SIMULATION OF Ti6Al4V USING DEFORM 3D

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Abstract

Analysis in simulation give an effective approach to use graphical comparison and representation of various parameters and their effect on variables. Temperature study is a very essential parameter in machining of hard metals. Similarly a number of other factors are important in this study like velocity, force, stress etc. The present study explores the basic finishing characteristics of the magnetic abrasive produced by the sintering process. After sintering process improved quality magnetic abrasives was obtained, where the abrasive particle sticks on the base metal matrix.

Keywords: DEFORM 3D; Meshing; FEA analysis.

Introduction

In modern manufacturing area, a number of new tools and manufacturing techniques have been developed. The new expected results cannot be possible to be achieved with traditional methods of manufacturing. So new methods have to be analyzed before actual manufacturing. It has been observed that it requires a large amount to be invested in set up and testing. So better way is that all of these should be analyzed in DEFORM 3D to save expenditures. Though, for the pre-selection of tool geometries and machining factors, model wear test by utilizing finite element methods would be significantly useful. This research aims to examine the outcome of cutting insert geometries [2,3] such as relief angle, nose radius, and cutting insert shape [4,5] on output response specifications. The machining specifications like feed rate, depth of cut and cutting speed may be taken as constant.

Literature

M. Shrivastva explained the abrasive is a material, often a mineral that is used to shape or finish a work piece through rubbing which leads to part of the piece being worn away. Abrasives are extremely commonplace and are used very extensively in a wide variety of industrial, domestic, and technological applications [7]. This gives rise to a large variation in the physical and chemical composition of abrasives as well as the shape of the abrasive. Common uses for abrasives include grinding, polishing, buffing, honing, cutting, drilling, sharpening,

and abrasive machining. For any manufacturing industry, the standard of the component produced determine its competitiveness and effectiveness. They studied the effect of different tool geometries on surface roughness, cutting forces and wear. DEFORM-3D, analysis software and a machining simulation are used in simulation analysis depending on the designed experiment. Mesh generated in cutting insert and workpiece are shown in figure 1 [8].

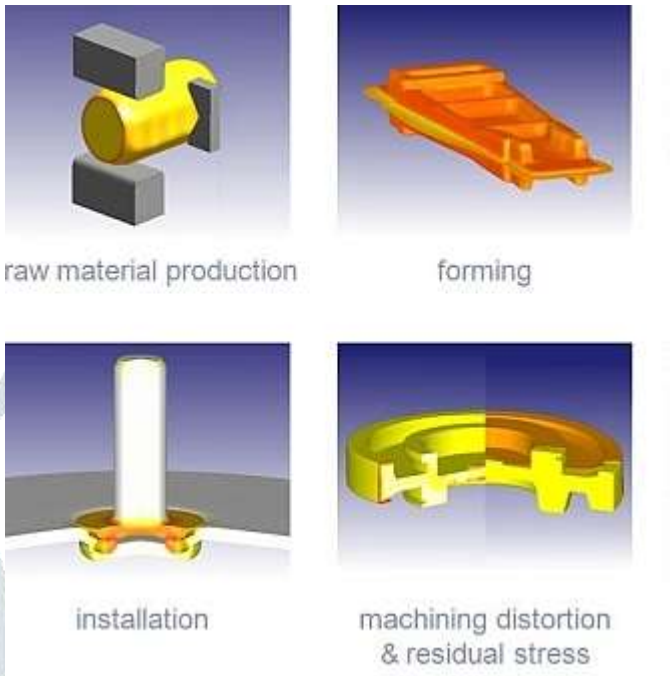

Fig. 1: Mesh generated in cutting

They have compared experimental values with the simulated values. The main parameter selected was the temperature only. Using DEFORM 3D software, Finite Element Analysis is carried out. Milling operation has been selected and three times the speed of mill cutter was changed. John-cook's equation is used to define the material in the software. The results got from the simulation and experimental work were proved as valid after comparison [9]. Thermal-Mechanical finite element method (FEM) model is used in the machining of metals. DEFORM 3D is used for simulation of milling of steel material. To predict the milling force DEFORM-3D software could be used.

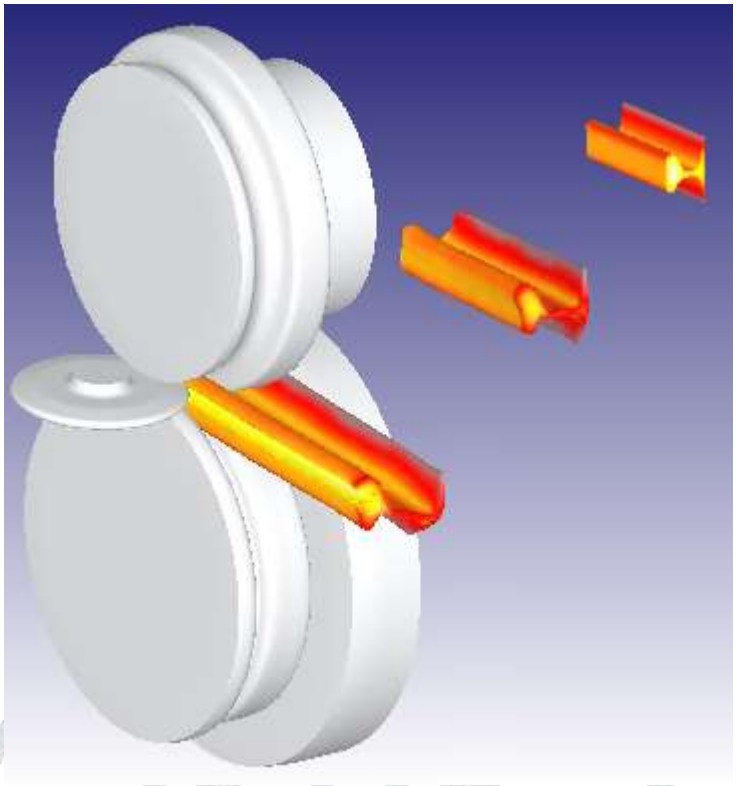

Fig. 2: Predict the milling force DEFORM-3D software

In this, the model's prediction was confirmed experimentally and the experimental results obtained were found to match one another. Figure 2 indicates the temperature variability inside the workpiece [8]. C. Zhuo et al used Titanium material that are accurately simulated using DFORM 3D tool. Research had acquired the effect of cutting depth on cutting power and accuracy [9].

When the part of machining is completed then the stress area with variation in values is shown in figure 3. As a part of result analysis, the primary, feeding and thrust cutting force graphs have been plotted concerning different load values and shown in figure 3.

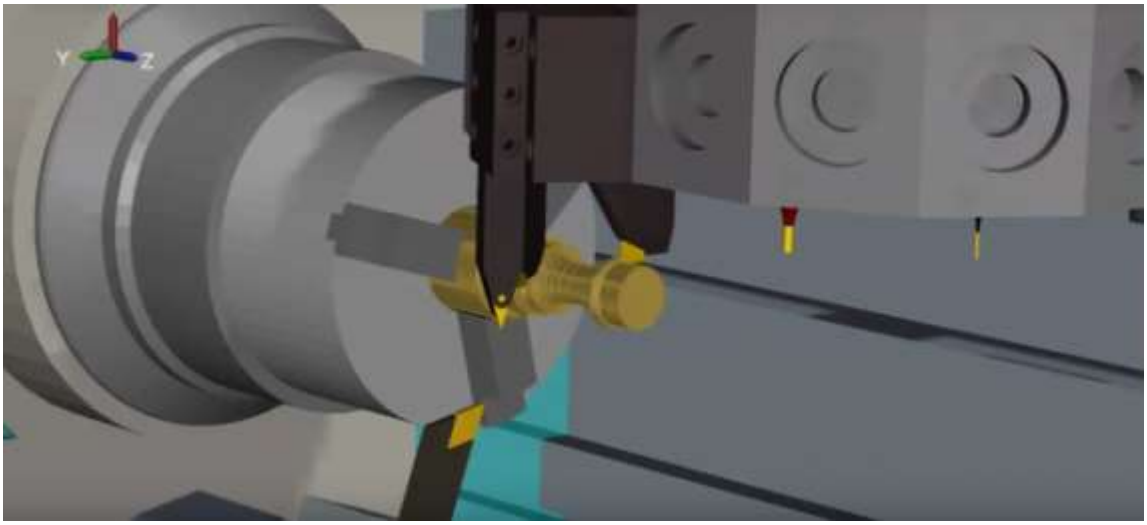

Fig. 3: Result analysis, the primary, feeding and thrust cutting force.

Attanasioa et al. aimed to simulate the wear of the device by drilling nickel based alloys, precisely Inconel 718. The main concern is to research the effect of mechanical and thermal behavior when machining these kinds of alloys, due to this reason the impact of tool wear on the life of the tool on the quality of the end part and power consumption and cutting force in important to examine. The commercial FEM software usually allows certain device wear models to be implemented except for upgrading the design of device. In the drilling of Inconel 718, DEFORM 3D FEA software was used to build and implement a feasible subroutine taking tool geometry update to simulate tool wear. The agreement between the wear value of the measured and predicted tool was strong. A method has been developed for this simulation according to the necessary dimensions as shown in figure 4.A mesh generation of tool is shown in figure 4 [10].

Fig. 4: Simulation according to the necessary dimensions.

R. Rajesh et al. have used cutting insert of tungsten carbide having a coating of Titanium, Aluminium oxide, and Titanium Carbo-Nitride (TiCN). Selected four parameters that are- cut depth, speed, federate and material. They have taken these factors at three different levels and get a total of 9 experiments. Taguchi's method was used to enhance all these experiments. After that best acceptable condition and factors were examined for the minimal quantity of tool wear in the turning process. After the simulation, the analysis of wear rate has been performed and shown in figure 5. Similar to this an important part of the analysis has shown in figure 5.

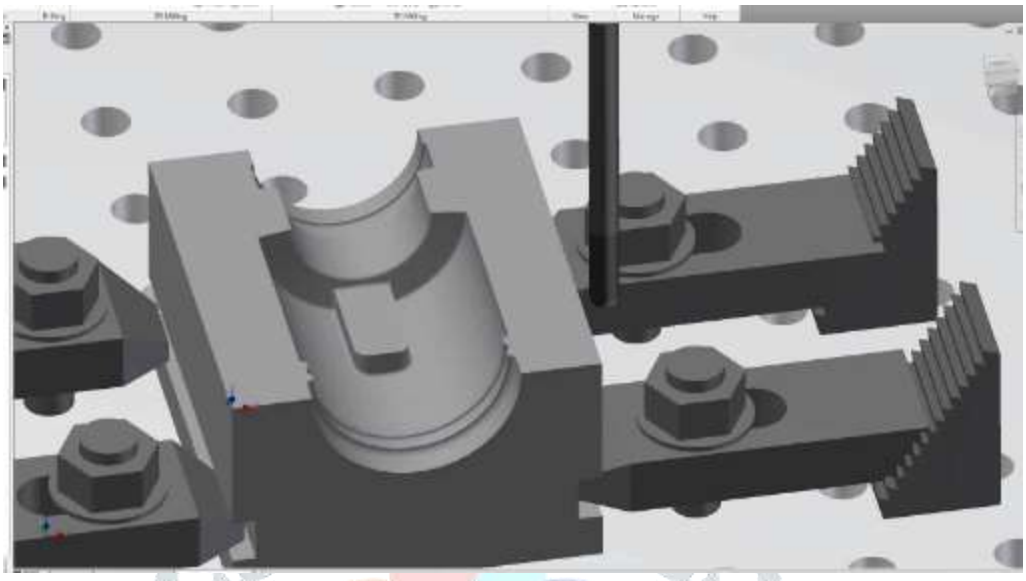

Fig. 5: Important part of the analysis

A. S. Mohruni et al. used DEFORM for FEM simulation to avoid the error in the thin-walled machining to obtain the characteristics across the thin-wall. In this investigation, like validation, the study was carried out with a helical end-mill of 42˚. The outcome prooves that FEM simulation using DEFORM 3D has failed in approaching the experimental results. It might be due to the occurrence of vibration and the depth of cut was very small [12]. R. S. Parihara et al. (2017) tried to examine the impact on performance characteristics of significant machining variables, using ceramic tools in the turning of ASI H13, precise and accurate attempts were taken. To predict the temperature, cutting forces, etc by Langrangian model, DEFORM 3D which is a FEM based software was used as a 3D machining model. [13].

Conclusion

From the above literature for efficient finishing process to be developed for enabling unskilled operators to finish automatically the complicated micro curved surface and edge surface of the magnesium alloy. He also

showed that the removal volume per unit of magnesium alloy is larger than that of the order materials such as brass and stainless steel that is high efficiency finishing could be achieved.

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