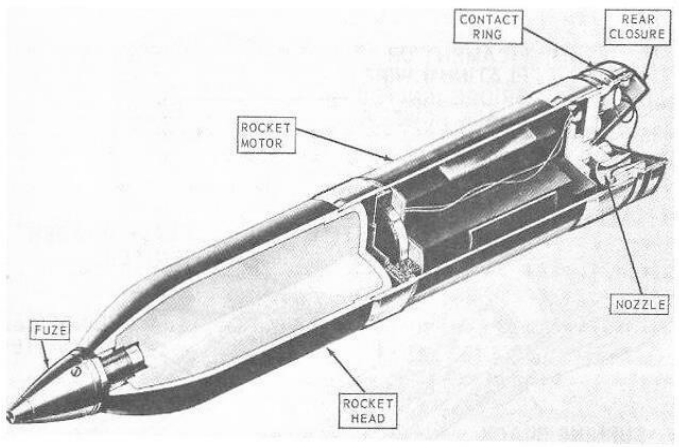


FIGURE 11A1.—5-inch spin-stabilized rocket.

Fig.1: Rocket with Parts

DESIGNING FIXTURE FOR FUZE SHELL

Fixtures accurately locate and secure a part during machining operations such that the part can be manufactured to design specifications. To reduce the design costs associated with fixturing, various computer-aided fixture design methods have been developed through the years to assist the fixture designer.

Fixture layout design is a major concern in the development of automated fixture design systems. The task of fixture layout design is to layout a set of locating & clamping points on work piece surfaces such that the work piece is accurately located & completely restrained during manufacturing operations. Fixtures accurately locate and secure a part during machining operations such that the part can be manufactured to design specifications. To reduce the design costs associated with fixturing, various computer-aided fixture design (CAFD) methods have been developed through the years to assist the fixture designer.

Fixture Design Concepts: (Managing degree of freedom)3:2:1 (3 At least 3-Point to define a plane) (2 At least 2-Points to define location) (1 At least 1-point for clamping)

Fixture layout design has received considerable attention in the recent years. However, little attention has been focused on the optimization of manufacturing fixture layout under dynamic conditions of the work piece.

MODELLING OF FUZE SHELL

Fuze shell 2D drawing

A 2D drawing is used to design a 3D model for our component using Unigraphics NX 7.5 CAD software.

Below image shows the 2D drawings of the Fuze shell with all the required dimensions for manufacturing the component without any errors.

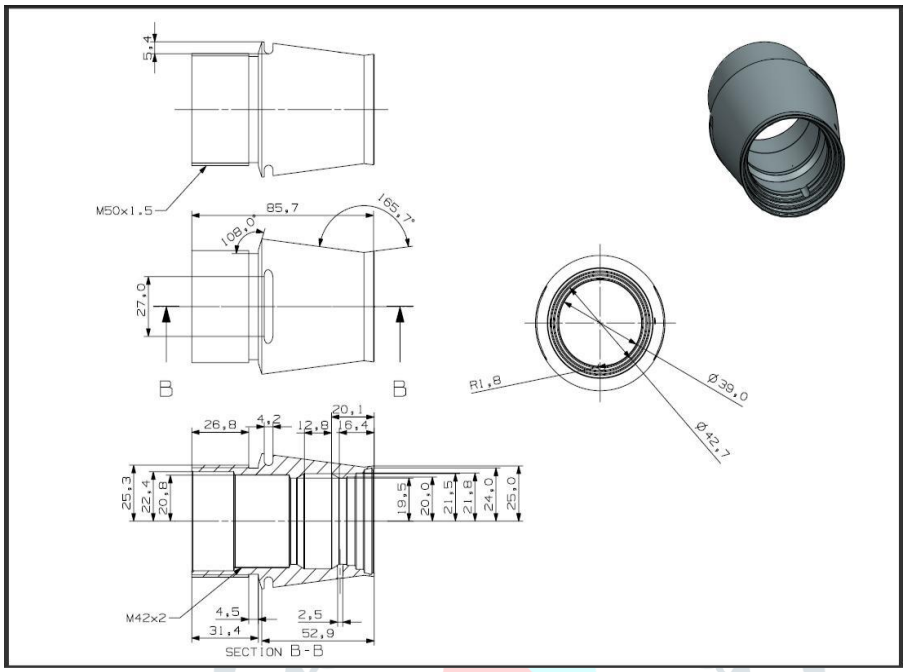


Fig.2: 2D drawing of Fuze shell

STEPS INVOLVED IN 3D MODELLIMG OF FUZE SHELL

3D modelling of Fuze shell by using NX cad software

Sketching:

Below is the sketch required to obtain the 3D model of the Fuze shell from the above 2D drawing.Below image shows the sketch and revolve of the Fuze shell. Fig.shows : the sketch and revolve

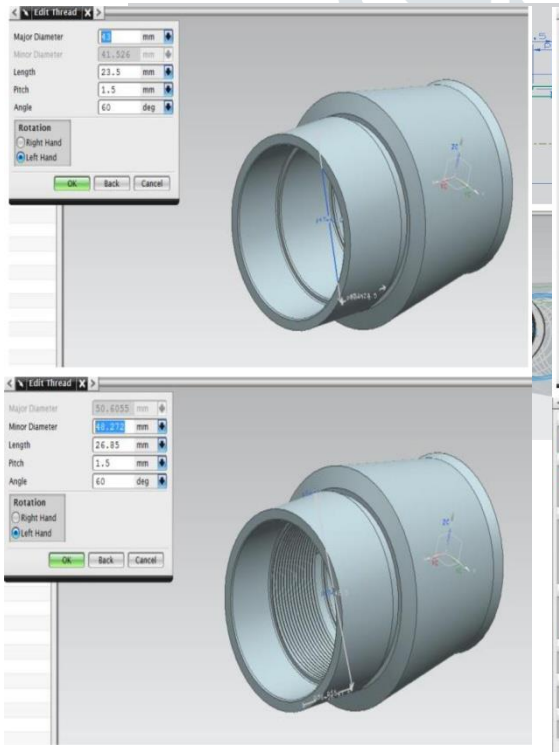


Fig.3: Internal and external threading

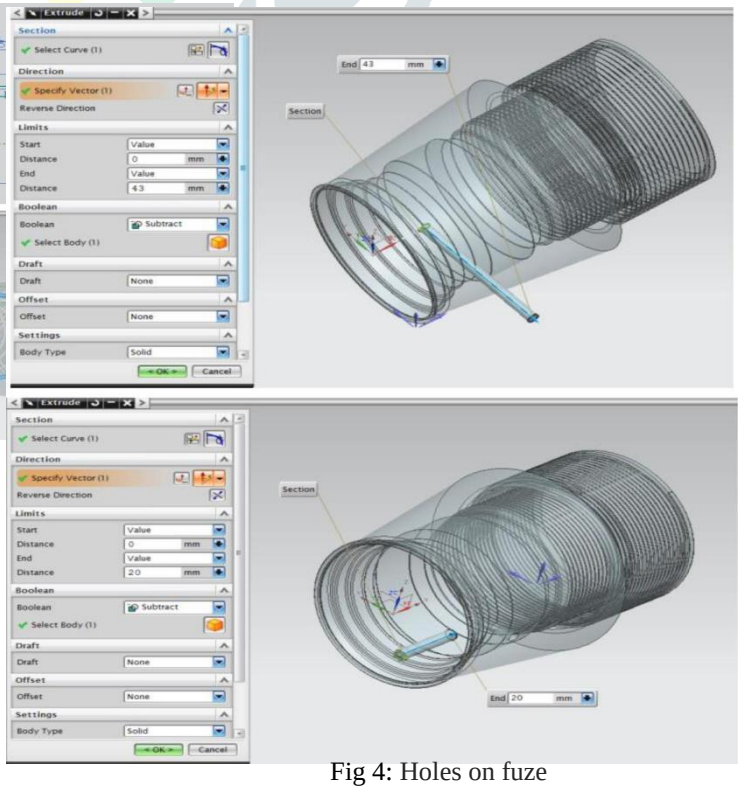
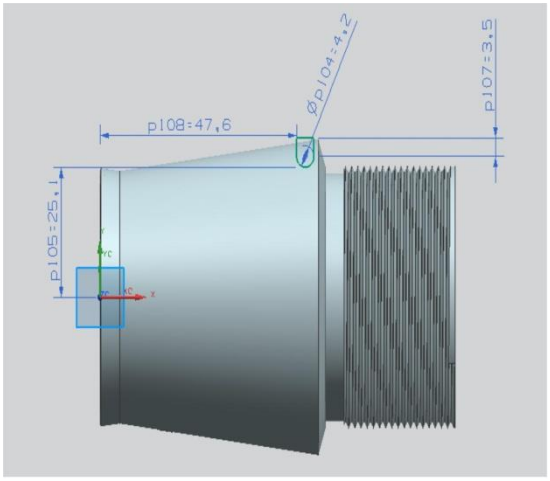


Fig 4: Holes on fuze



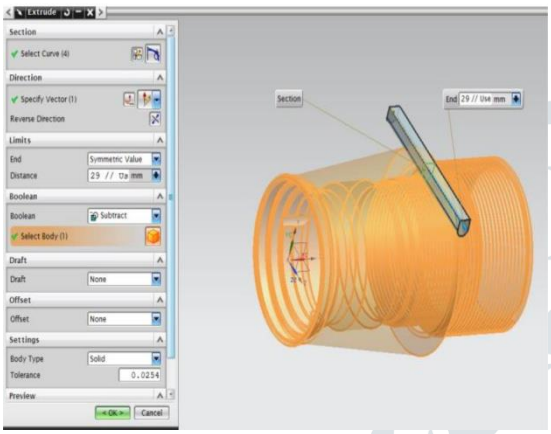
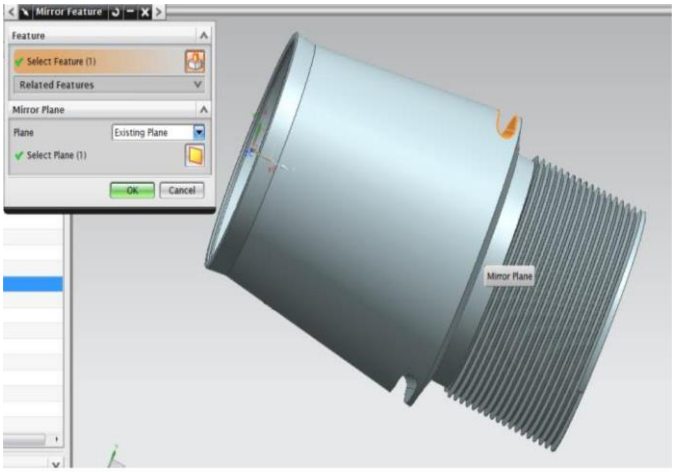


Fig.5: Slots on fuze



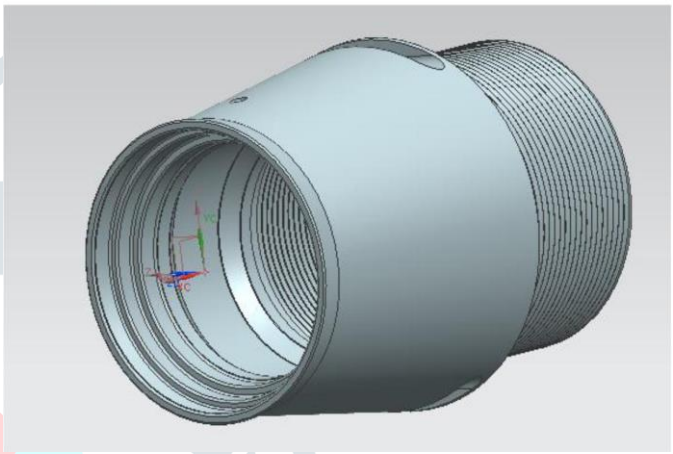


Fig.6: final 3D model of fuze

COMPUTER AIDED MANUFACTURING

- After creating 3D model of Fuze shell tool path is generated using NX-cam software.Fuze shell material is steel.
- Methodology used in manufacturing of Fuze shell is as mentioned below.
- Identifying suitable machine.
- Selecting suitable tools for manufacturing component.
- Designing fixture/fixture to support Fuze shell component for external operations. Listing down the Sequence of operations performed on Fuze shell component.
- Generating tool path at specified cutting speed.
- Generating NC program using NX-CAM software.

IDENTIFY SUITABLE MACHINE

TYPES OF CNC MACHINE USED IN THIS PROJECT:

MORI SEIKI 4-AXIS CNC turning machine is used for machining Fuze shell. DMG MORI SEIKI offers the industry's best line-up of high-performance lathes with better precision and rigidity, greater multi-axis compatibility and smaller footprints

High rigidity with Integrated Turning Spindle. Spindle is directly coupled with motor. Y-axis machining, Up to 100mm (+/- 50). 4-axes simultaneous machining, C-axis with 360 deg, Positional Accuracy +/- 0.005mm, Repeatability +/- 0.003mm. In 4-axis turning machine, Axis represents as work piece rotation and spindle movement in x, y, z directions.

Fig 7: axis CNC MORI SIEKI turning machine

GENERATING TOOL PATH ON FUZE SHELL

The series of movements made by the tip of a cutting tool. X and Z codes indicate a tool path within a part program. The path through space that the tip of a cutting tool follows on its way to producing the desired geometry of the work piece.

Below image shows Raw material and part of Fuze shell

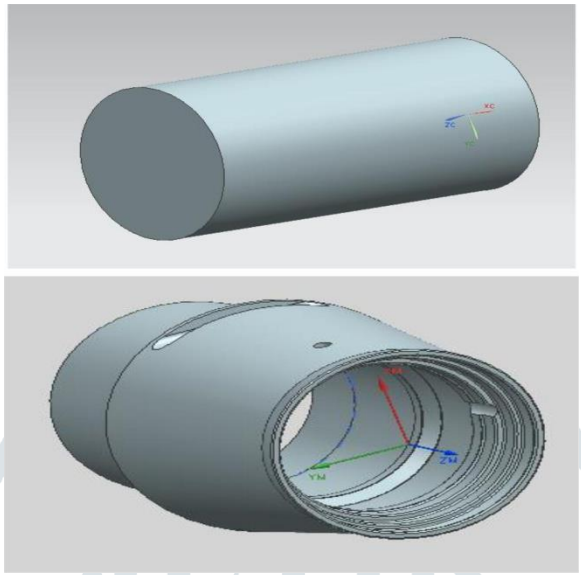


Fig 8: Raw material and part of Fuze shell

CAM OPERATION IN NX-CAM

Basic CAM setup

In NX the NC machining environment is referred to as the setup.

The set up for the machining jobs should be decided by looking at all the environmental information from four viewpoints: Program, Method, Geometry, and Tool.

These four viewpoints were designed to mimic the thought process that can be used when planning the NC program.

Each viewpoint organizes the information for the operation in a manner relevant to that particular viewpoint.

GENERATING TOOL PATH ON FUZE SHELL

The series of movements made by the tip of a cutting tool X and Z codes indicate a tool path within a part program. The path through space that the tip of a cutting tool follows on its way to producing the desired geometry of the work piece.

Below image shows Raw material and part of Fuze shell

LIST OF OPERATIONS AND TOOLS

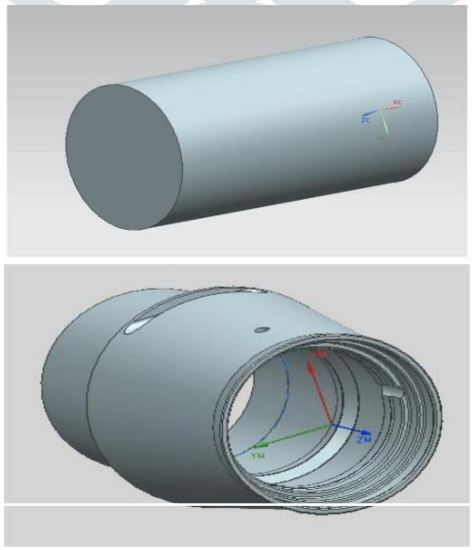


Fig 9: Raw material and part of Fuze shell

TOOL PATH CREATION AND VERIFICATION ON FUZE SHELL:

Setup_1 Operations:

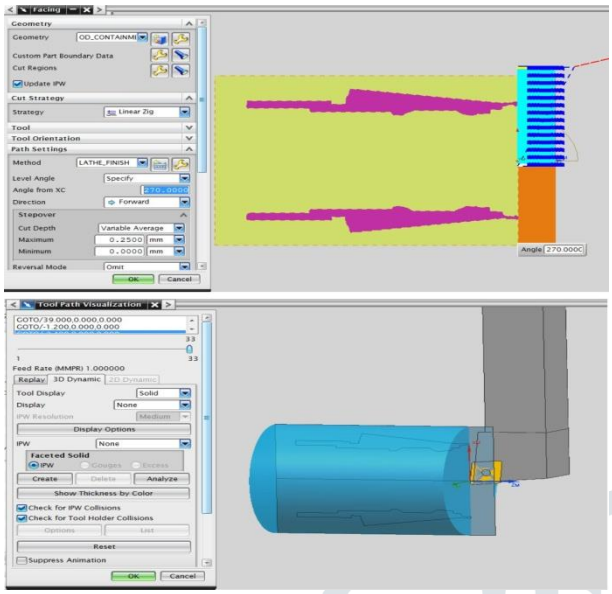


Fig.10: facing operation & verification

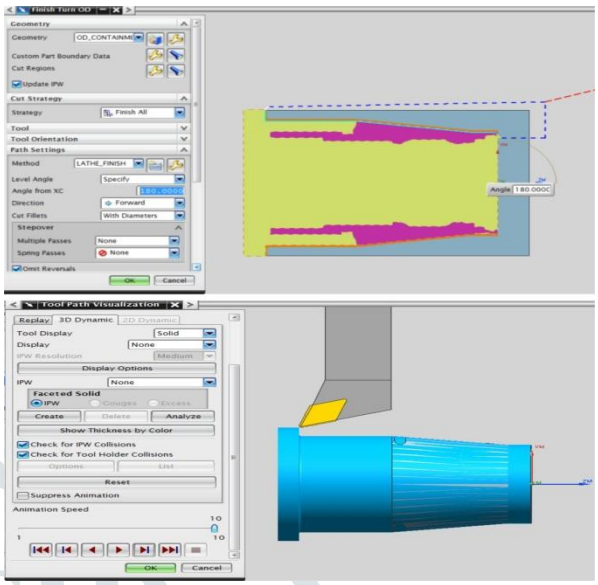


Fig.11: finishing operation & verification

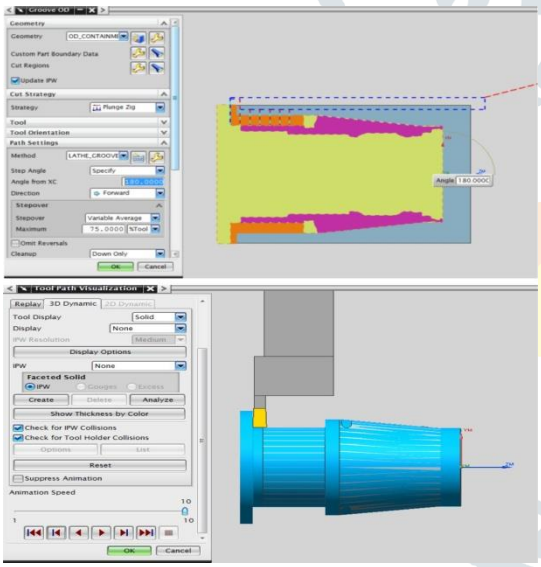


Fig 12: Groove operation & verification

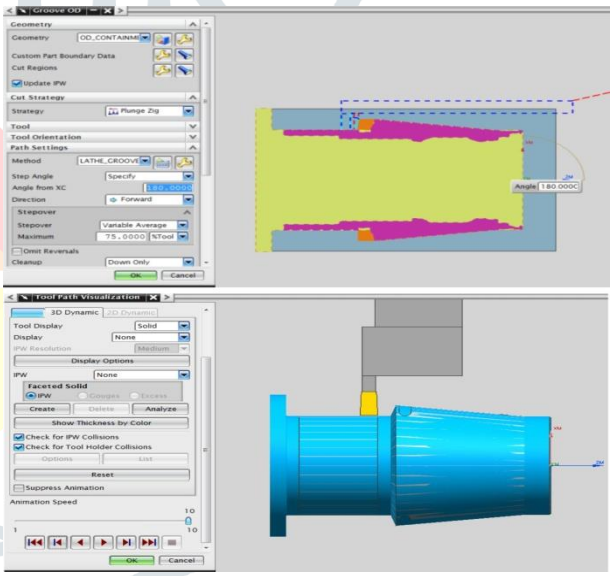


Fig 13: Groove operation & verification

MILLING OPERATIONS

After completing turning operations part is placed on milling operation semi finished part is raw material for milling operations.

Below image shows raw material and part for milling operations

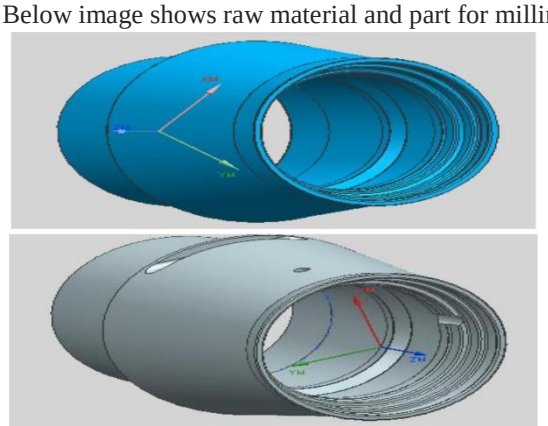


Fig 14: raw material and part for milling operations

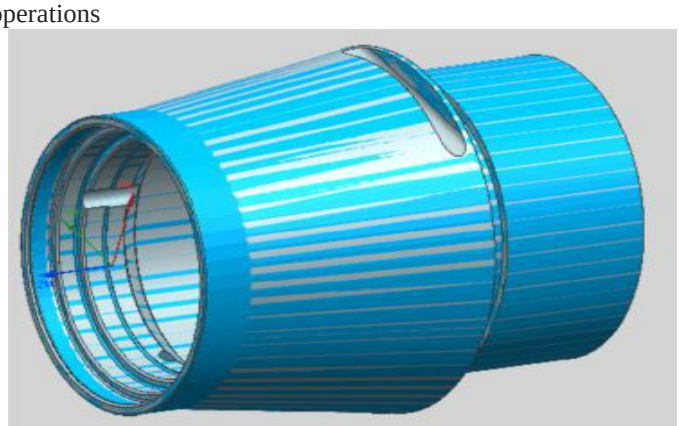


Fig 15: final component after generating tool path

CONCLUSION

- 3D model of FUZE SHELL is created using UGNX-7.5 –CAD.
- Tool path is generated for "FUZE SHELL" component using CAM software ('UGNX-7.5' which is CAD/CAM software used to generate part program by designing and feeding the geometry of the component)
- The generated part program will be transferred to the required CNC machine with the help of DNC lines.
- Hence this component is being manufactured by using MORISEIKI machine.

REFERENCES:

1. Shailesh S.Pachbhai- A Review on Design of Fixtures- International Journal of Engineering Research and General Science Volume 2, Issue 2, Feb-Mar 2014.
2. Suvo, Lamar Stonecypher 2010- The 3-2-1 Principle of Jig Fixture Design-bright hub engineering.
3. Colvin, Fred H.; Haas, Lucian L. (1938). *Jigs and Fixtures: A Reference Book*. New York and London: McGraw-Hill Book Company.
4. Iain Boyle-A review and analysis of current computer-aided fixture design approaches in Journal Robotics and Computer-Integrated Manufacturing Volume 27 Issue 1, February, 2011
5. Shrikant V.Peshatwar-Design and Development of Fixture for eccentric shaft International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com Vol. 3, Issue 1, January -February 2013
6. J. C. Trappey and C. R. Liu- A literature survey of fixturedesign automation–vol 5.
7. 4expertise.com Store Directory: Jig and Fixture Design, 3rd Edition. www.4expertise.com/jigs-fixtures.html
8. N. P. Maniar, D. P. Vakharia -Design & Development Of Rotary Fixture For CNC With An Approach Of Developing Pre-Mortem Tool For Mass Balancing- vol2.
9. Pollack - A Global Average Model of Atmospheric Aerosols for Radiative Transfer Calculations. *J. Appl. Meteor*, -vol 15, 225–246.
10. "Five Whys Technique". *adb.org*. Asian Development Bank. February 2009. Retrieved 26 March 2012.
11. Burley and Corbett -Design for Tooling to Enable Jigless Assembly - An Integrated Methodology for Jigless Assembly.
12. Henriksen, Erik K. (1973). *Jig and Fixture Design Manual*. New York, N.Y.: Industrial Press Inc.
13. Bekijk en vergelijk informatie, beoordelingen, vragen & antwoorden en de beste winkels voor 'Jig And Fixture Design' op BESLIST.nl ▪ Boeken Engels ms and Software, 2005, in press.