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RESEARCHES ON SINGLE POINT CUTTING TOOL DEFLECTION

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ДОСЛІДЖЕННЯ ПРОГИНУ ОДНОЛЕЗВІЙНОГО РІЗАЛЬНОГО ІНСТРУМЕНТУ

Firstly the cutting forces were measured using dynamometer which is taken from reference, then finite element method (FEM) was used to obtain the cutting tool deflection which is finite element analysis (FEA). The FEA results were then validated using cantilever beam model results. The predicted results from FEA were very close to the theoretical study. Though the prediction from FEA and the theoretical results are reasonably accurate.

The researches of single point cutting tool deflection is important on the basis of accuracy. Cutter deflection consist of different directional deformation such as axial deformation, tangential deformation, radial deformation due to cutting forces exist during cutting. Also other factors like depth of cut, cutting speed, and feed also effects on the accuracy of ideal geometry. However, the deflection of tool under the action of cutting forces could be beyond acceptance level especially when the geometric condition of tool is changed. Over the years many researchers focused to compensate many different factors affected by cutting forces and geometrical changes of tool. Flank wear of single point cutting tool due to cutting forces by varying side cutting edge angle can be calculated by using shear area of cutting process [1]. Cutting force varies as there is change in cutting condition such as width of cut, thickness of cut, feed, depth of cut and tool cutting edge angle. So the cutting forces are influenced not only by the cutting condition but also the cutting edge geometry and material of workpiece [2]. Cutting parameters have influence tool temperature, tool wear, cutting forces and surface roughness of carbide coated tools [3]. Using von-Misses theory tool life's increment can be achieved by increasing back rake angle. The resultant von-Misses stress can be calculated using FEA simulation [4]. Deflection of tool effects on their tool life, surface roughness and dimensional correctness. The results can be calculated using Taguchi's experimental design method and FEM analysis using ABAQUS finite element program.

Analytical solution may not predict the deflection very accurately whereas the more realistic prediction by FEA requires extensive computational time and space. Thus the tool deflection can be predicted by FEA prediction and results may compared and validated with beam model. Cantilever beam model predicts the deflection to very close accuracy similar to finite element. The predicted deflections in axial, radial, tangential directions by FEA can assimilated to Beam model results at different side cutting edge angle and increasing side rake angle for single point cutting tool for steel materials.

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