International Journal For Advanced Research In Science & Technology
A peer reviewed international journal www.ijarst.in
ISSN: 2457-0362

DESIGN AND ANALYSIS OF CNC MILLED 3D COMPONENTS FOR DIFFERENT OPERATIONS

Desamsetty Venkata Lakshmi Siva Kishore[1], SK. Reshma Begum[2]
[1]PG scholar, Department of Mechanical, Eswar College of Engineering
[2]Assistant professor, Department of Mechanical, Eswar College of Engineering

Abstract:
Machining of different alloy materials on CNC with respect to cutting tool Geometry and modeling also an important task in production industries Design feasibility also has to check before going to machining giving a good analysis in the cam program preparation. A twisted blade component with different alloys and forged outline blade of Inconel material taken in to account for design and machining with raw material blocks and shaped forging component. The surface will be analyzed by RSM to check the accuracy of machined 3D die object. Present work progressed on CNC 4-axis machine with A- axis availability. The core of this approach is to decompose a NX 8.0 model of complex forging die in geometric features. Technological data and topological relations are aggregated to a geometric feature in order to create machining features. A machining process model is proposed to formalize the links between information imbedded in the machining features and the parameters of cutting tools and machining strategies. At last machining sequences are grouped and ordered to generate the complete die machining process. In this project the identification of geometrical features is detailed. Geometrical features identification is based on machining knowledge formalization which is translated in the generation of maps from STEP models imported DELCAM software do the 3D simulation after then The theoretical die model analyses is carried out with software tool ANSYS with impact load analyses .the practical work is has been compared to theoretical analyses and conclusions given for production rate.

Key words: 3-D die component, RSM, materials. Machining feature, NX 8.0, DELCAM, machining process preparation,

I. INTRODUCTION

The transfer of high speed as well as the high cutting speed of machine tools is very essential important for the improvement of productivity. It ensures not only faster cutting rates but also lesser cutting force. Faster cutting speeds can be acquired only by structure which has high stiffness and good damping characteristics. The deformation of machine tool structure under cutting forces and loads which leads to the poor quality of products with less accuracy, both dimensional as well as geometrical of the product So, the level of deformation and vibration that determines the components with high precision Clearly the life of a machine is inversely proportional to the levels of vibration that the machine is subjected.

The further process is carried out to under goes the deformation, natural frequency and displacement using Static analysis, Modal analysis and Harmonic analysis respectively. To analyse the bed for possible material changes that could increase stiffness, reduce weight, improve damping characteristics and isolate natural frequency from the operating range. At present the Machine Beds are made of grey Cast Iron material, which cause a number of problems in Machine tools. Cast Iron cannot with stand the sudden loads during operation whenever the load reaches Ultimate loads it simply fails without any prior indication. Casting is only the Manufacturing process used to produce the beds. This Process leads to various Casting Defects in the component. In order to have high strength and high stiffness the weight of the machine bed should be high.

Introduction to Die:

A die is a specialized tool used in manufacturing industries to cut or shape material mostly using a press. Like molds, dies are generally customized to the item they are used to create. Products made with dies range from simple paper clips to complex pieces used in advanced technology.

PROBLEM DEFINITION

3D Models are typically manufactured by using CNC Machines and different operations

- Manufacturing process by using different cutters
- While designing the Manufacturing process for 3D Model, the grain-flow direction can be aligned with the direction of maximum stress that is applied to the component.
- We are going to design of 3D Model with EN3/3 Material and after then milling operations
- We are doing Quality for finding out the optimized product in 3D die model

II. LITERATURE REVIEW

[1] Milon D. Selvam, Dr.A.K.ShaikDawood and Dr. G. Karuppusami (2012) Need of continuous improvement in a product or process in this era of global competition leads to apply value engineering for functional and aesthetic improvement in consideration with economical aspect to o. In this paper many alternative technologies such as: using alternative materials, applying ribs and cut outs, obtaining a box type shape, filling the interior space with metallic aluminum foam etc., are studied & observed for drawing bright suggestions for improving structure stiffness & Rigidity. Emphasis is certain on Structural ribs with hollow offers a method to improve the conventional design of machine structure. Based on structural modifications, ribs parameters and distributions can be further optimized.

[2] Pinki Maurya et. Al (2016) The capability to develop prototype hardware systems is improving steadily as computer technology is dramatically enhancing design, fabrication processes, and tools. Designers now make extensive use of sophisticated 3D solid modeling programs to visualize design concepts, perform engineering analysis, and communicate detailed design data through networked file transfers. Numerically controlled computerized machine tools are then programmed using the design data to produce parts faster and with greater accuracy than ever before. New laser machining, electrical discharge machining, and rapid prototyping technology are enabling the fabrication of small, precision components not possible using traditional methods. The result is faster product development cycle times and lower costs. (Keywords: Casting, Computer-aided design, Computer-aided machining, Electrical discharge machining, Finite-element analysis, Laser machining, Rapid prototyping.

III. CNC MACHINING

On the other hand, direct manufacture of metal parts is one of the key indicators for the process to be used in RM applications. Qualitative assessment of various processes that are capable of producing metal parts is presented According to this diagram, only two processes are capable of directly fabricating metal parts. The rest can be considered as indirect processes because they use other methods such as moulds and dies to actually produce the parts.

Since the limitations of AM processes remain unsolved, alternative methods need to be considered for RM such

International Journal For Advanced Research In Science & Technology
A peer reviewed international journal
www.ijarst.in
ISSN: 2457-0362

as cutting operations. However, there is a limitation in terms of part complexity despite the capability to handle low to medium production quantities. This method of manufacturing is categorized under subtractive processes. Essentially, further investigation is required to explore the capability of this method in RM processes.

Fanuc CNC controllers Using Simulation DTH:

FANUC is the leading global manufacturer of factory automation, with more than 60 years' experience in the development of computer numerical control equipment. It has 4 million CNCcontrols and 20,000 laser systems installed worldwide and satisfied customers in every corner of the globe.

Highest quality – shortest processing time with more than 60 years‘ experience FANUC offers the widest range of CNC systems in the industry from best value controls with powerful functionality, to high-performance control systems for complex machines – all with fast programming and ease of use, guaranteeing the highest quality and short processing times.

IV. METHODOLOGY

PROCEDURE OF 3D DIE COMPONENT MODEL:

Structural materials used in a machine tool have a decisive role in determining the productivity and accuracy of the part manufactured in it. The conventional structural materials used in precision machine tools such as cast iron and steel at high operating speeds develop positional errors due to the vibrations transferred into the structure. Faster cutting speeds can be acquired only by structure which has high stiffness and good damping characteristics.

Clearly the life of a machine is inversely proportional to the levels of vibration that the machine is subjected. The further process is carried out to undergo the deformation, natural frequency and displacement using Static analysis, Modal analysis and Harmonic analysis respectively. Since the bed in machine tool plays a critical role in ensuring the precision and accuracy in components.

4.1 Milling Process

Milling is the process of removing extra material from the work piece with a rotating multi-point cutting tool, called milling cutter. The machine tool employed for milling is called milling machine. Milling machines are basically classified as vertical or horizontal.

4.2 Surface Roughness

Surface roughness is an important measure of product quality since it greatly influences the performance of mechanical parts as well as production cost. Surface roughness has received serious attention for many years and it is a key process to assess the quality of a particular product. Surface roughness has an impact on the mechanical properties like fatigue behavior, corrosion resistance, creep life, etc. It also affects other functional attributes of parts like friction, wear, light reflection, heat transmission, lubrication, electrical conductivity; etc Surface roughness of turned components has greater influence on the quality of the product. Whenever two machined surfaces come in contact with one another the quality of the mating parts plays an important role in the performance and wear of the mating parts.

International Journal For Advanced Research In Science & Technology
A peer reviewed international journal
www.ijarst.in
ISSN: 2457-0362

3.1.DESIGNINGPROCEDURE

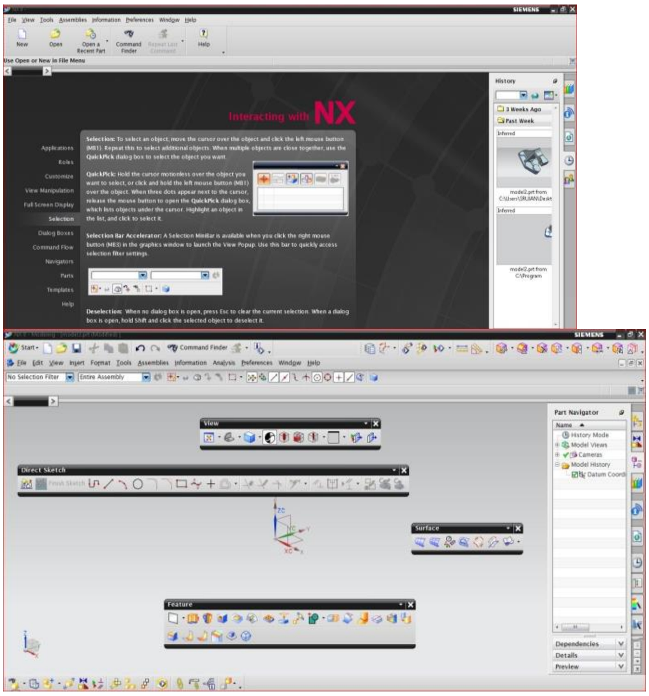


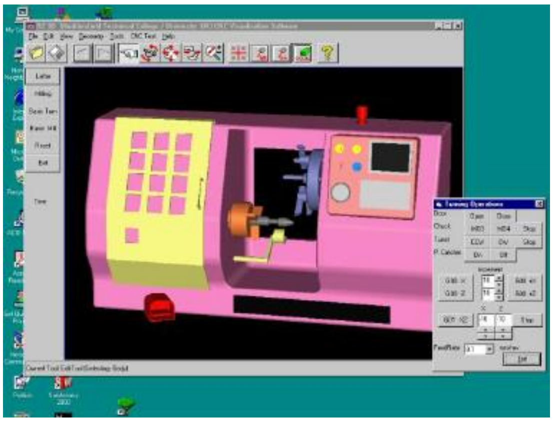
Figure: the Siemens tool bar status for design

V. RESULTS

The trends of rapid manufacturing (RM) have influenced numerous developments of technologies mainly in additive processes. However, the material compatibility and accuracy problems of additive techniques have limited the ability to manufacture end-user products. More established manufacturing methods such as Computer Numerical Controlled (CNC) machining can be adapted for RM under some circumstances. The use of a 3-axis CNC milling machine with an indexing device increases tool accessibility and overcomes most of the process constraints. However, more work is required to enhance the application of CNC for RM, and this thesis focuses on the improvement of roughing and finishing operations and the integration of cutting tools in CNC machining to make it viable for RM applications. The purpose of this research is to further adapt CNC machining to rapid manufacturing, and it is believed that implementing the suggested approaches will speed up production, enhance part quality and make the process more suitable for RM. A feasible approach to improving roughing operations is investigated through the adoption of different cutting orientations. Simulation analyses are performed to manipulate the values of the orientations and to generate estimated cutting times. An orientations set with minimum machining time is selected to execute roughing processes.

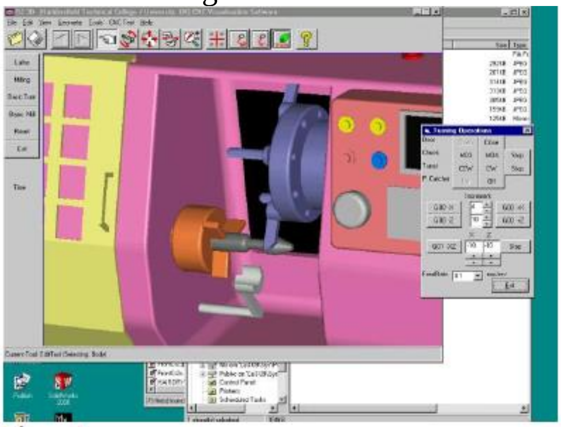
CNC SIMULATION APPLICATIONS

There are numerous suppliers of CNC simulation software used for simulating the machining process and generating part programs that are post-processed into machine specific cutter paths. Such packages can usually import geometry such as 2D lines and text, surfaces and solid models. Many of these are standalone Computer Assisted Part Programming (CAPP) systems whilst others form part of a vendor‟s suite of CAD/CAM applications. The former relies heavily on data translation through a neutral format such as IGES, DXF, STEP or a dedicated direct translator (which can be more reliable in data exchange, though less commonly found). In the latter transfer of geometrical data from CAD to CAM, using the vendor‟s proprietary software should be a seamless process. Examples of the former (standalone CAPP programs) include, AlphaCAM by LICOM, PEPS by CAMTEK, MasterCAM. PTC, SDRC, Unigraphics Solutions, Dessault Systems amongst many other providers, supply turnkey systems with bundles of their own CAD/CAM software.



International Journal For Advanced Research In Science & Technology
A peer reviewed international journal www.ijarst.in
ISSN: 2457-0362

Figure: Model-1



Model-2

Beyond support for viewing, querying and manipulating ACIS 3D models, this reduced version of the ACIS kernel includes a basic set of model design features. While these won't help to build sophisticated CAD applications, they are good enough to build simple modelling applications, sketching, reading 3D data from other sources and parts recognition for programming. Other low cost application areas can include virtual product design, sales support, training, technical support and simulation.

Different 3 D VIEW machining application:

Figure: Real picture

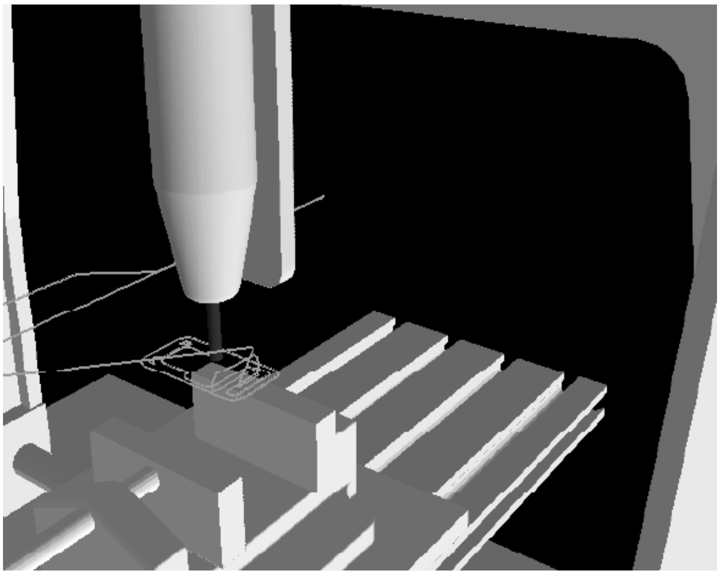


Figure: EMC2 simulation

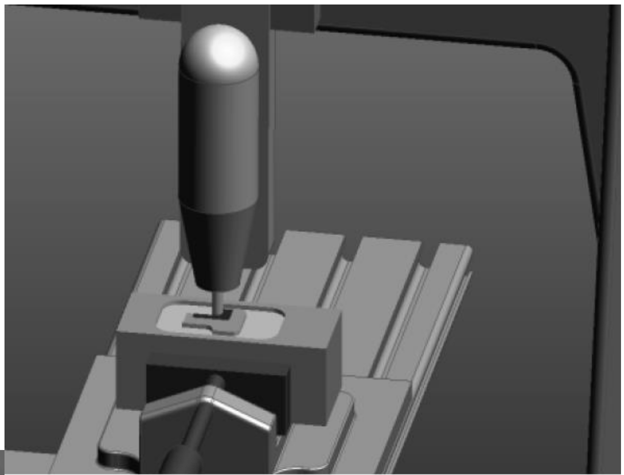


Figure: Edge CAM simulation

International Journal For Advanced Research In Science & Technology
A peer reviewed international journal
www.ijarst.in
ISSN: 2457-0362

Figure: double circle maching 3D model-1

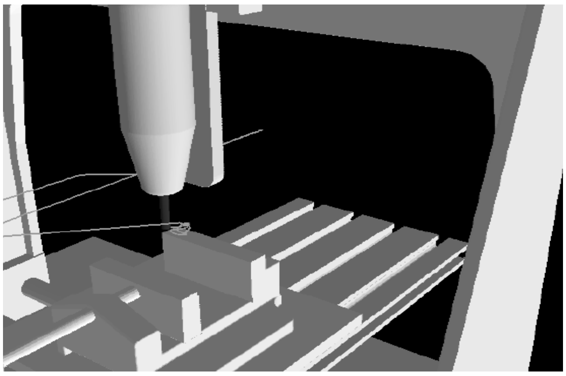


Figure: double circle maching 3D model-2

In this work a simulator of both the whole NC machine and the tool path is presented. It allows users to perform a preliminary check of both the part program and the tool path; it also allows not only to predict NC machine behaviours before using it, but also to detect possible collisions between tools/mobile components and the clamping system/static parts of the machine. A detailed and accurate comparison between two different simulation approaches has been performed. The first simulator is based on free Open Source software, customized by the authors, embedded into the NC software and able to control the directly connected machine; the second one is Edge CAM, commercial CAM software. Edge CAM offers a more detailed simulation, is able to display the whole machine, the work piece and the tool path, but is expensive and is not embedded in the NC software. Moreover, it requires a more powerful computer than the NC machines. It should be noticed that EMC2 is an opportunity for students and researchers to investigate the whole structure of the software and thus to understand the principles on which a modern numerical control system is based; moreover, it allows users to freely modify the structure.

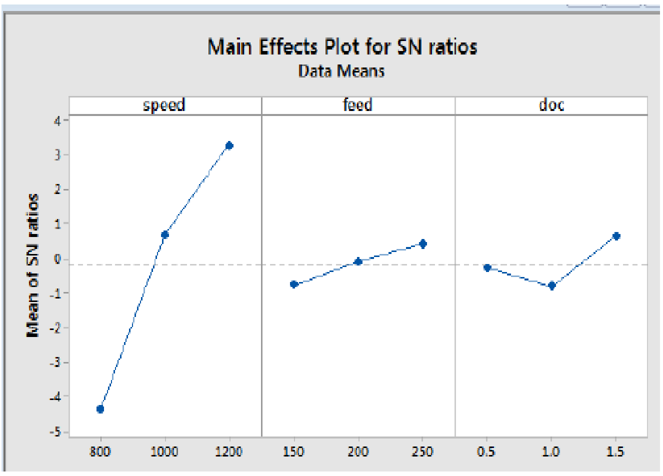


Table: Response Table for Signal to Noise Ratios

levels	Spindle speed	Feed rate	Depth of cut
1	-4.39	-2.323	-0.279
2	1.23	-0.09	-0.805
3	2.27	0.42	0.641

To get better surface finish, the optimal parameters are spindle speed – 1200rpm, feed rate – 250mm/min and depth of cut – 1.5mm.

CNC Machine Programming

The way an operator tells the machine what exactly to do is through specialized programming. The program is written with a bunch of sentence like commands. Every single command is composed of particular CNC words which have both a letter and number element. The letter describes the “kind” and the number describes the “value.” These instructions are literally step-by-step guidelines on what the machine should do at any given point in the machining process.

Someone called a CNC programmer must first visualize the entire process as it would happen during implementation. Then they would need to insert those steps into the program via the different available commands/words.

INTRODUCTION TO DELCAM

PowerMILL is a 3D CAM (Computer-aided manufacturing) solution that runs on Microsoft Windows for the programming of tool paths for 2 to 5 axis CNC (Computer Numerical Control) Milling machines developed by Delcam Plc. The software is used in a range of different engineering industries to determine optimal tool paths to reduce time and manufacturing costs as well as reduce tool loads and produce smooth surface finishes.

The code of Power MILL originates from the software DUCT which was developed in 1973 by Donald Welbourne and Ed Lambourne along with the help of Delta Metal Group, whose funding aided the transferral of the system into industry. The advancement of mini computers from 1982 meant that it became economically viable to design complex 3D shapes using a computer.

DELCAM starting

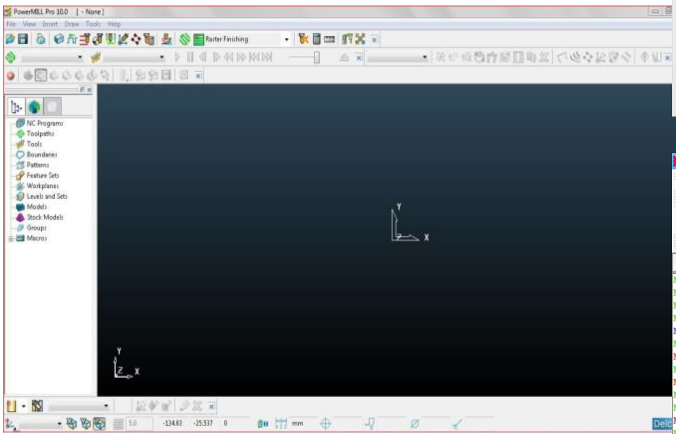


Fig shows Del-Cam window

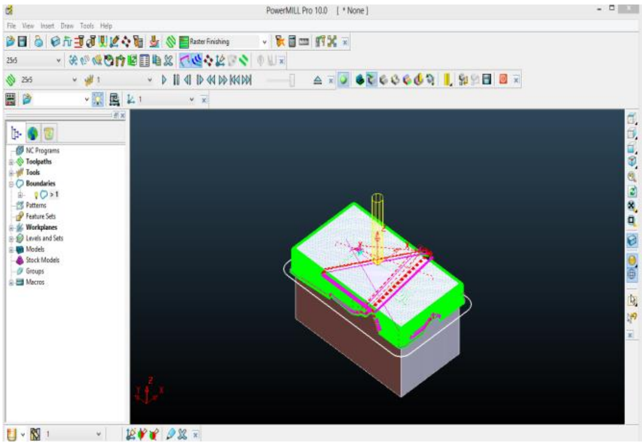


Figure: shows del-cam tool path

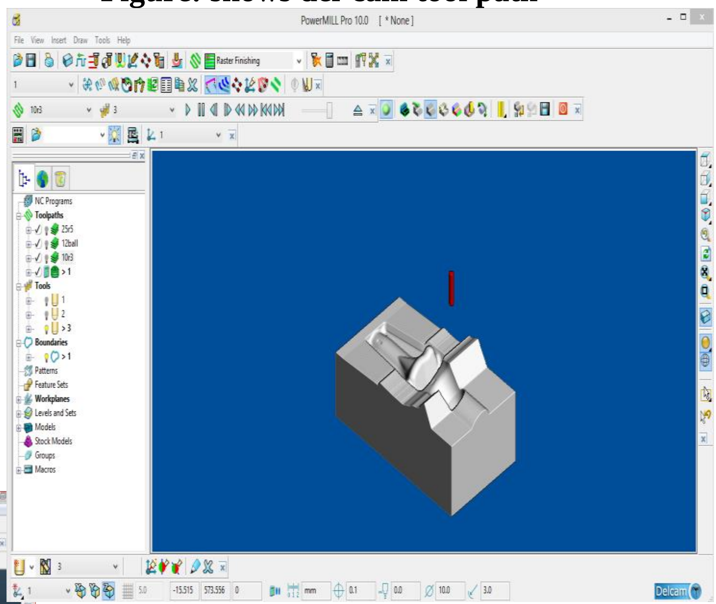


Fig shows the tool path simulation

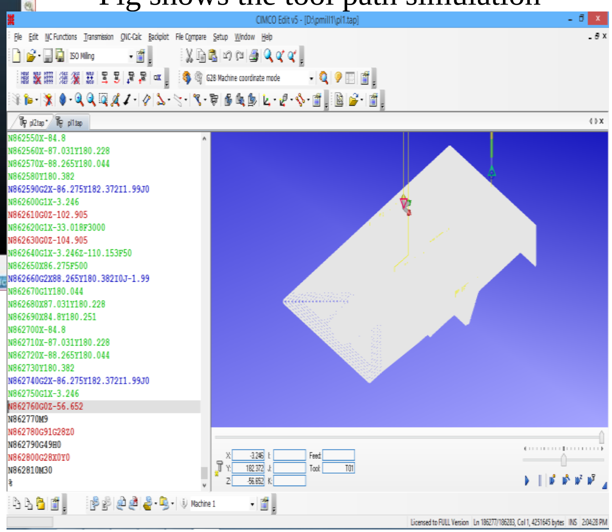


Fig shows CNC program simulation

IJARST
International Journal For Advanced Research In Science & Technology
A peer reviewed international journal
www.ijarst.in
ISSN: 2457-0362

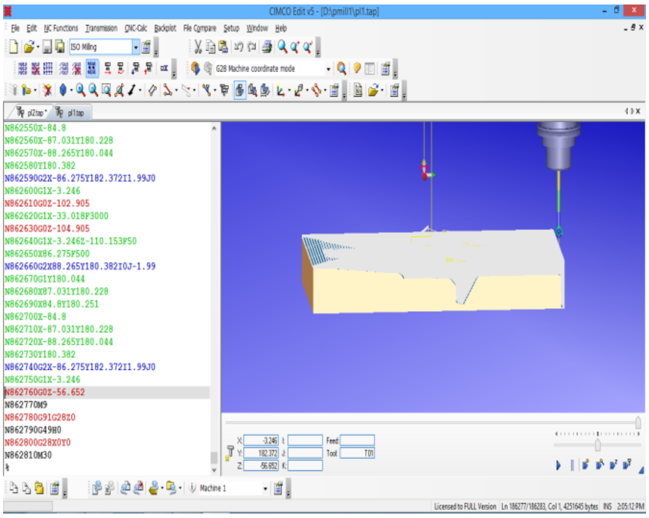


Fig shows 3d simulation of tool path

VI. CONCLUSIONS

Taguchi optimization approach to optimize slicing parameters during excessive pace milling of aluminum alloy using cemented carbide reducing device The slicing parameters are cutting velocity, feed charge and intensity of reduce for milling of labor piece aluminum alloy6061. In this paintings, the most efficient parameters of reducing pace are 800 rpm, 1000rpm and 1200rpm, feed charge are 150mm/min, 200mm/min and 250mm/min and intensity of cut are 0.5mm, 1.0mm and 1.5 mm. Experimental paintings is carried out by way of thinking about the above parameters. Cutting forces, surface end and slicing temperatures are established experimentally. Milling experiments could be performed to enhance the surface finish pleasant of aluminum alloy paintings piece through the usage of carbide, insert cutter, HSS and with the aid of the usage of Taguchi's method which include L9 orthogonal array. By observing the experimental effects via taguchi, the following conclusions may be made: After completing the project it can be observed that optimal value of surface finish is obtained at third level of Spindle Speed and it was 1200rpm, third level of Feed Rate and it was 250mm/min and third level of Depth of Cut and it was1.5mm.

- Based on the configuration principles, the existing RSM material shows improve in the characteristics.
- Simulations results show that the static characteristics of the machine bed have been improved to The transfer of high speed as well as the high cutting speed of machine tools is very essential important for the improvement of productivity.
- It ensures not only faster cutting rates but also lesser cutting force.

REFERENCES

[1] Milon D. Selvam, Dr.A.K.ShaikDawood and Dr. G. Karuppusami, "Optimization Of Machining Parameters For Face Milling Operation in a Vertical CNC Milling Machine using Genetic Algorithm", Engineering Science and Technology: An International Journal, Vol.2, No. 4, August 2012,

[2] Pinki Maurya et. al,"Implementation of Taguchi methodology to Optimization of CNC end milling process parameters of AL6351 –T6".The International Journal of Advanced Manufacturing Technology, 16

[3] Avinash A. Thakre, Optimization of Milling Parameters for Minimizing Surface RoughnessUsing Taguchi„s Approach, IJETAE, Volume3, Issue 6, June 2013.

[4] T R Raguraman , D Thresh Kumar, "Optimization OF Milling Parameter OHNS Steel Using TiALN Coated Cutter By DOE Technique", IJMERR, Vol. 3, No. 1, Jan 2014.

[5] T. K. Barman and P. Sahoo, "Fractal Dimension Modeling in CNC Milling Using Taguchi Method", ICME2009, December 2009

[6] John D. Kechagias, Christos K. Ziogas,"Parameter Optimization during Finish End Milling of Al Alloy 5083 using RobustDesign", Proceedings of the World Congress on Engineering Vol I,July, 2011.

[7] B. Malleswara Swami, K. Sunil Ratna Kumar “Design and structure analysis of cnc vertical milling machine bed”, International journal of advanced engineering technology E-ISSN 0976-3945
[8] S. Syath Abuthakeer, P.V.Mohanram, G. Mohan Kumar “Structural redesigning of a cnc lathe bed to improve its static and dynamic characteristics”, Annals of faculty engineering hunedoara- international journal of engineering Tome IX (2011)
[9] Kunal Gajjar, Dr. Amit Trivedi “Optimization of cnc lathe saddle”
[10] Mihai Simon, Lucian Grama, Macedon Ganea “Methods for improving dynamic properties of large moving cnc machine tool components” The 6th edition of the Interdisciplinarity in Engineering International Conference “Petru Maior” University of Tîrgu Mures, Romania, 2012.