

## 3D Model Generation For Deckel Cover Plate By Using CAD/CAM Application

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### ABSTRACT

Process planning is a production organization activity that transforms a product design into a set of instruction (sequence, machine tool setup etc.) to manufacture machined part economically and competitively. Deckel cover is a board, usually of stainless steel, fitted under part of the wire in a Fourdrinier machine for supporting the pulp stack. Pulp stack is a fibrous material prepared by chemically or mechanically separating cellulose fibres from wood, fibre crops or waste paper. Wood pulp is the most common raw material in paper making. A frame used to contain pulp on the mould in the making of handmade paper. Also called deckle strap a strap on each edge of the moving web of paper on a paper-making machine that fixes the width of the paper. This project's goal is to developing manufacturing process of deckle cover using NX-CAM software. Unigraphics software shall be used for making design of deckle cover.

### INTRODUCTION

#### FOURDRINIER MACHINE

**Fourdrinier machine**, device for producing paper, paperboard, and other fibreboards, consisting of a moving endless belt of wire or plastic screen that receives a mixture of pulp and water and allows excess water to drain off, forming a continuous sheet for further drying by suction, pressure, and heat. Calenders (rollers or plates) smooth the paper or board and impart gloss or other desired finish to the surface.

The Fourdrinier Machine is the basis for papermaking. There are four main sections used in the Fourdrinier Machine. In order to make paper the pulp has to be prepared from trees, which need to have the bark removed.

Pulp preparations The four Sections of the paper machine are:

1. Wet end
2. Press section
3. Dryer section
4. Calendar section

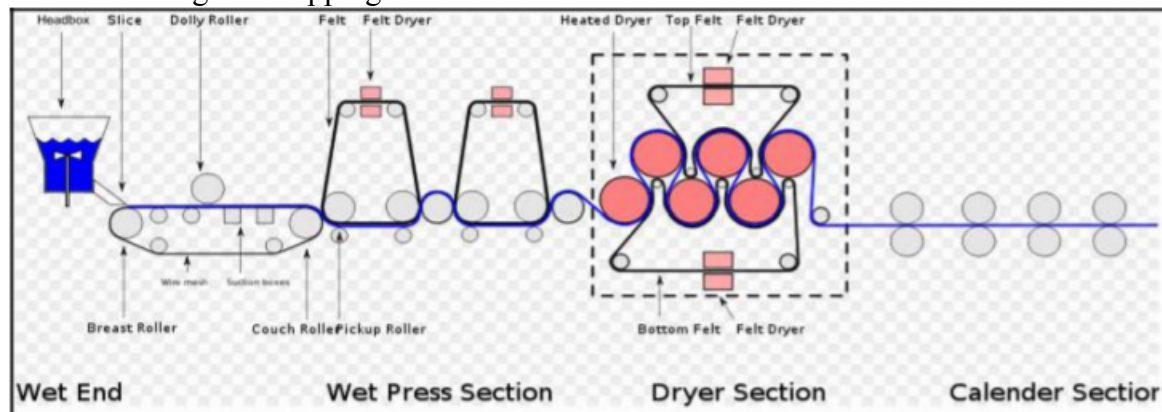
The first section is typically known as the wet end. Pulp may be delivered to the Fourdrinier machine in a slurry form (a mixture of fibre and water) directly from the pulping process. After refining the pulp is mixed with some of the following: sizing, fillers, colours, retention aid and waste paper called broke to a stock, and passed on. The stock enters the headbox and is fed onto wire mesh rollers with jets of pressurised water to make the fibres in the pulp face the same way. The water is removed along these belts.

The second section of the Fourdrinier machine is the press section, which removes the most water. The paper is fed over huge rollers that spin and remove the water from the paper.

The third section is the dryer section of the Fourdrinier machine. It dries the pulp by way of a series of steam-heated rollers that stretch the paper and help remove any moisture. Additional

sizing agents, including resins, glue, or starch, can be added to the web to alter its characteristics. Sizing improves the paper's water resistance, decreases its ability to fuzz, reduces abrasiveness, and improves its printing properties and surface bond strength.

The fourth section is called the calender section and consists of a number of rolls, where pressure and heat is applied to the passing paper. Calenders are used to make the paper surface extra smooth and glossy. It also gives it a more uniform thickness. The pressure applied to the web by the rollers determines the finish of the paper. After calendering, the web has a moisture content of about 6%. It is wound onto a roll called a tambour, and stored for final cutting and shipping.



## 1.2 DECKEL COVER

Deckel cover is a board, usually of stainless steel, fitted under part of the wire in a Fourdrinier machine for supporting the pulp stack. Pulp stack is a fibrous material prepared by chemically or mechanically separating cellulose fibres from wood, fibre crops or waste paper. Wood pulp is the most common raw material in papermaking. A frame used to contain pulp on the mould in the making of handmade paper.

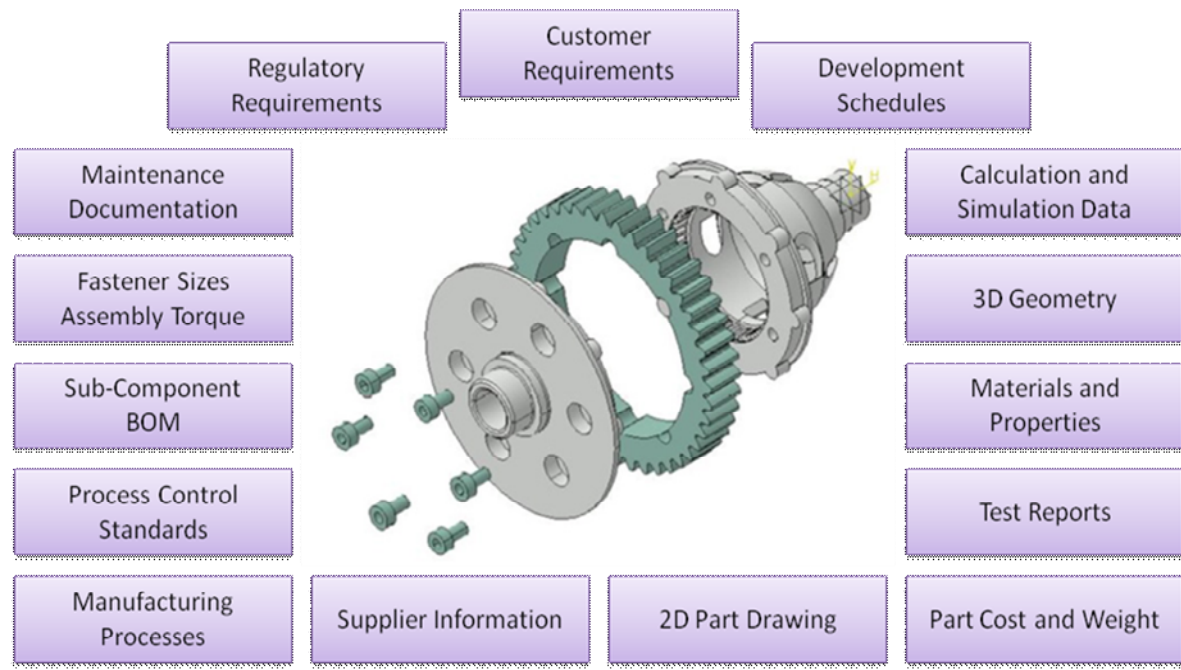
## 1.3 PROCESS PLAN

Process planning refers to the product design and decides how to manufacture it within the resource constraints. Process planning can be seen as an activity which integrates knowledge about products and resources. Manufacturing process planning is the process of selecting and sequencing manufacturing processes such that they achieve one or more goals and satisfy a set of domain constraints. Process planning is a production organization activity that transforms a product design into a set of instruction (sequence, machine tool setup etc.) to manufacture machined part economically and competitively. The information provided in design includes dimensional specification (geometric shape and its feature) and technical specification (tolerance, surface finish etc.) My project deals with the manufacturing of “support” component using CAM software (‘UGNX-7.5’ which is a CAD/CAM software used to generate part program by designing and feeding the geometry of the component) and defining the proper tool path and thus transferring the generated part program to the required CNC machine with the help of DNC lines. Then the program is executed with suitable requirements.

A board, usually of stainless steel, fitted under part of the wire in a Fourdrinier machine for supporting the pulp stack before it is sufficiently formed to support itself on the wire. The component can be either designed in UG or can be retrieved from any other CAD software. Then sequence of programs such as modeling the component, selection of tools

according to the sequence of operations and sizes, generating the tool path, at last the generated NC part program is verified and sent to the required CNC machine to manufacture the particular component. Finally the required surface finish has been obtained by machining the component at optimum speeds and feeds and the cost of machining is also optimized by choosing optimal machining process and machine tools.

### Product Development in a Manufacturing Industry:



## LITERATURE REVIEW

**1. Engine valve cover die modelling, manufacturing with analysis of valve cover by rupesh v kharbe1a, girish tembhare,** The engine is a major source of vibration and noise in automotive vehicles. Among the power train components, the valve cover has been identified as one of the main noise contributors due to its large radiating surface and thin shell-like structure. From design point of view, it is necessary to know the modal characteristics (modal frequencies and mode shapes) of the valve cover structure so that the design modification can be carried out accordingly. In this project, the modal response of a production cover was studied through experimental testing and numerical simulation (finite element modelling). During testing, the production engine cover was placed in free-standing and fixed conditions. The engine cover was excited with an impact hammer and its vibration responses were measured by a number of accelerometers placed at cover surface. The first five modal frequencies ranged from approximately 500 Hz to 2000 Hz. The modal response of the engine cover was further analyzed by finite element simulation. The simulations were conducted at identical boundary conditions: free-standing and fixed. The finite element analysis predicted the similar modal frequencies to those obtained from experimental testing. In addition, the finite element simulation showed the mode shape of the cover.

**2. Design of integrated breather valve cover for large power engines by Sudhakar Nandam,** Tier 4 Emission control versus Conventional engine design” is what every design

engineer's challenge to be dealt with. To design an engine to current market standards and requirements has become very intricate. In order to make such an explicit design which meets the standards, every component of the engine plays as a vital role. Every component design and development to current engineering standards pushes the envelope of manufacturability to new limits, which constraints the cost of the product across the ease of manufacturability of it. In consideration of the complexity to be attained, every component design contributes to the existence of a complete standardized engine, such as integrated valve cover.

With the new tier 4 final regulations for engine manufactures, every new engine produced needs to meet those regulations. Caterpillar Inc regulated to produce tier 4 final compatible engines for the market. The new drive for development of new engines identified the objective of this project to design a new integrated breather valve cover for large power engines. Valve Cover, the noun by name explains it covers valves. In explanation to the definition of the valve cover, it covers the cylinder head mechanism; this is a high speed operating valve. Valve Cover not only covers the head mechanism and should also be persistent to pressure, stress and heat dissipated during the operation of the engine. Valve cover design initiates and explains the intricacy of a complete engine design.

Conclusion on complete product design of integrated breather valve cover with optimal solution of all the available techniques in every aspect of design, development and real time production of valve cover have been discussed in this project.

**3. Finite Element Analysis of Gate Valve by Dr. K.H. Jatkari, Sunil S. Dhanwe,** Gate valves are used when a straight-line flow of fluid and minimum restriction is desired. Gate valves are so named because the part that either stops or allows flow of fluid through the valve acts somewhat like the opening or closing of a gate and is called, appropriately, the gate. The objective of this paper to perform a stress analysis of the critical component of Gate Valve. The critical components in the Gate Valve are Body, Gate Stem and slab gate. This paper comprises Finite element analysis of Gate Valve. A model of each element of Gate Valve is developed in CATIA V5R17, and analyzed in ANSYS 11. Gate valve stress analysis is done by FEM using ANSYS 11 and validation is supported by stress analysis using classical theory of mechanics. Finally, the result obtained from FEM software and classical analytical theory is compared.

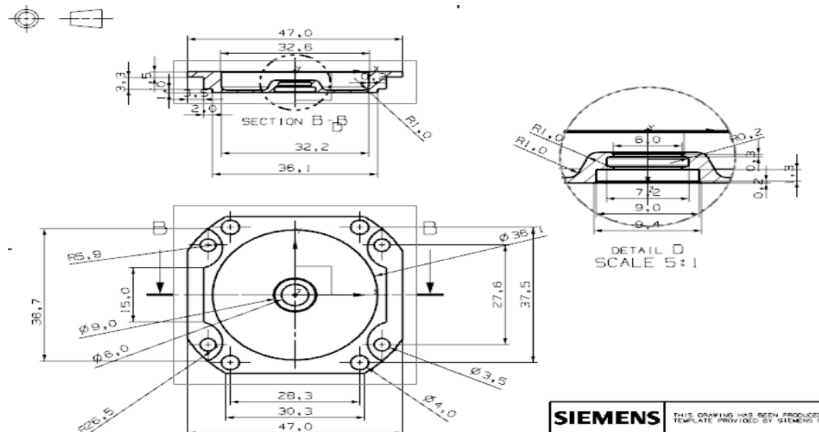
**4. Designing successful rocker covers in PA66 by Charles Taylor,** Rocker covers were first used in the 1920s and 1930s at the advent of overhead valve engines. These early models were typically either stamped steel or cast in aluminium or iron. In the 1930s and 1940s, automotive design and engineering began to standardize across the industry. Almost all rocker covers during this period were made out of stamped steel, and designs changed very little until the 1980s. The one notable exception to the stamped steel trend involved overhead cam (OHC) and double overhead cam (DOHC) engines. Because of their more complex designs, a stamped steel rocker cover could not be formed to meet all the contours, and cast aluminium was most often used.

## INPUT FOR THE PROJECT

### 2D Drawing

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

Below shows the 2D drawings of the deckle cover plate with all the required dimensions and GD&T representations the suits the best for manufacturing the component without any errors.

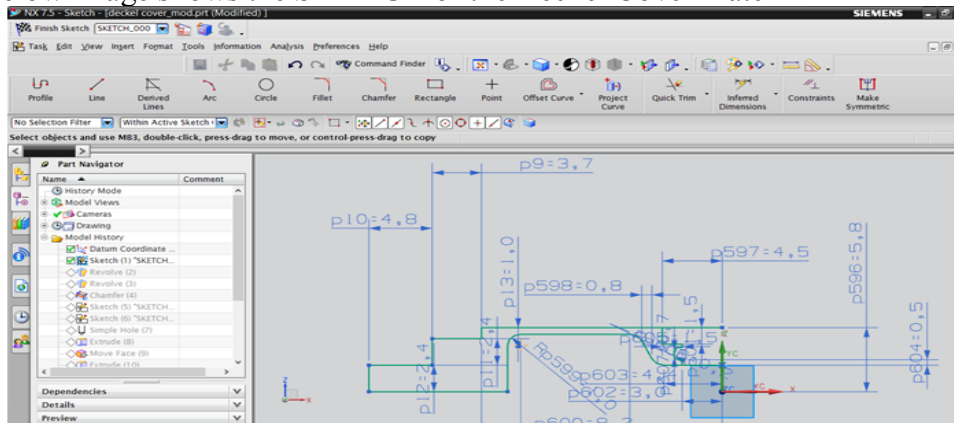


## Steps involved in 3d modeling

### Sketching

Below is the sketch required to obtain the 3D model of the deckle cover plate from the above 2D drawing.

Below image shows the **SKETCH** of the Deckle Cover Plate



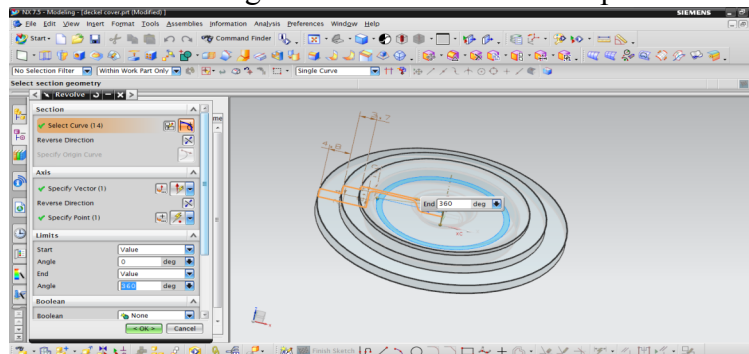
Procedure to draw the above sketch

Insert → sketch in task environment → select plane → ok.

insert → curve → profile.

By using profile curve we will get the 2D design of deckle cover plate.

Below image shows the **REVOLVE** option



### REVOLVE

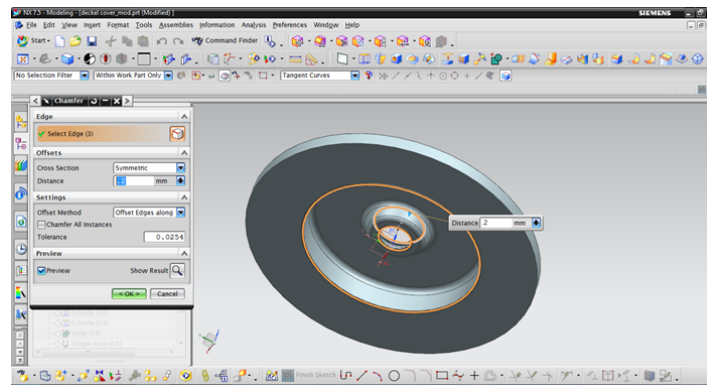
Procedure to revolve the above 2D sketch.



insert ► design features → revolve  
select sketch → select vector( in which direction u want to revolve) specify point  
in limits give input as 360deg in end angle ► Boolean give input as none ► ok.

By using revolve command we convert sketch from 2D to 3D only for axis symmetry bodies.

Below image shows the **CHAMFER** option

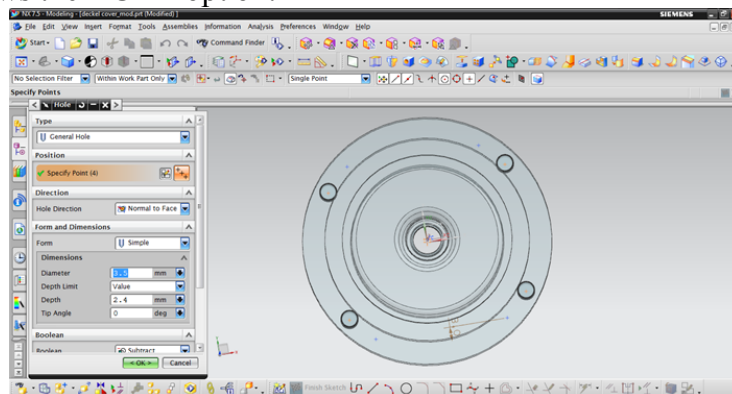


## CHAMFER

- Cuts the edges or corners into straight lines

Insert → detail feature → chamfer  
Select the edges → specify the distance → ok

Below image shows the **HOLE** option.



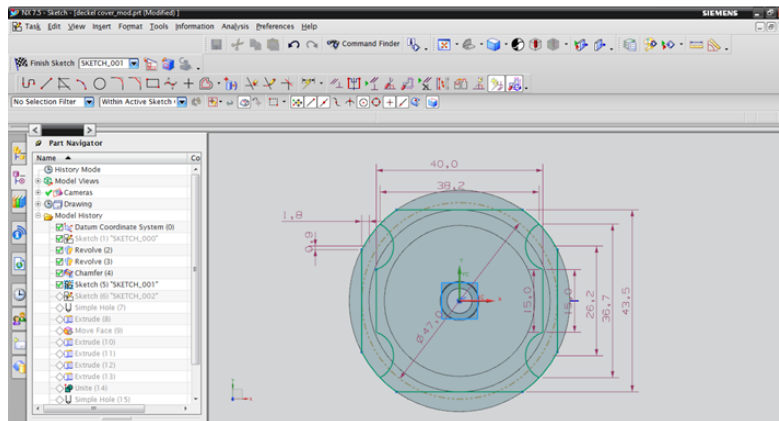
## HOLE

Generate holes on the body by using Simple , Counter bore and Counter sunk.

insert → design features → hole.

In form & dimensions specify type of hole required (simple hole) and dimensions of hole (3.5dia,2.4 depth). In Boolean select subtract option then click ok.

Below image shows another **SKETCH** for the deckel cover



Procedure to draw the above sketch

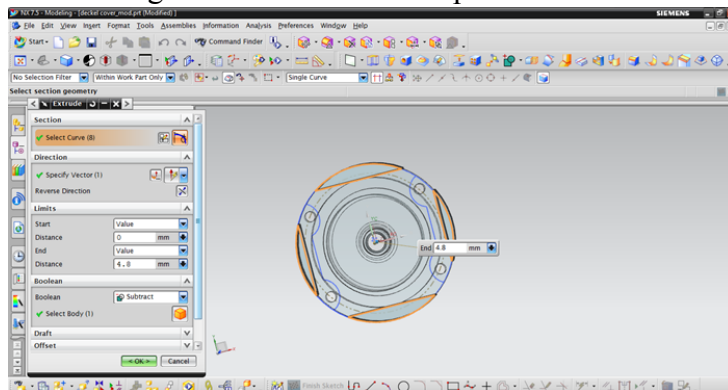
Insert → sketch in task environment → select plane → ok.

insert → curve → profile.

insert → curve → arc.

By using profile curve & arc command we will get the 2D design of deckle cover plate on selected surface.

Below image shows **EXTRUDE** option.



## EXTRUDE

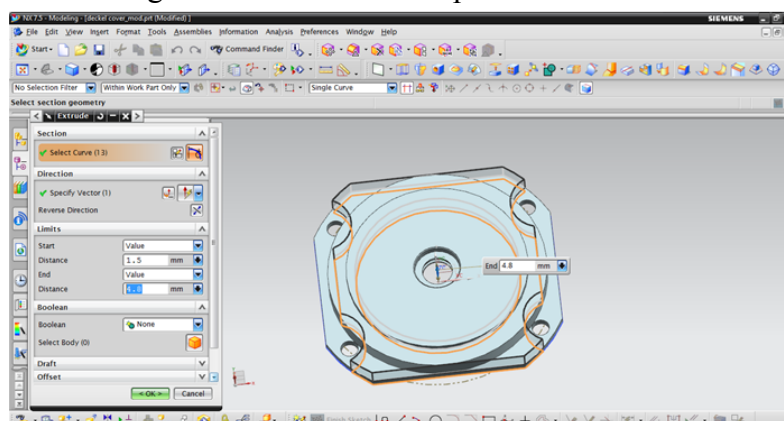
- Extrude command is used to create a body by sweeping a 2D or 3D section of curves, Edges, sketches in a specified Direction.

Insert → design features → extrude.

Select curve → specify vector → Boolean operation (subtract) → ok.

In the above fig unwanted material is removed by using subtract option.

Below image shows **EXTRUDE** option.



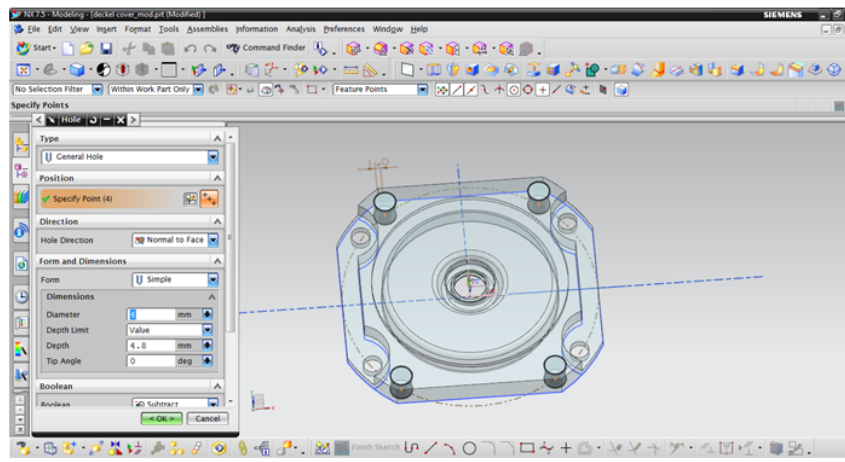
## EXTRUDE

- Extrude command is used to create a body by sweeping a 2D or 3D section of curves, Edges, sketches in a specified Direction.

Insert → design features → extrude.

Select curve → specify vector → Boolean operation (unite) → ok.

Below image shows the **HOLE** option.



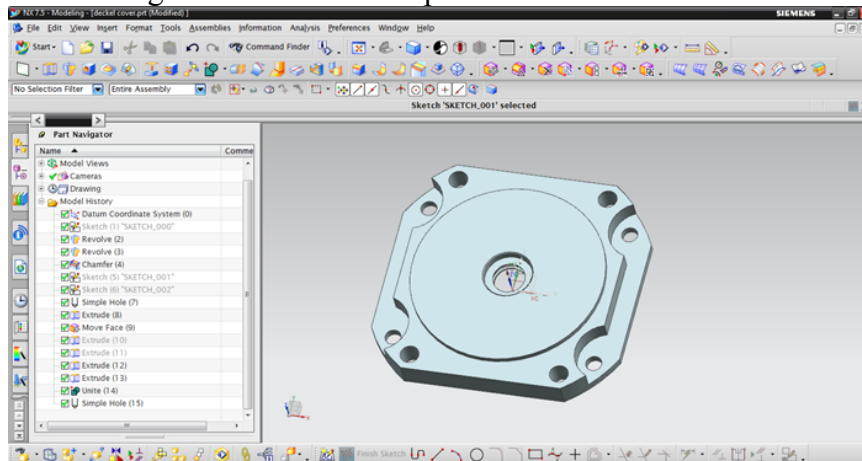
## HOLE

Generate holes on the body by using Simple, Counter bore and Counter sunk.

Insert → design features → hole.

In form & dimensions specify type of hole required (simple hole) and dimensions of hole (4dia, 4.8 depth). In Boolean select subtract option then click ok.

Below image shows the **3D** component of the deckel cover.



## SETUP TOOLING LIST

We need to select/create a tool for each of the Machining operations. In the Project Manager, you can create and automatically assign new tools to tool stations in the Tools view. You can also create tools from the Machining menu



SHOP FLOOR DOCUMENTATION

TOOLING LIST

DRILLING TOOLS

TOOL NAME	DESCRIPTION	DIAMETER	TIP ANG	FLUTE LEN	ADJ REG
SPOTDRILLING TOOL	Drilling Tool	2.5000	120.0000	35.0000	0

MILLING TOOLS

TOOL NAME	DESCRIPTION	DIAMETER	COR RAD	FLUTE LEN	ADJ REG
MILL_D70	Milling Parameters Tool-5	70.0000	0.0000	50.0000	0
MILL_EM_D20	Milling Parameters Tool-5	20.0000	0.0000	50.0000	0
MILL_D10	Milling Parameters Tool-5	10.0000	0.0000	50.0000	0
EM_D6	Milling Parameters Tool-5	6.0000	0.0000	50.0000	0
COUNTERSINKING_TOOL	Milling Parameters Tool-5	16.0000	0.0000	15.0000	0

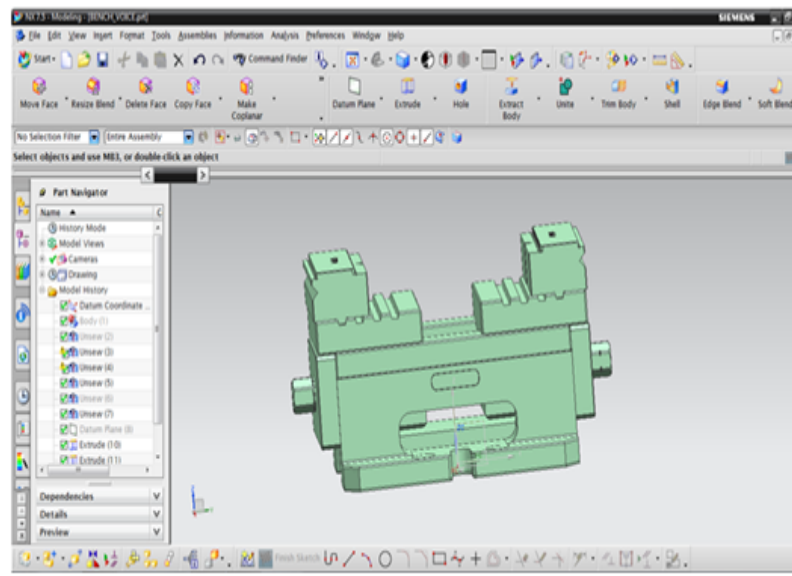
FIXTURE DESIGN

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 labour by simplifying how workpieces are mounted, and increasing conformity across a production run.



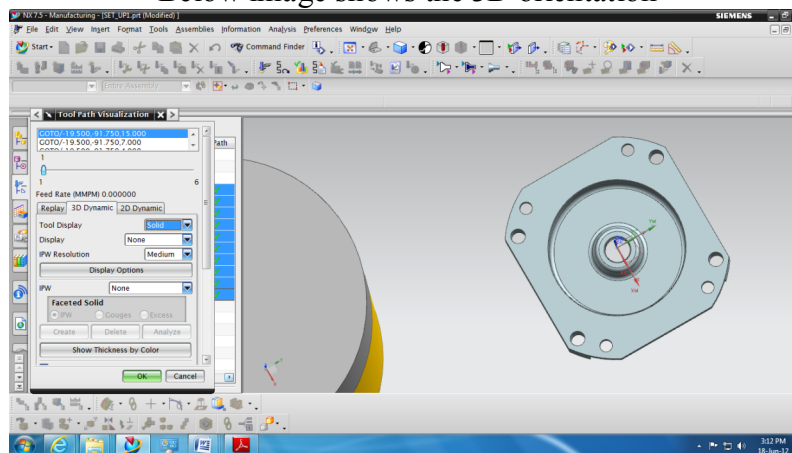
A common type of fixture, used in materials tensile testing

Bench vice used a fixture for dicket cover plate

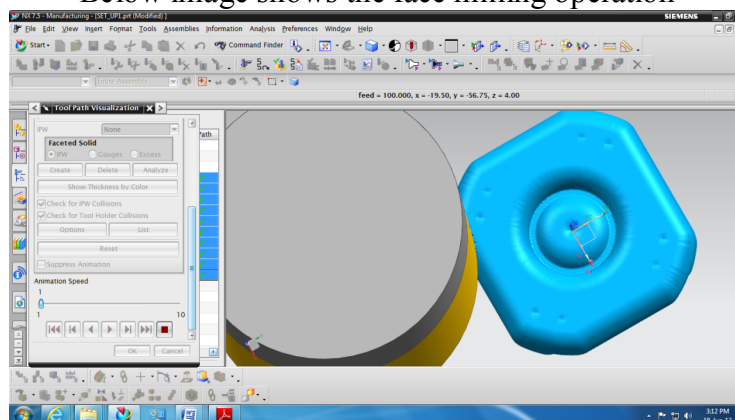


Generating NC Program for the Decklet cover  
CAM GENERATION  
SETUP 1

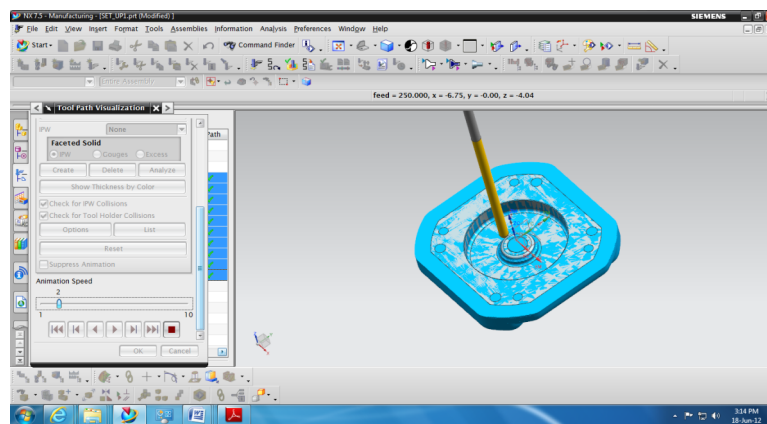
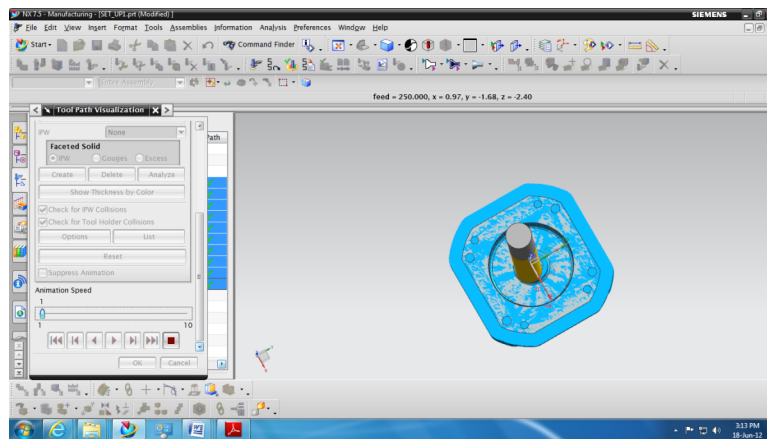
Below image shows the 3D orientation



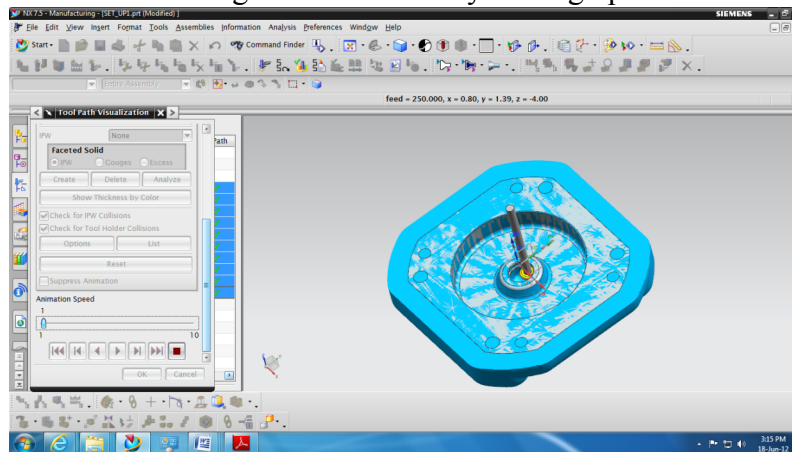
Below image shows the face milling operation



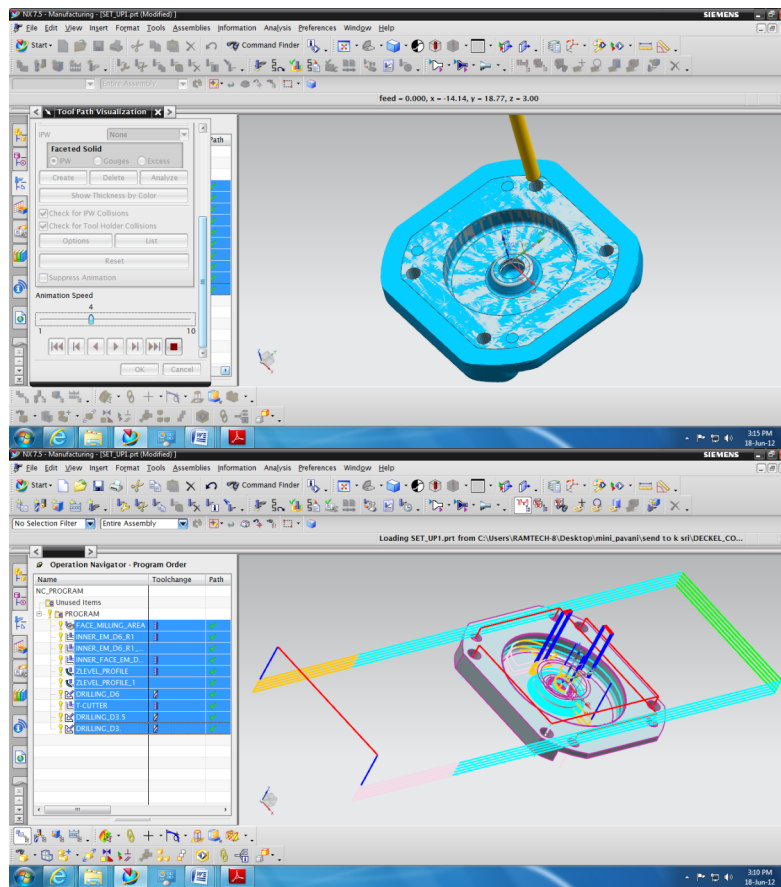
Below image shows the profile milling operation.



Below image shows the cavity milling operation.

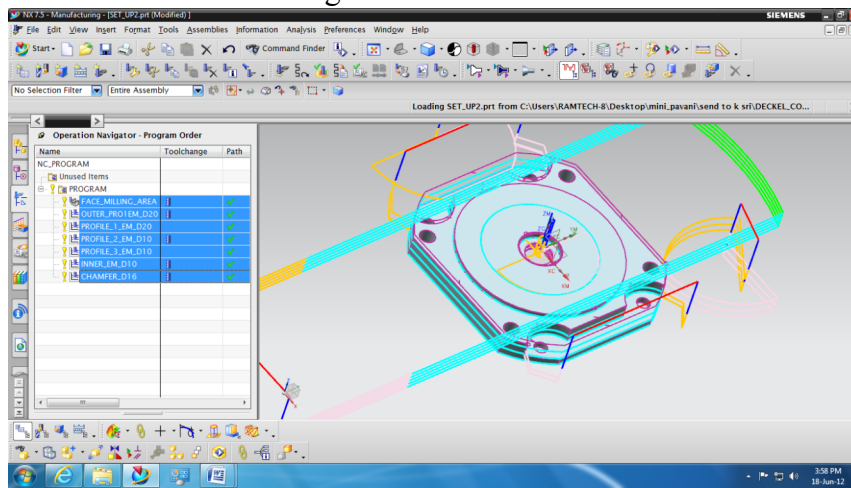


Below image shows the drilling operation.

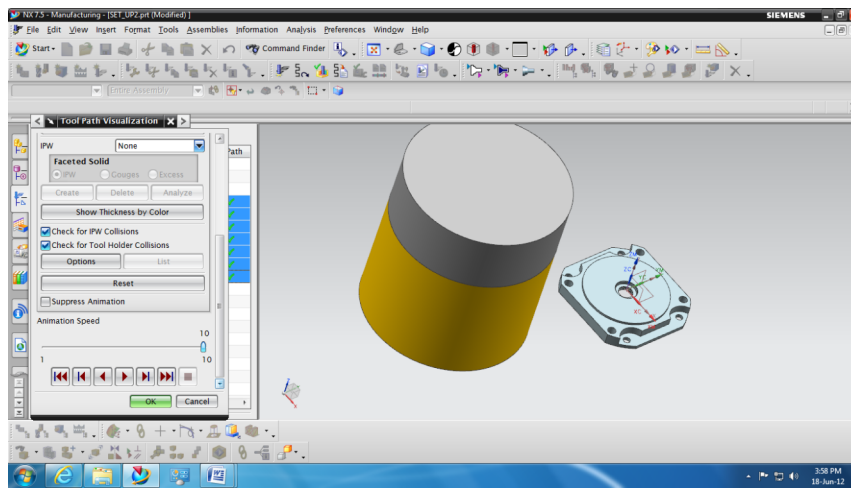


### SETUP 2

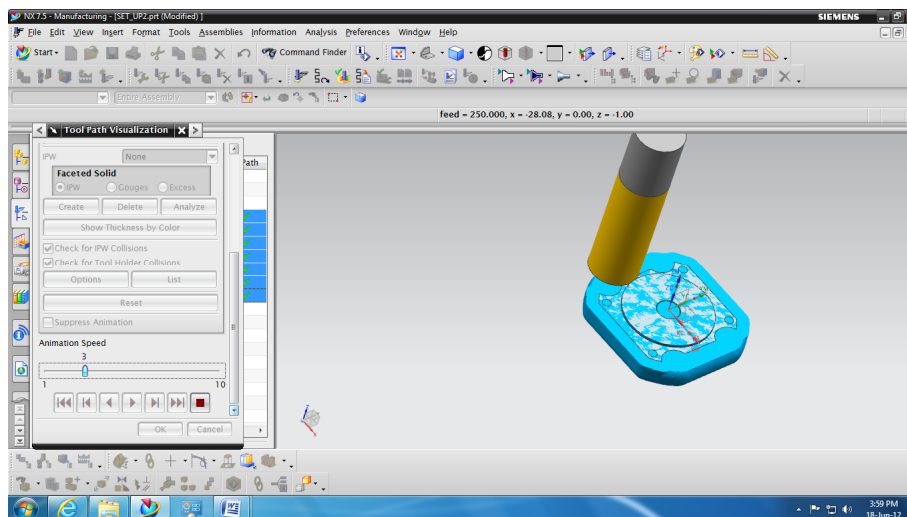
Below image shows the 2D orientation



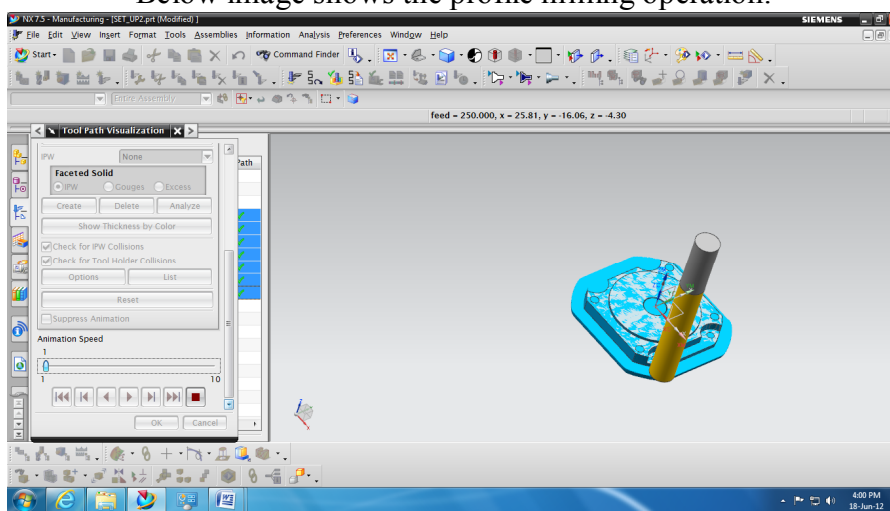
Below image shows the 3D orientation



Below image shows the face milling operation.

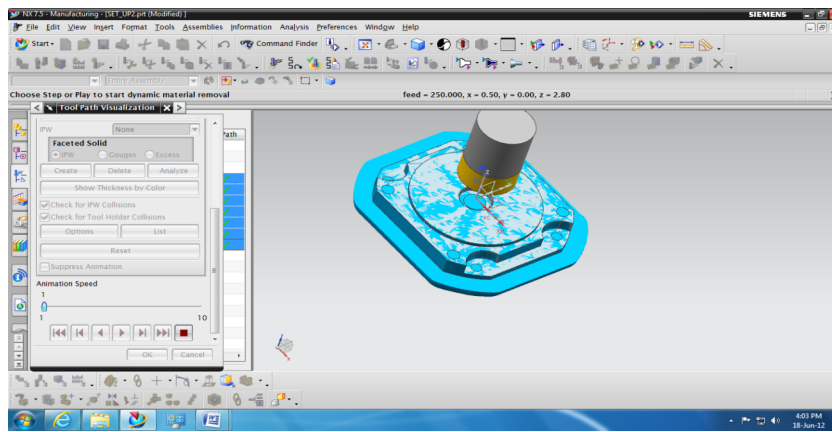


Below image shows the profile milling operation.



Below image shows the chamfer operation





### PROCESS SHEET FOR SETUP 1

Operation No.	Machining Operation	Tools Used	Spindle Speed(rpm)	Cutting Feed(mm/min)	Setup time
10	Face Milling	Face mill $\phi$ 70 mm	1000	350	240/5
20	Profile milling	End mill $\phi$ 20 mm	600	150 to 200	320/15
30	Cavity milling	End mill $\phi$ 10 mm	1000	150	250/12
40	Drilling	End Mill $\phi$ 2 mm	800	150 to 200	240/5

### PROCESS SHEET FOR SETUP 2

Operation No.	Machining Operation	Tools Used	Spindle Speed(rpm)	Cutting Feed(m/min)	Setup time
10	Face Milling	Face mill $\phi$ 70 mm	1000	350	240/5
20	Profile milling	End mill $\phi$ 20 mm	600	150 to 200	320/15
30	Chamfer	CSK tool $\phi$ 10 mm	1000	150	250/12

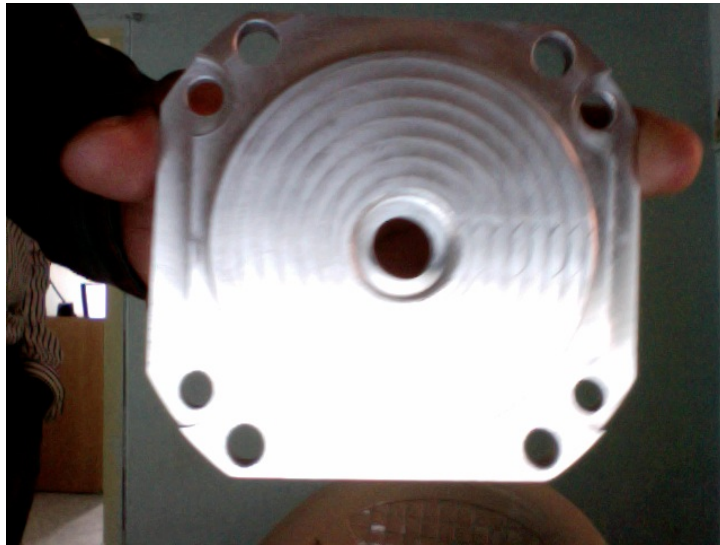
## 4.9 RESULTS & CONCLUSION

By using NX CAD 3D model is generated.

Deckel cover is a board fitted under part of the wire in papermaking machine for supporting the pulp stack before it is sufficiently formed to support itself on the wire.

The thickness of deckel cover is reduced to decrease the friction between its mating parts and also we got an idea on NXCAD DESIGN.

### FINAL COMPONENT:



## REFERENCES

1. Alex Renner, "Computer Aided Process Planning for Rapid Prototyping using a genetic algorithm", IOWA State University, Iowa, 2008.
2. Khershed P Cooper, "Layered Manufacturing: Challenges and Opportunities", Defense Technical Information Center Compilation Report No. ADP014215.
3. Prashant Kulkarni , Anne Marsan and Debasish Dutta "A review of process planning techniques in layered manufacturing", Rapid Prototyping Journal, Vol.6, I1, 2000.
4. Pulak Mohan Pandey, N Venkat Reddy and Sanjay G Dhande "Slicing procedures in layered manufacturing", Rapid Prototyping Journal, Vol. 9, No.5, 2003.
5. Kennedy D Gunawardana, Introduction of AMT: a literature review, Sabaragamuwa University Journal, Pg. 3, Vol. 6, no.1, 1995.