AIJREAS VOLUME 2 ,ISSUE11(2017, NOV) (ISSN-2455-6300)ONLINE
ANVESHANA'S INTERNATIONAL JOURNAL OF RESEARCHIN ENGINEERING AND APPLIED SCIENCES

A SCHEMATIC DESIGN AND ANALYSIS OF MACHINE TOOL ELEMENTS UNDER SOME STRESS CONDITIONS USING ANSYS

MEDURI ANNAPURNA, M.Tech Student, Dept of Mechanical-CAD/CAM, Brilliant grammar school educational institutions group of institutions integrated campus, T.S, India

MR.K.SRINIVASA RAO, Associate Professor, Dept of Mechanical-CAD/CAM, Brilliant grammar school educational institutions group of institutions integrated campus, T.S, India

ABSTRACT

In this project, temperature at tool-tip interface is determined, generated in high-speed machining operations. Specifically three different analyses are comparing to an experimental measurement of temperature in a machining process at slow speed, medium speed and at high speed. in addition, three analyses are done of a high speed steel and of a carbide tip tool machining process at three different machine speeds, in order to compare to experimental results produced as part of this study. An investigation of heat generation in machine tool is performed by varying machine parameters at the suitable machine tool geometry. The experimental results reveal that the main factors responsible for increasing machine temperature are machine speed (v), feed rate (f), and depth of cut (d), respectively. it is also determined that change in machine speed and depth of cut has the maximum effect on increasing machine temperature. Various researches have been undertaken in measuring the temperatures generated during machine operations. Investigators made attempt to measure these machine temperatures with various techniques during machining. In this project, "fluke 62 max ir thermometer" (range -40 0c to 650 0c) is used for measuring temperature at tool-tip interface. single point machine tool has been solid modeled by using cad modeler Siemens 8.0 and fea carried out by using ansys workbench 15 experimental work is at "s.v.p engineering "by varying various parameters the effect of those on temperature are compared with the experimental results and FEA results. Keywords: multi point machine tool (carbide) tool and carbide tip tool (p -30), computer aided design (cad), milling , fluke 62 max in thermometer (range -40 0c to 650 0c), finite element analysis, solid modeling.

Keywords*: production, machine tools, design objectives, FEA*

1.0 INTRODUCTION

The fabrication of a wide variety of parts and products in various fields, like aeronautics, automotives, biomedical, medical and electronics requires proper finishing for proper mating and functioning of products. A variety of operations like milling, drilling, turning, grinding, EDM and water jet Machine are utilized to fabricate and finish parts. One of the most common and important form of machining is the milling operation, in which material is cut away from the work piece in the form of small chips by feeding it into a rotating cutter to create the desired shape. Milling is typically used to produce parts that are not axially symmetric and have multiple features, such as holes, slots, pockets, and even three dimensional surface contours. Contoured surfaces, which include rack and circular gears, spheres, helical, ratchets, sprockets, cams, and other shapes, can be readily cut by using milling operation. Recently, micro milling process has gained immense popularity due to market requirements and technological advancements which has lead to fabrication and use of micro structures. It possesses several advantages like ease of use, capability to produce complex three dimensional geometries, process flexibility, low set-up cost, wide range of machinable materials and high material removal rates. This chapter develops the background for the present work and discusses the need to take up this work. It presents a review of available relevant literature. Objectives of the present work along with methodology adopted to accomplish them are also discussed here.

With the growth in technology, the expectations from products have greatly increased. More and more complex shaped parts of varying sizes are being designed, developed and used for a wide variety of industrial applications. The commercial success of a new product is strongly influenced by the highest possible quality and productivity achieved. This can be achieved only when the parts and/or products have excellent surface finish. One of the important causes of poor surface finish is the formation of burrs along the machined edges / boundaries.

1.1 MOTIVATION:

Conventional milling has a wide range of industrial applications and is used where there is a requirement of complex shapes, removal of large amounts of material, and accuracy. However, with the advancement in technology, more and more industries are leaning towards the use and fabrication of miniaturized parts and products. In the present scenario, micromachining is increasingly finding application in various fields like biomedical devices, avionics, medicine, optics, communication, and electronics. Among all micro-machining operations, micro-milling and micro-drilling are the two most important operations. In today's competitive world, every industry is dependent on the adequate functionality of its micro components.

Problem Definition

This work is an attempt to optimize micro milling tool parameters for minimization of micro burrs formed during micro machining. The objectives of this work are stated as follows:

- To develop three-dimensional solid models of multi point milling cutters.
- To perform the static finite element analysis of the tools during milling.
- To perform the finite element detailed analysis of the tool and work piece combination during milling.
- To perform burr formation simulation in milling

1.3 Manufacturing Processes and its Classification

Manufacturing can be defined as value addition processes, which produces high utility and valued products from raw materials of low value and utility. The center of manufacturing operations is the methodology answerable for converting the shape, size and completion of the object. Manufacturing processes can be broadly classified in three major groups, namely,

(i) subtractive machining (removal processes),
(ii) additive manufacturing, (deposition of material in an empty volume or layer)

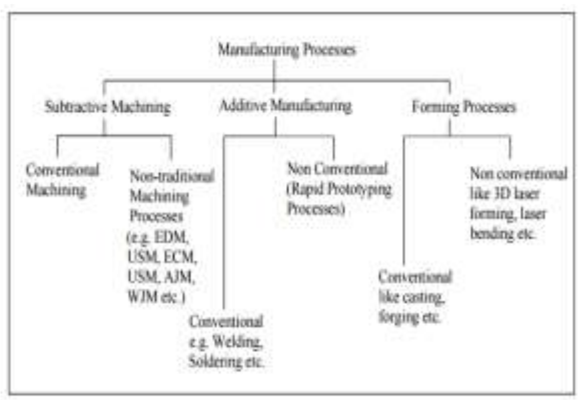


Figure 1.1: Classification of Manufacturing Processes

Number	(Size)(mm)
1	22
2	28
3	34
4	42
5	50
6	60

Table 1 Standard size longitudinal table travel Number

SCOPE OF THE PRESENT WORK

The outcome of the research will be a static finite element analysis of multi point Machine tool formed during milling which can help in determining tool life and detailed dynamic analysis of tool formed during milling operation in Al6061T6 which can benefit the aerospace industry, which utilises this alloy for fabrication of a large number of components. The results obtained during the analysis may be used for further research for burr minimization through tool optimization and process control.

2.0 LITERATURE SURVEY

Ritz (2012) developed an effective method [for the approximate solution of problems in the mechanics of deformable solids. It includes an approximation of energy functional by the known functions with unknown coefficients. Minimisation of functional in relation to each unknown leads to the system of equations from which the unknown coefficients may be determined. One from the main restrictions in the Ritz method is that functions used should satisfy to the boundary conditions of the problem.

Hrennikov (1998) The present model considers the longitudinal movement of a rail through the straightening machine, contact conditions between rail and rollers and kinematic hardening so as to take into account the plastic behavior of the rail material (steel). These results were compared with the experimental investigations and good agreement was observed. In this respect, this paper presents a novel, more realistic numerical simulation by FEM for the roller straightening process. Finally, an improvement of the straightening process in order to obtain smaller residual stress in the rail section is proposed

Martin (2010) present work involves the study of tool wear caused by the change in hardness of single point Machine tool for a turning operation to predict the tool life in orthogonal Machine based on the heat transfer analysis using Finite Element Method (FEM). The Experiments 19 were performed with EN-24 steel as work piece and Carbide uncoated tool bit as a tool material and the flank wear has been measured experimentally.

Turner (2000) The aim of the model is to determine the temperature distribution in the work piece and the geometry of the Machine front during the cut. Mathematically, we model the problem as a coupled system of equations; heat conduction equation with Signori-type boundary conditions and level-set equation as a result of reformulation of Stefan-type boundary condition. The weak formulation of the model is discussed in the framework of variation inequalities and level-set theory. Using the adaptive finite elements method, numerical results are obtained and illustrated in the manuscript. Our formulations provide a conceptually new approach towards the mathematical understanding of physical phenomena involved in the process of thermal plasma Machine

Ren L Q and Liang Y H Subsequently, in order to improve the precision of dimension and volume shrinkage, more expensive equipment is used on the market. Also, it is expensive and inefficient to obtain better process parameters through trial and error in the RP process. In order to improve the precision of dimension, reduce the processing cost and the frequency of trial and error, this study first induces the concept of computer aided engineering (CAE) into the processing of RP, which uses a finite element simulation code to simulate the photo polymerization process, so as to obtain the distortion data. Besides, it is believed that this research method can be promoted to other materials or build methods in RP fabrication.

3.0 FINITE ELEMENT ANALYSIS

In general, there are three phases in any computer-aided engineering task:

- Pre-processing – defining the finite element model and environmental factors to be applied to it
- Analysis solver – solution of finite element model
- Post-processing of results using visualization tools

The ANSYS program allows engineers to construct computer models or transfer CAD models of structures, products, components, or systems, apply loads or other design performance conditions and study physical responses such as stress levels, temperature distribution or the impact of lector magnetic fields.

Competitive companies look for ways to produce the highest quality product at the lowest cost. ANSYS (FEA) can help significantly by reducing the design and manufacturing costs and by giving engineers added confidence in the products they design. FEA is most effective when used at the conceptual design stage. It is also useful when used later in manufacturing process to verify the final design before prototyping.

It is an efficient design tool by which designers can perform parametric design studies by considering various design cases, (different shapes, materials, loads, etc.) and analyze them to choose the optimum design. The method originated in the aerospace industry as a tool to study stress in a complex airframe structures. It grows out of what was called the matrix analysis method used in aircraft design. The method has gained increased popularity among both researchers and practitioners. The basic concept of finite element method is that a body or structure may be divided into small elements of finite dimensions called "finite elements". The original body or the structure is then considered, as an assemblage of these elements connected at a finite number of joints called nodes or nodal points.

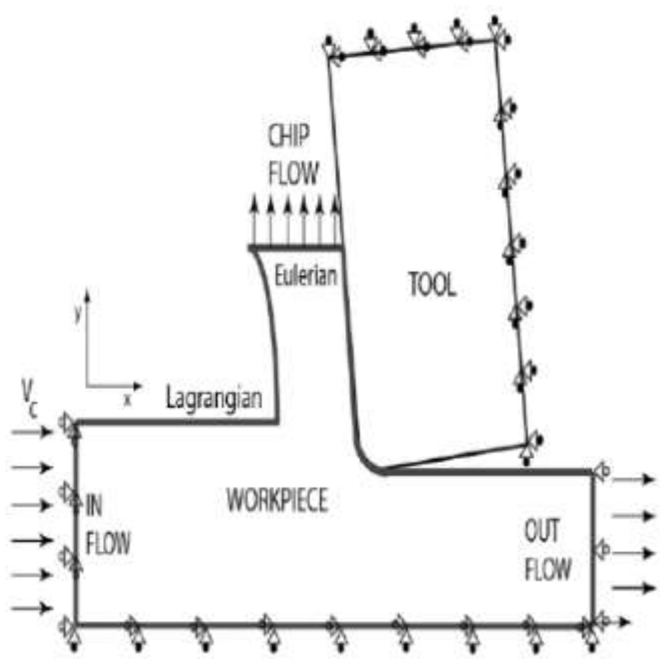


Figure 3.1 placement of tool in the machine

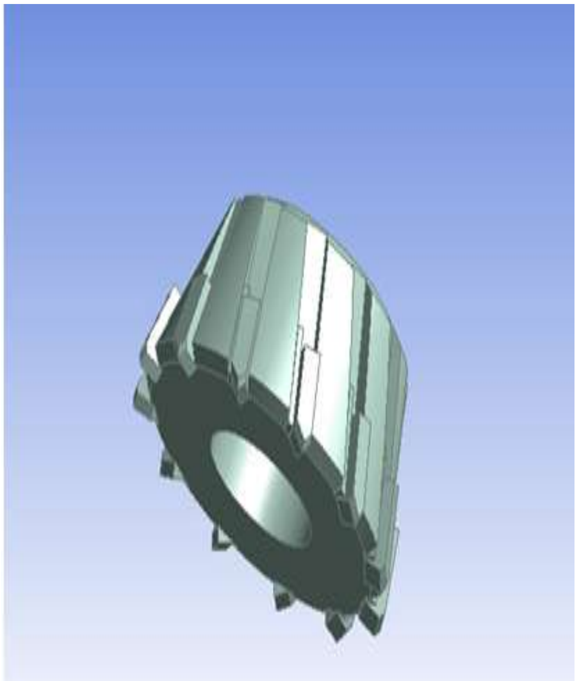


Figure 3.2 cad model of the tool

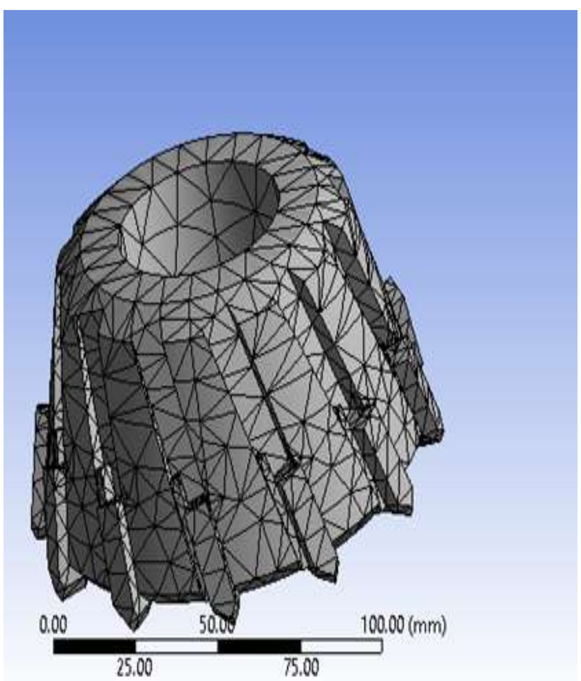


Figure 3.3 meshed model of tool

4.0 RESULTS

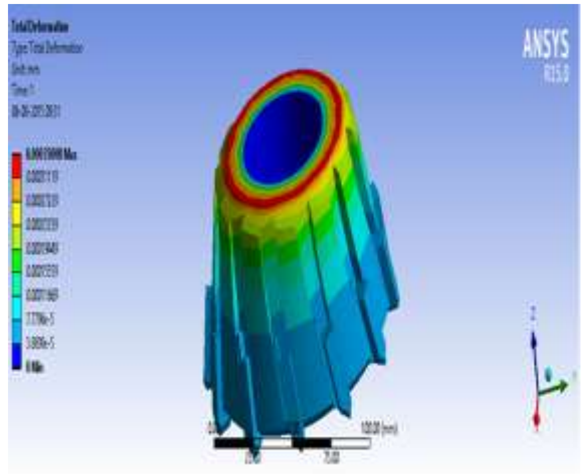


Figure 4.1 total deformation of tool

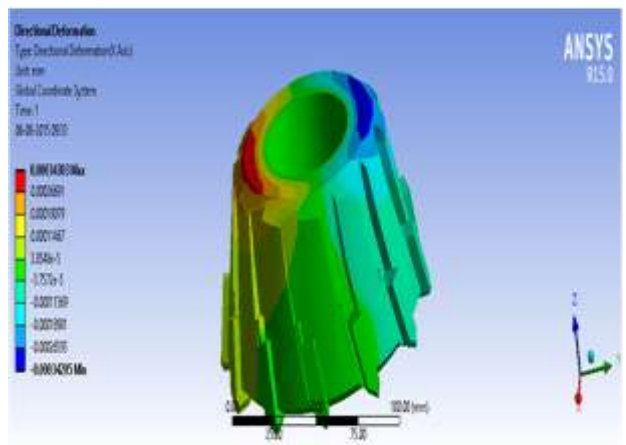


Figure 4.2 deformation of tool along x-axis

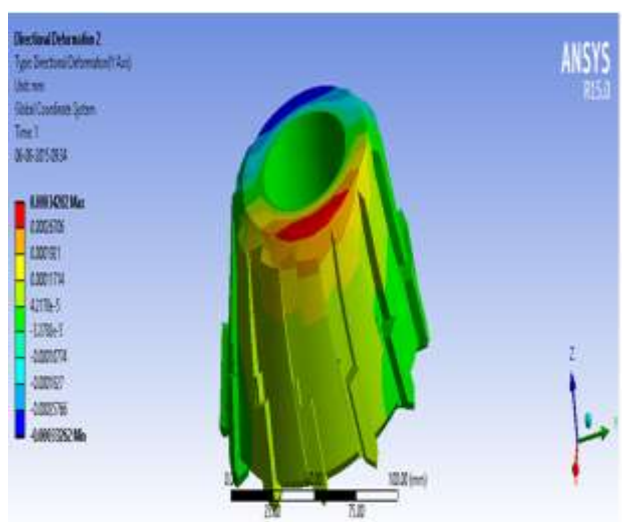


Figure 4.3 deformation of tool along y-axis

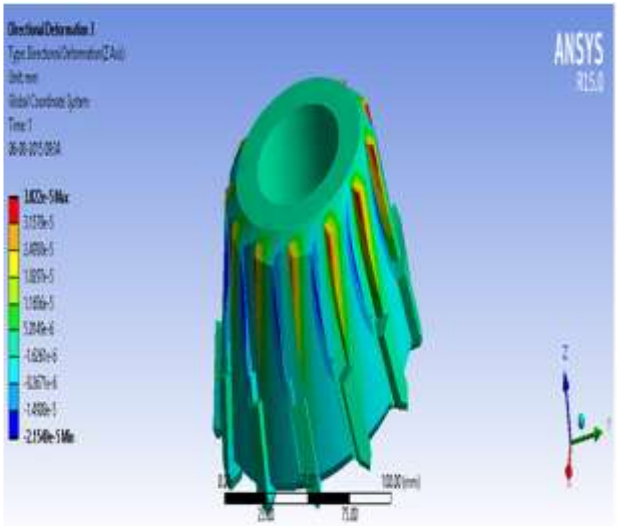


Figure 4.4 deformation of tool along z-axis

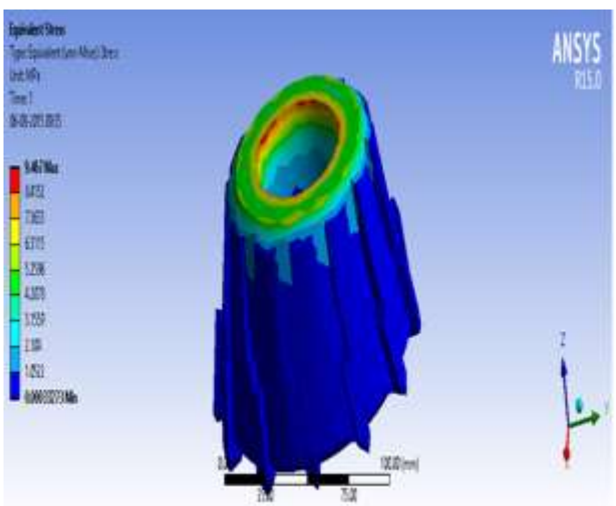


Figure 4.5 equivalent stresses

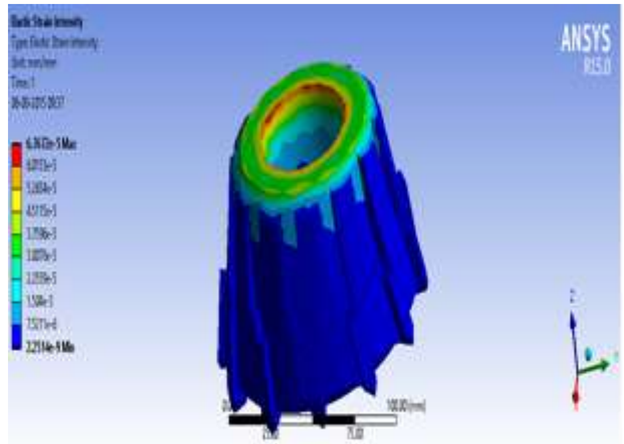
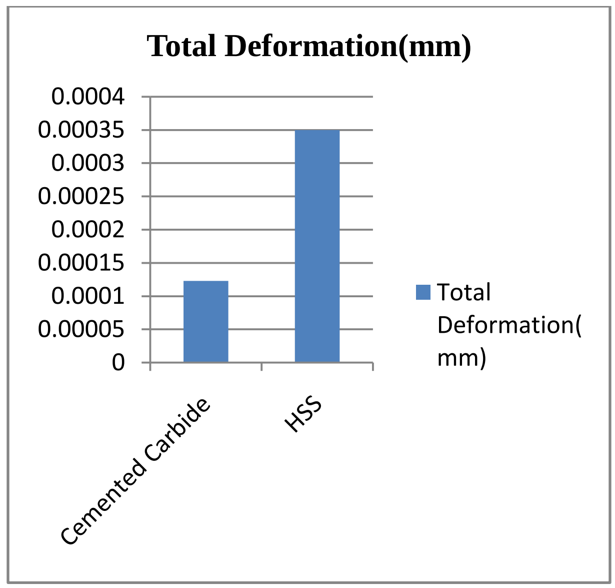


Figure 4.6 elastic strain intensity



Graph 4.1 Comparison of Total Deformation for cemented carbide and HSS

5.0 CONCLUSIONS AND FUTURE SCOPE

From the results obtained in ANSYS it can be observed that the deformation for HSS material tool is more than the Cemented Carbide tool by approximately 85%.This is due to the high density of cemented carbide.

Equivalent stress observed for cemented carbide tool is more than HSS material tool. Stress intensity for the cemented carbide material multi point tool is more than the high speed steel tool. From the results the fail safe condition for the tool has been established by comparing with the practical data.

FUTURE SCOPE

The analysis can be carried out with different rotational speeds, under varing load and for different materials other then the materials used in this thesis.

REFERENCES

1. Chen P Y, Lin A Y M, Lin Y S, Seki Y, Stokes A G, Peyras J, Olevsky E A, Meyers M A and McKittrick J (2008), "Structure and Mechanical Properties of Selected Biological Materials", Journal of the Mechanical Behavior of Biomedical Materials, Vol. 1, pp. 208-226.

2. Junior W K and Guanabara A S (2005), "Methodology for Product Design Based on the Study of Bionics", Materials and Design, Vol. 26, pp. 149-155.

3. Kim D I, Jung S C, Lee J E and Chang S H (2006), "Parametric Study on Design of Composite-Foam-Resin Concrete Sandwich Structures for Precision Machine Tool Structures", Composite Structures, Vol. 75, pp. 408-414.

4. Ma J F, Chen W Y, Zhao L and Zhao D H (2008), "Elastic Buckling of Bionic Cylindrical Shells Based on Bamboo", Journal of Bionic Engineering, Vol. 5, pp. 231-238.

5. Ren L Q and Liang Y H (2010), "Biological Couplings: Function, Characteristics and Implementation Mode", Science in China Series Es: Technological Sciences, Vol. 53, pp. 379-387.