REVIEW ARTICLE ON VARIOUS PARAMETER IN FEM SIMULATION

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Abstract

Simulation using Deform 3D tool is very popular and effective to study the various parametric effect in manufacturing of variety of objects. It provides an easy and effective way of analyses and then declaring the results. It give an effective approach to use graphical comparison and representation of various parameters and their effect on variables. In current research work magnetic abrasive particles were used as finishing tools during MAF process. However, these magnetic abrasives are fabricated by special techniques i.e., adhesive bonding based method, sintering method, plasma-based method and many more.

Keywords: DEFORM 3D; Meshing; FEA analysis.

Introduction

The variation in the magnetic flux density in the machining gap determines the force acting on the abrasive particle, which generates finishing pressure on the work piece surface during MAM. The range of magnetic flux density in most of studies is 0.4T to 1.2T. In modern manufacturing area, a number of new tools and manufacturing techniques have been developed [1, 2]. 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 significantly useful. This research aims to examine the outcome of cutting insert geometries [3] such as relief angle, nose radius, and cutting insert shape [4] on output response specifications. The machining specifications like feed rate, depth of cut and cutting speed may be taken as constant [5].

Literature

T Tamizharasan and S. Kumar used the AISI 1045 steel for FEA analysis which attempts in reducing and making it a minimum for the wear of non-coated carbide insert. The main reason that results in the lowgrade surface finish is the tool wear and is the cause behind the dimensional precision of the machined surface. 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 [6].

G. G. Reddy et al. have done machining on AISI 420 and coated tungsten carbide tool and study of comparison of various obtained values during the milling is done. 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 [7]. Z. Wanga et al. (2014) have done the 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.

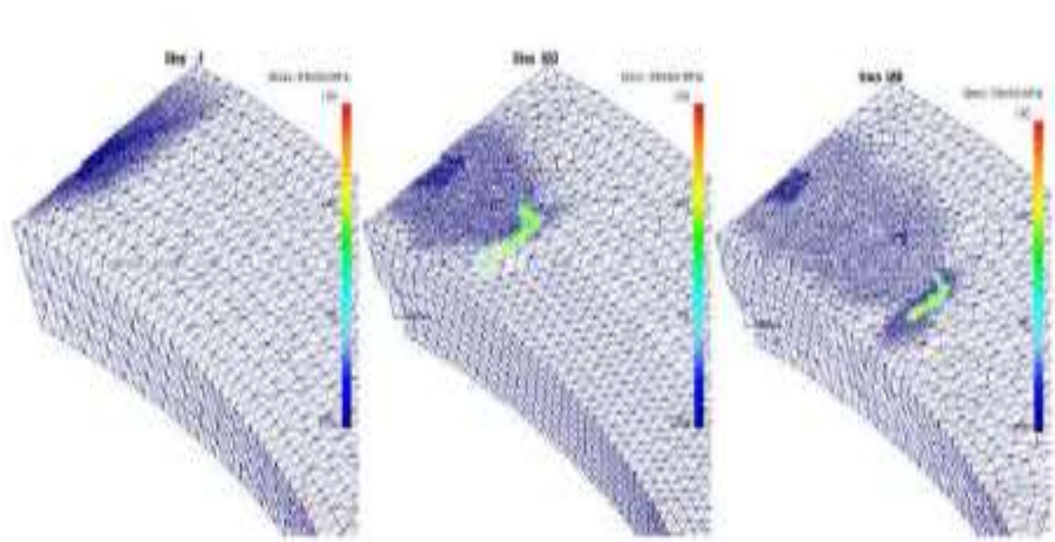


Fig. 2: Variation of temperature in workpiece [7].

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].

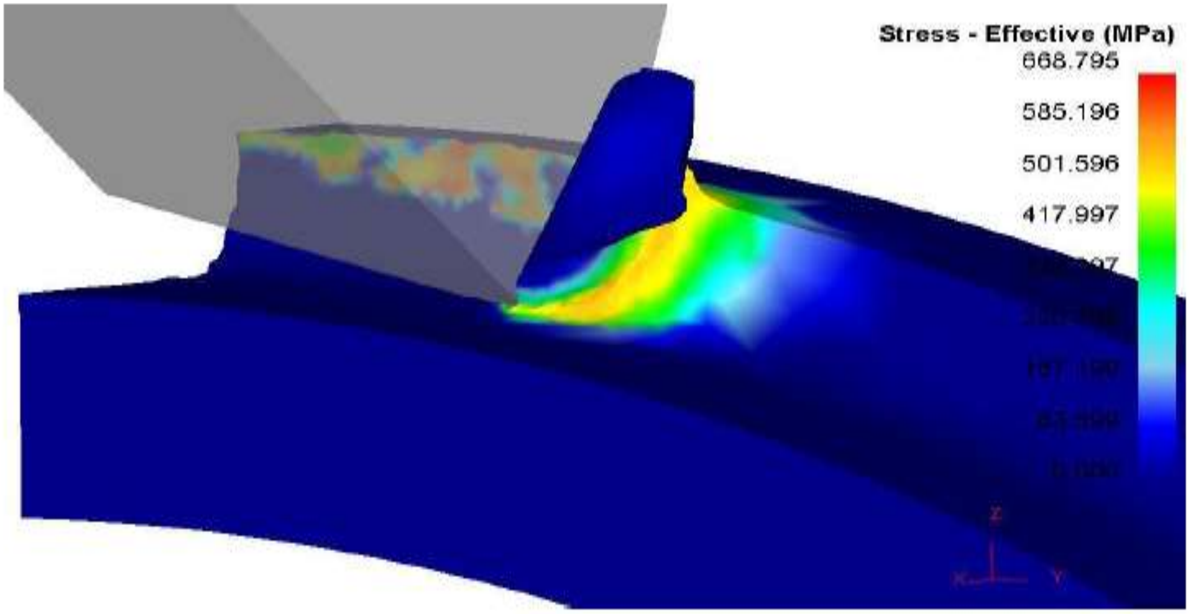
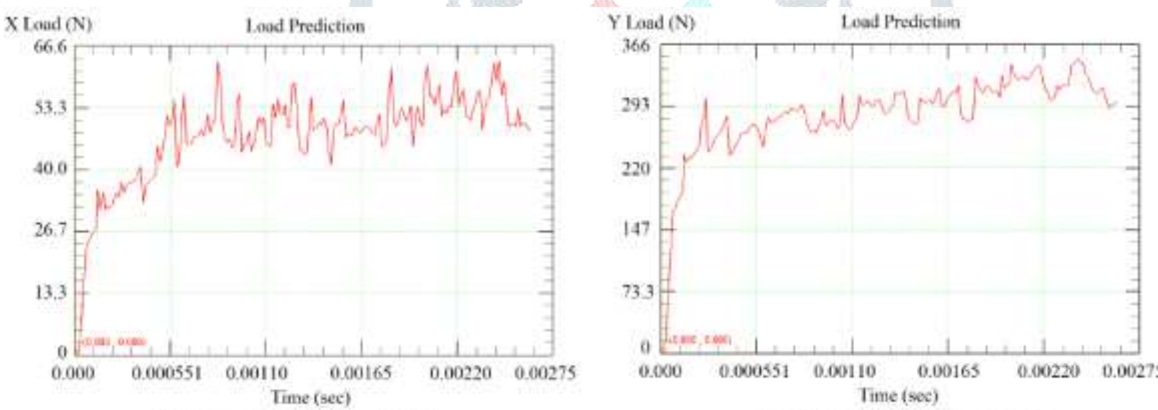


Fig. 3: Stress contour in front cutting edge [9].

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 4.



(a) Primary cutting force (b) Feeding cutting force

Fig. 4: Graph of cutting force with parameter [9].

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 5.A mesh generation of tool is shown in figure 6 [10].

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 7. Similar to this an important part of the analysis has shown in figure 8. Then a comparison has been made in between the simulation and experimental results in terms of wear rate shown in figure 9.

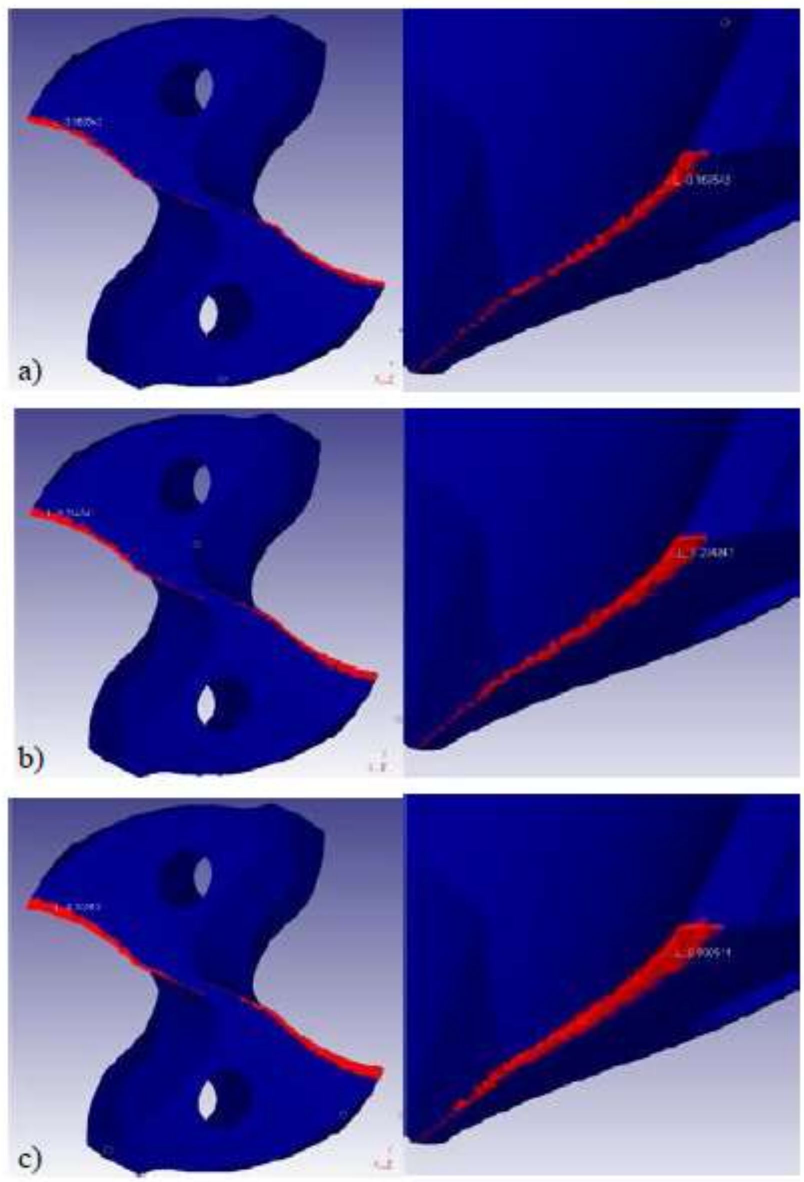


Fig. 7: Result in terms of wear rate [11].

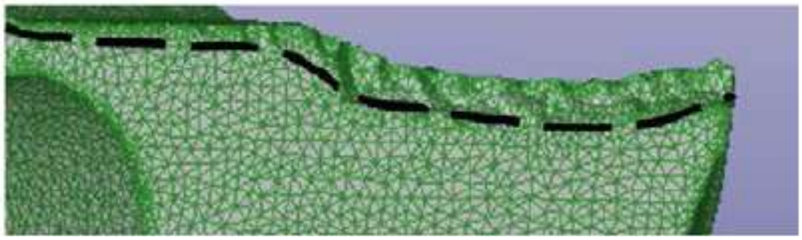


Fig. 8: Cutting tool showing wear rate [11].

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, 13].

Conclusion

Various factors can be studied very easily using DEFORM 3D an advance tool for optimization. The results from such analysis can be compared with experimental results for declaring the final effectiveness of that particular techniques and its variables. It also makes a clear 3D representation, graphical representation of results.

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