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Optimize The Manufacturing Plan Of Spike Support Using Cam Software

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ABSTRACT

The project was developed to reduce the rejections of the component. This project includes reducing the rejection rate to 6% or below from 9% of rejection rate and improve the reworks rate to 10% below from 15% reduce rate.

At first, by using CAE system (i.e. ANSYS software) harmonic analysis is done to determine the optimum cutting speed of the tool. After determination of cutting speeds, by using cam system, manufacturing process is determined in nx-cam software. Finally optimization was done in process by using mandrel to hold the job for better finish of component while performing the machining.

INTRODUCTION

Israeli company with the help of the other nations developed a missile. The missile is the fourth generation man-portable fire-and-forget anti-tank guided missile with tandem-charged HEAT warhead. Spike support is the one of the components of the missile. As the missile fly's, the weight of the missile should be less, Therefore the spike support should be light weight. So, the material used for spike support is aluminum for its best material properties.

3D MODELING OF THE SPIKE SUPPORT

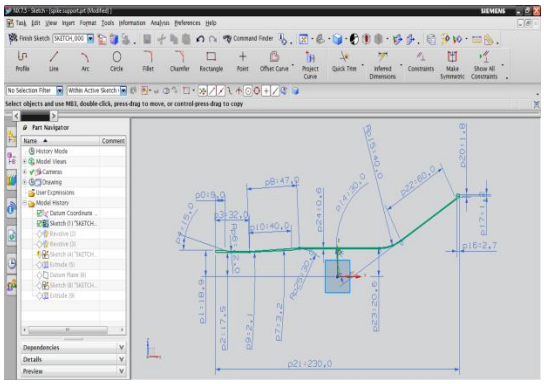


Fig shows sketch of spike support

Below image shows the **revolve** option

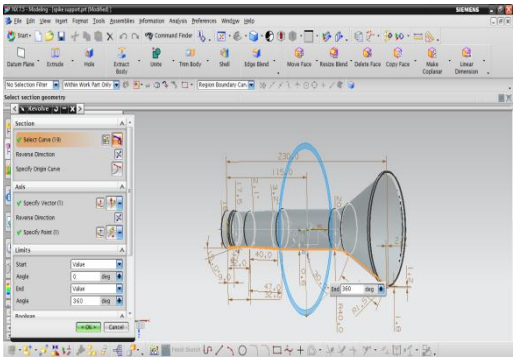


Fig shows revolve option

Final 3D model of spike support

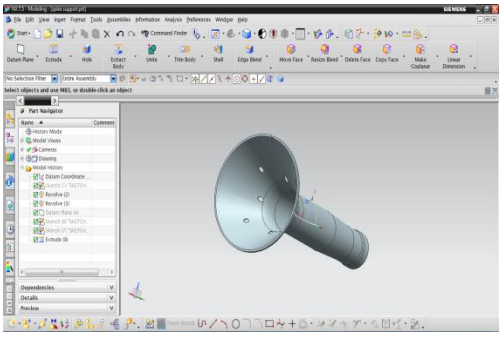


Fig. final 3D model of spike support

DESIGN AND FINITE ELEMENT ANALYSIS OF SPINDLE

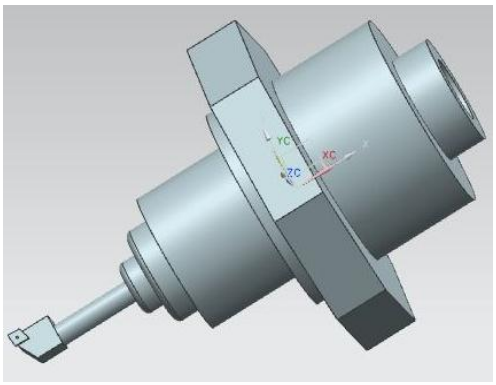


Fig shows Isometric view of the spindle and tool assembly

Modal analysis:

Material properties used in the analysis

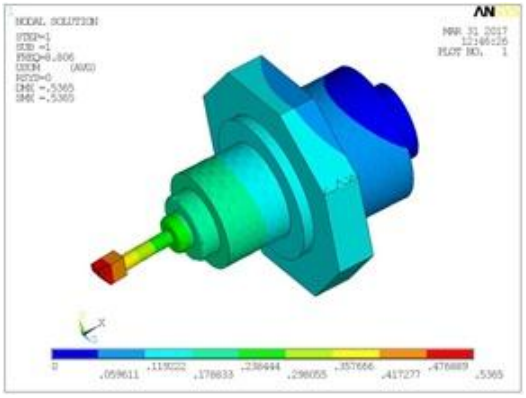
Material	Young's Modulus(Mpa)	Poisson's Ratio	Density (Kg/m3)
High speed steel	2e5	0.3	7850
Carbide cutting tool	5.5e5	0.3	1563

Results:

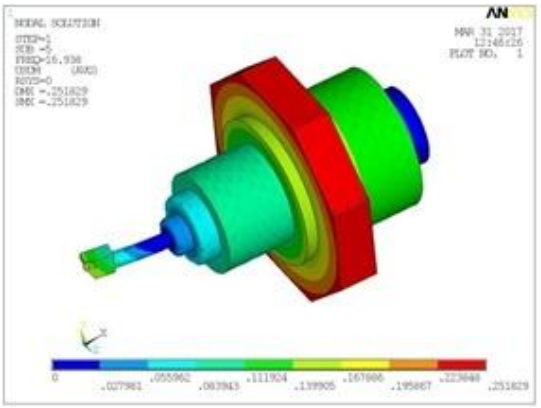
Mode No	Natural Frequency (Hz)
1	8.8
2	8.81
3	16.46
4	16.49
5	16.93

Table shows First 5 Natural frequencies of the spindle

Mode1@8.8 Hz:



Mode5@ 16.93 Hz:



MODAL ANALYSIS OF SPIKE SUPPORT COMPONENT

Shell63 element is used

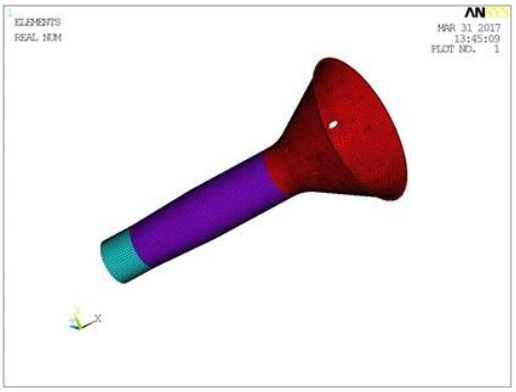


Fig shows finite element meshed model of the spike support component

Material properties used in the analysis

material	young's modulus(mpa)	poisson's ratio	density (kg/m3)
aluminum	0.7e5	0.3	2700

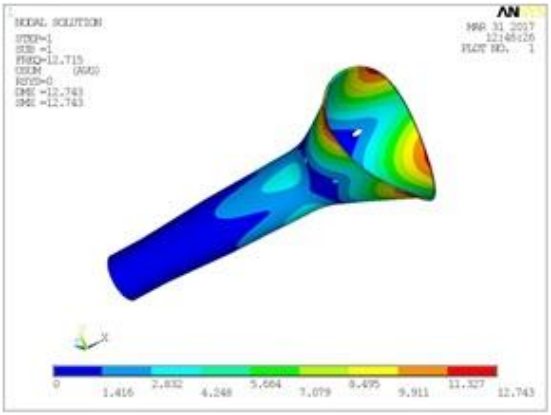
Results:

mode no	natural frequency (Hz)
1	8.8
2	8.81
3	16.46

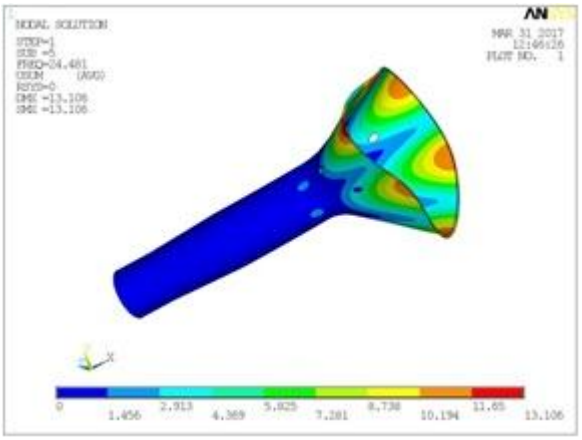
4	16.49
5	16.93

Table shows first 5 natural frequencies of the spindle

mode1@12.71 Hz:



mode5@ 24.48 Hz:



COMPUTER AIDED MANUFACTURING (CAM)

Design of mandrel:

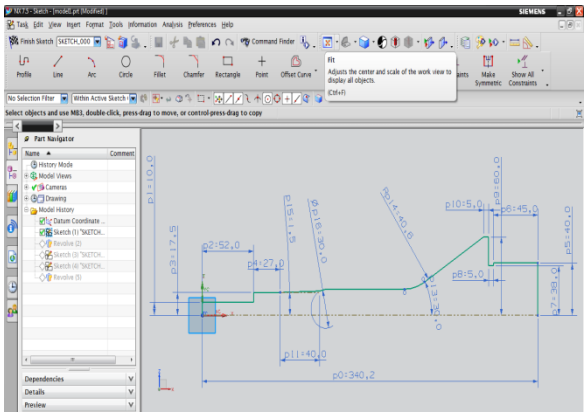


Fig shows sketch of mandrel

Below image shows the**revolve** of the mandrel.

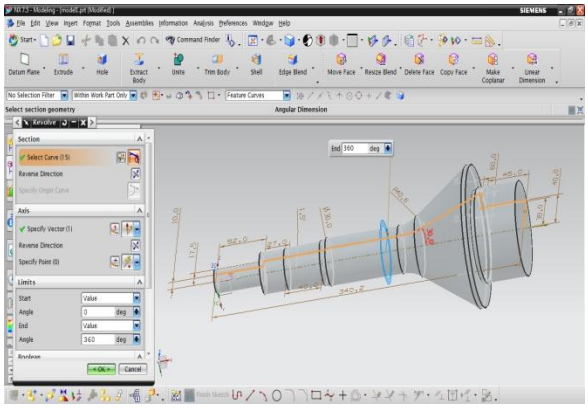


Fig shows revolve option

Below image shows the **sketch** of the mandrel.

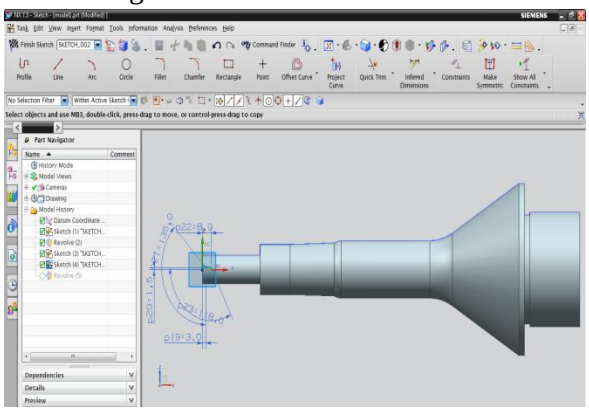


Fig shows sketch option

Below image shows the**revolve** of the mandrel.

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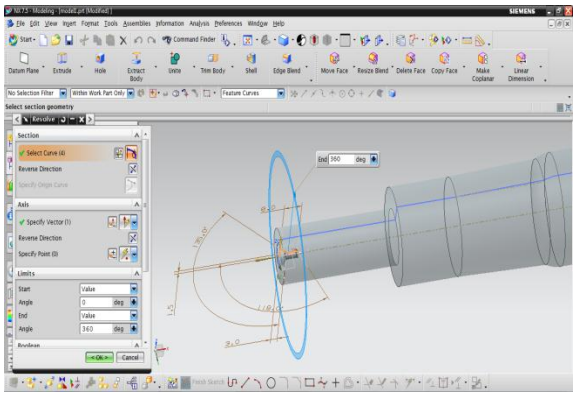

Fig shows revolve option

Below image shows Final 3D model of mandrel.

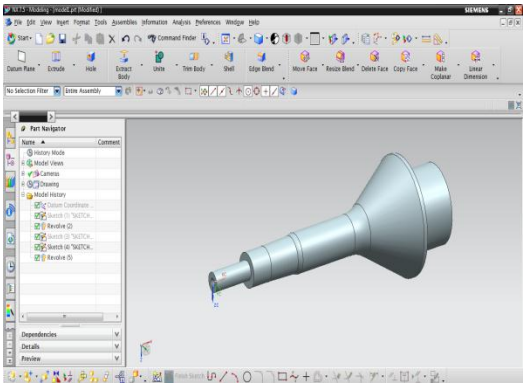

Fig shows final 3D model of mandrel

Procedure to create 3D model of non-expandable mandrel

Generating tool path on spike support:

Set_up_1 tool path generation:

Below image shows the creation of facing operation on spike model.

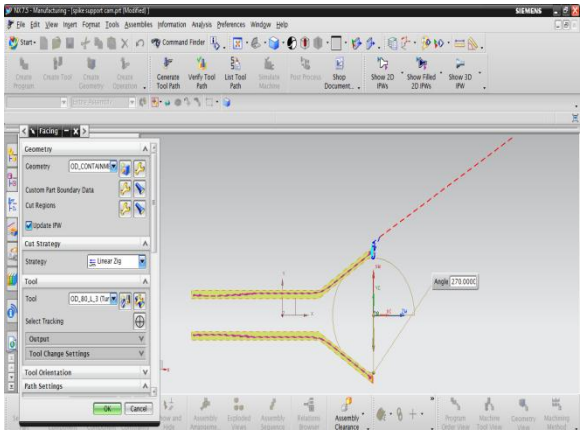

Fig shows facing operation

Below image shows the verification of facing operation

Below image shows the creation of OD_ROUGH operation on spike model

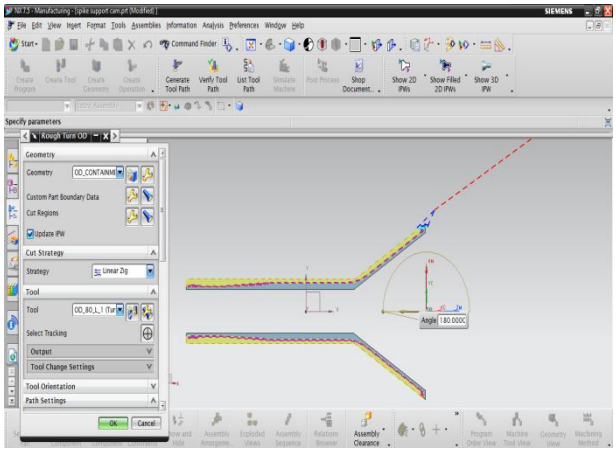

Fig shows OD_Rough_Turn operation

Below image shows the verification of OD_ROUGH operation

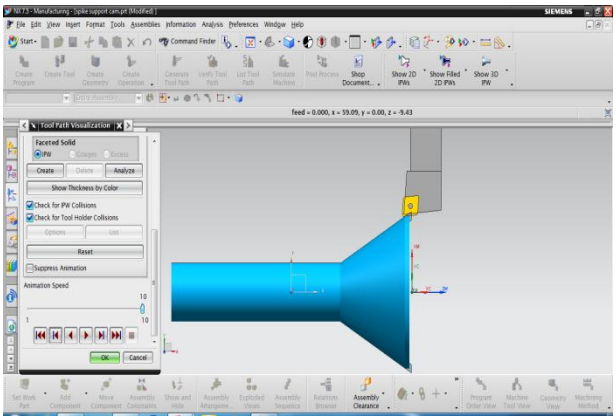

Fig shows verification of OD_Rough_Turn operation

Below image shows the creation of ID_ROUGH operation

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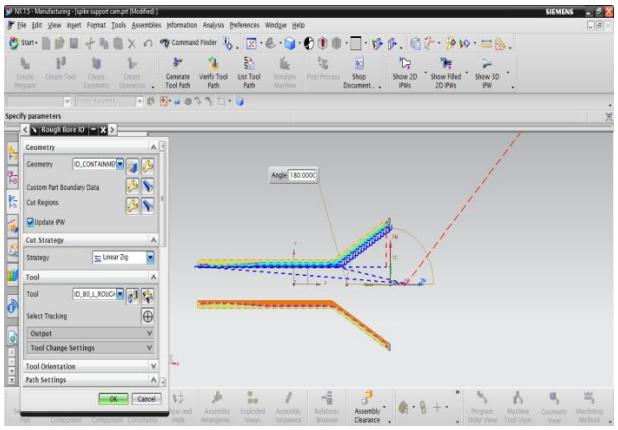

Fig shows ID_Rough operation

Below image shows the verification of ID_ROUGH operation

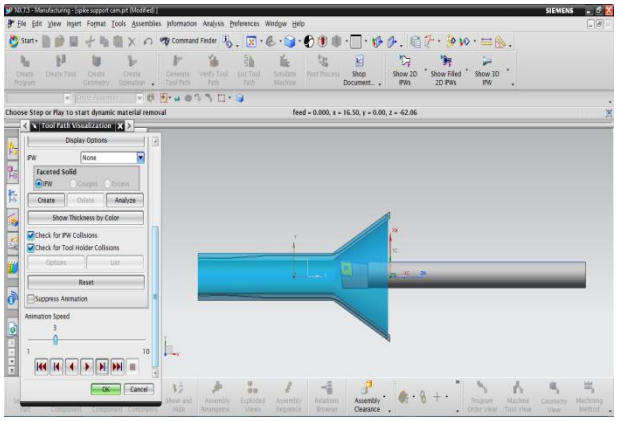

Fig shows verification of ID_Rough operation

Set_up_2 tool path generation

Below image shows the creation of FACING operation on spike model

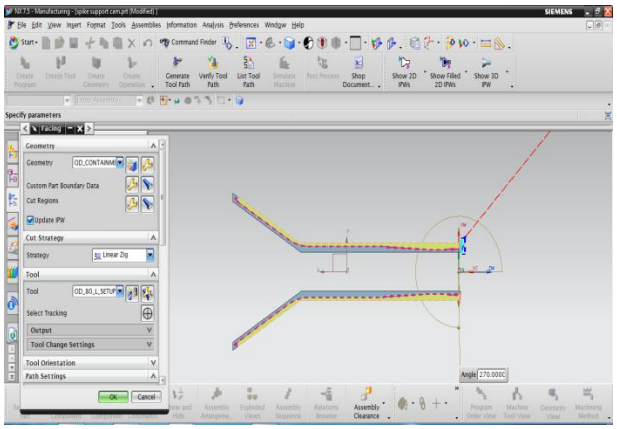

Fig shows facing operation

Below image shows the verification of facing operation

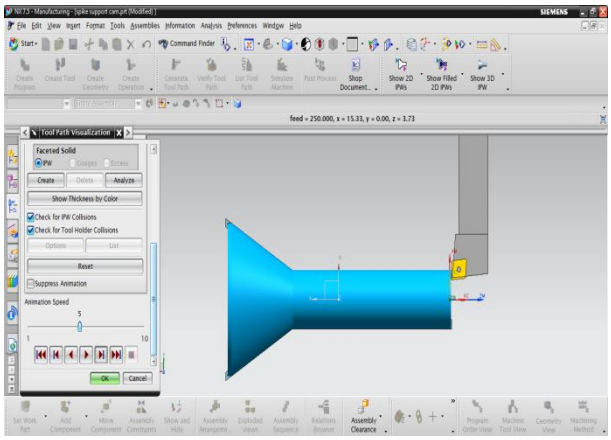

Fig shows verification of facing operation

Below image shows the creation of OD_ROUGH operation

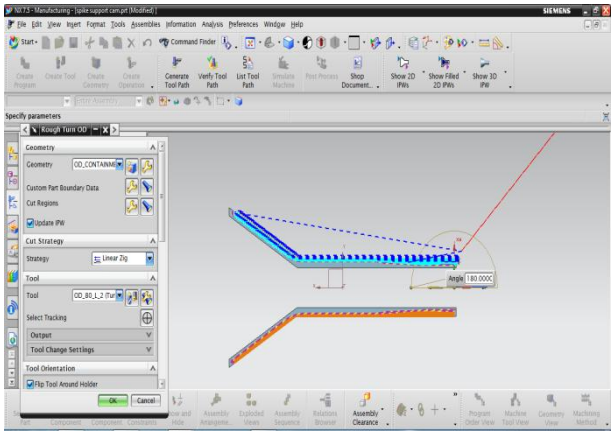

Fig shows OD_Rough operation

Below image shows the creation of drilling operation on spike model

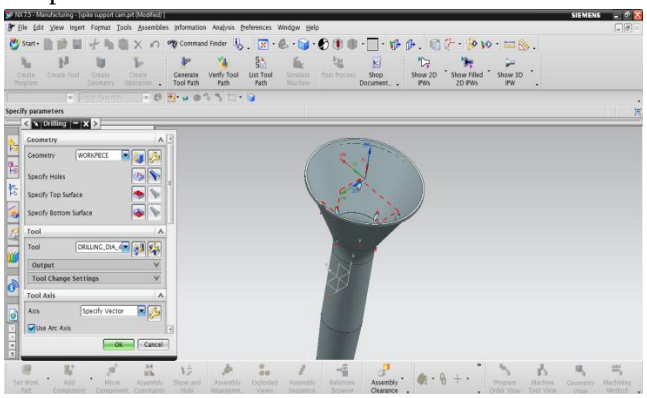

Fig shows Drilling operation

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Below image shows the verification of drilling operation

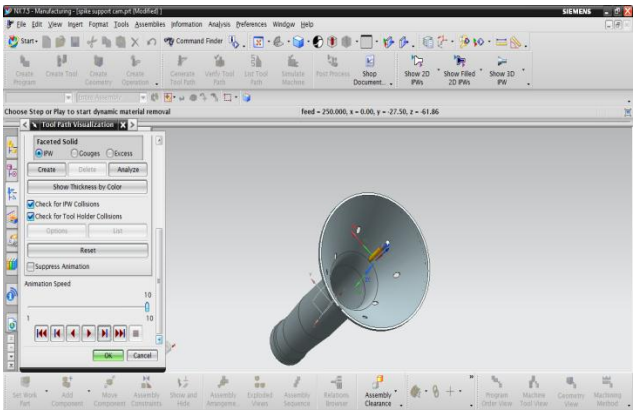


Fig shows verification of drilling operation

Final model obtained after generation of tool path

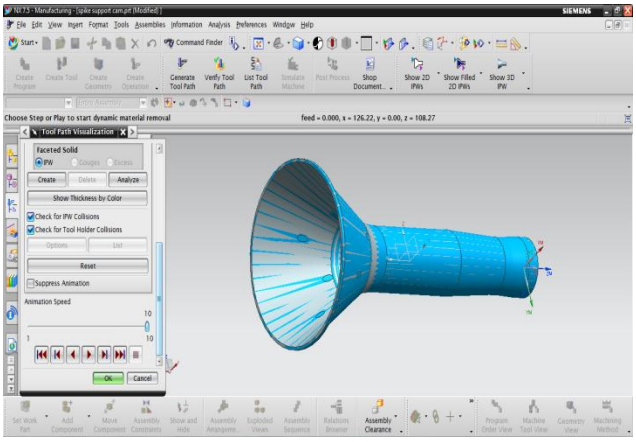


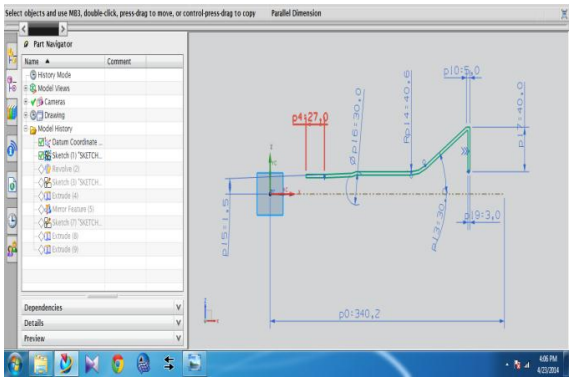
Fig shows Final model

Final component after manufacturing:

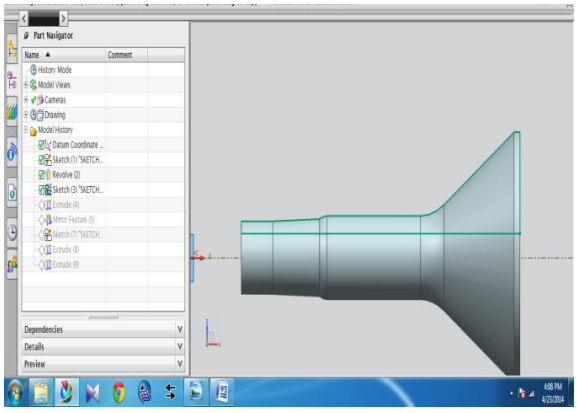
The above figures shows surface roughness and scratches on the surface of spike support

Design of expandable mandrel:

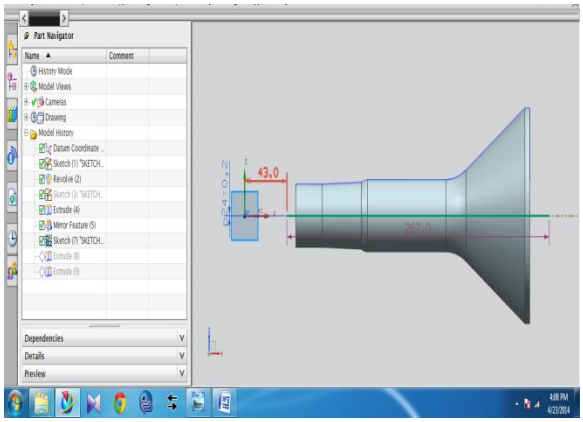
Below image shows sketch and revolve of the expandable mandrel



Below image shows sketch and extrude



Below image shows sketch and extrude



Below image shows the mandrel rod

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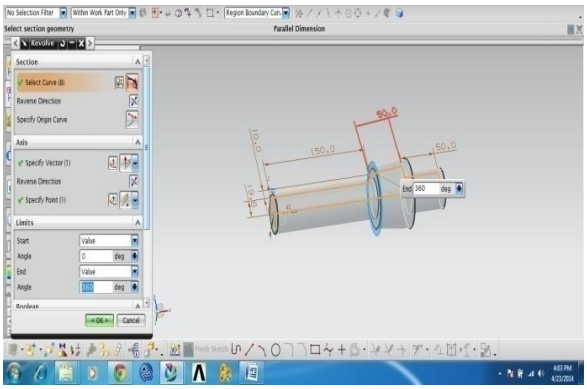


Below image shows the assembly of expandable mandrel

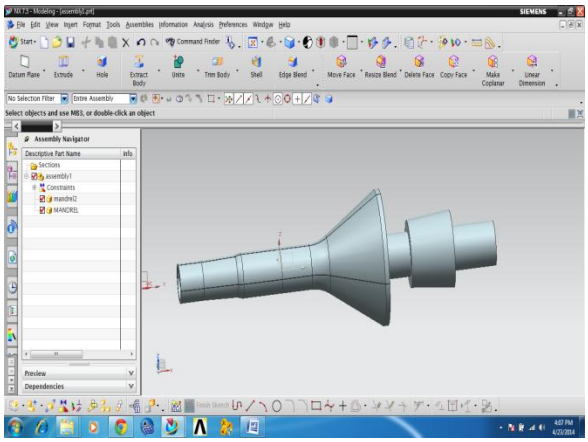


Fig shows Assembly of expandable mandrel

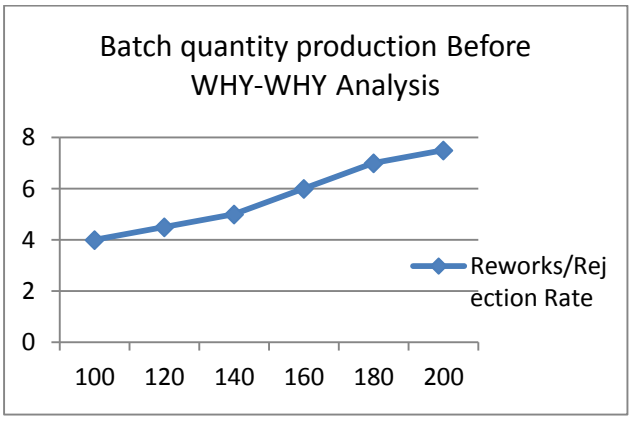
Procedure to create expandable mandrel

Create 2D sketch of expandable mandrel same as non expandable mandrel and using revolve option create 3D model. Create sketch on the surface of mandrel and subtract the sketch using extrude option to create flexibility to mandrel. Create supporting rod for mandrel using sketch and revolve option.

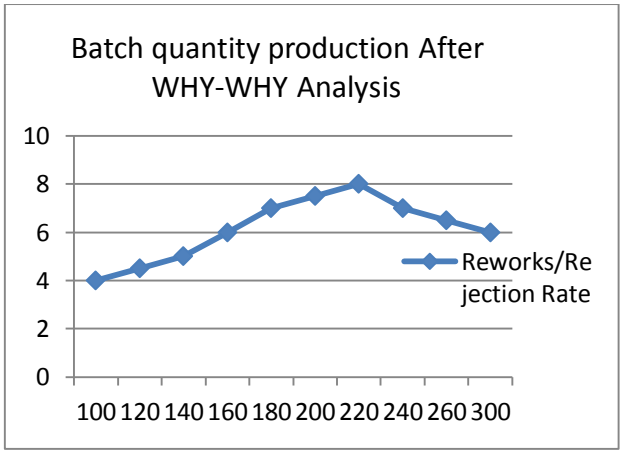
RESULTS

Graphical representation of rejection and reworks rate:

Results before WHY-WHY analysis



Results after WHY-WHY Analysis



From the above result graphs it is concluded that the reworks and rejection rate is decreased from 9% to 6% after using WHY-WHY Analysis.

CONCLUSION

- 3D demonstrates is produced by utilizing NX-CAD programming.
- Graphical portrayal of consonant investigation on spike bolster at various cutting velocity is appeared in comes about.
- NC program is produced by utilizing NX-CAM programming.
- WHY-WHY (or) 5-WHY examination is done to decrease lessening and modify rate.
- The thin walled (spike bolster) part is made in a succession as first inward operations and next by utilizing mandrel bolster outside operations are done to diminish dismissal rate.

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- Proper devices are indicated which will bolster for machining dainty walled part.
- Redesign of mandrel is done to achieve high surface complete without come up short.
- Graphical portrayal of BEFORE and AFTER WHY-WHY examination on spike bolster generation is appeared in comes about.

REFERENCES

- Study on fixtures by Pollhack, 1976.
- Fixture development by Burhley and Corgbett, 1996.
- Study of fixtures J. C. Trahppey and C. R. Liu 1995.
- Writes on fixture by N. P. Maniar, D. P. Vakharia2013.