A Dynamometer Design and Its Construction for Milling Operation

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Abstract— help during the course of the project. iv ABSTRACT The project aims at impact of reducing forces at the drill bit and end mill cutter tool in manufacturing. For High-speed machining operation, accuracy of device tip of the tool locations an essential function in mass manufacturing. In order to get excessive precision, excessive-performance automated production the device existence need to be longer sufficient to resist diverse stresses performing on it. The goal is to expand the mixture of most efficient reducing parameters the use of Taguchi method at the side of that we additionally going to investigate the surface finish of the workpiece. In this project Taguchi technique has been hired with Orthogonal Array for 3 parameters particularly speed, Feed and Depth of cut. For every of those parameters 3 various levels have to be diagnosed and used to carry out the reducing parameters for minimizing the stresses performing on diverse device in CNC milling. The materials decided on for aluminium plate with drill bit and end mill cutter. By applying different cutting force on Cutting tools various stress, strain, total deformation that supports software ANSYS. Cutting tools are modelled in CREO software program and then imported in ANSYS software program for evaluation. stress analysis of cutting tool is observed and cutting force is higher compared to thrust force. We carry out the surface end check at the workpiece to behaviour the optimum cutting parameters. Keywords: CREO;

ANSYS; CNC milling; CNC cutting tool; Cutting parameter; Tools; Workpiece; Taguchi method; Etc.

I.INTRODUCTION

High speed machining (HSM) is a complicated and rising machining method hired universally to system complicated elements with excessive productivity, progressed quality, sustainability and economy. Initially, HSM changed into advanced to system missile and plane additives made from aluminium and its alloys. Due to nonstop tendencies withinside the discipline of HSM these

days to be had system can system difficult metals, tough to reduce materials, complicated 3d geometry and micro/nano functions with excessive accuracy and precision. The reducing velocity variety in HSM relies upon up on numerous parameters consisting of paintings cloth, device cloth, reducing situations and system. However, paintings cloth extensively impacts the reducing velocity..

Composite materials

Most milling machines have similar components. First you have the base of the machine. This usually includes the worktable are usually ball screws, to move the machine. It can also include the electric drives that move the various machine components. CNC machines also require what is generally referred to as the "controller", which is the computer part of the CNC. This computer controller uses programmed input values and feedback loop data to control machine motion. In addition, milling machines include any spindle. The spindle rotates cutting tools for milling or, in the case of a lathe, rotates the actual workpiece for lathe tooling

Properties

Milling is the system of reducing and drilling material (like wood or metal). A milling system, no matter whether or not it's operated manually or via CNC, makes use of a rotating cylindrical device known as a milling cutter. It is held in a spindle and may range in shape and size. The primary distinction among a milling system and another drilling system is the capacity to reduce in extraordinary angles and circulate alongside extraordinary axes

II. LITERATURE REVIEW

J.S.Strenkowski et al focused-on development of FEM for oblique cutting by taking forces and moments acting on drill, which was based on viscos elastic effects on drill bit geometry for oblique sections. An analytical model for oblique cutting was described to analysis a single section in the cutting region .

S.Madhavan et al conducted drilling experiments on GFRP material using Taguchi design of experiments, but they concentrated on the effect of delamination factor by varying the cutting speed, feed rate, thrust force and torque during drilling operation.

R.Vimal Sam Singh et al developed a fuzzy logic-based model for forecasting thrust force and torque during drilling, but not considered the changes on geometry of drill.

P.V.Gopal Krishna et al concentrated their experiments on friction drilling which is unconventional drilling process in which a cone type rotating tool penetrate into material and generate a hole, without generating chips. Aluminium (AA6351) is taken as work material and friction drilling is carried outby has conical

rotating tool, finally they developed mathematical models for axial thrust force and torque.

M.Pirtini et al considered principles of mechanics to develop mathematical models in drilling to predict cutting forces and surface finish of a hole. This model is able to simulate the cutting forces for various machining conditions in the process in order to obtain drilled profiles. Therefore, in addition to predict the forces, the new model allows finding and visualization of drilled shapes in 3D.

G.Krishna studied and investigated "Selection of Optimum Process Parameters in High Speed CNC End-Milling of Composite Materials Using Meta Heuristic Techniques.

III. MATERIALS

Material could need a step with inside the manner of coming up with any physical object. In the content of product design, the principle aim of material choice is to limit value at the same time as assembly product overall performance goals, systematic choice of the pleasant material for a given utility starts with properties and charges of candidate materials.

▪ SPECIMEN MATERIAL: Aluminium-6061. ▪ TOOL MATERIAL: M08 molybdenum high speed steel drill bit and M10 molybdenum high speed steel end mill cutter.

▪ DEVICE: Tool dynamometer to calculate the cutting force.

▪ SOFTWARE USED: Cero and Ansys.

For this process we select speed, feed, depth of cut as cutting tool parameters, cutting speed (200250 mm/min), feed per tooth (0.03-0.4 mm) and depth of cut (0.20-6.0 mm) while the cutting force serves as the response of the designed experiment.

4.4 DESIGN OF EXPERIMENTS

For listed input parameters experiments are planned by following Taguchi technique and L9 Orthogonal array was performed.

4.5 EXPERIMENT PROCESS PARAMETERS

To design the experiment and cutting tool parameters are varied in order to obtain the L9 Orthogonal array was tabulated below. By providing various speed, feed and depth of cut to all the levels to identify the efficiency.

4.7 EXPERIMENTATION RESULT

The experiment was performed on various level of cutting parameters and cutting forces are estimated and results are tabulated below.

Moment Calculation

Moment = Thrust force × Radial distance of drill bit

Momentge : 157 × 4 = 628 N.mm

4.8 MODELLING

4.8.1 Two and Three- Dimensional Drawing

A 2D drawing states that sits in only the X and Y axis. More simply, A 2D drawing is flat and has a width and length but no depth or thickness. A drawing is a 2D model of 3D space if you want it to be. The two-dimensional model of three-dimensional space is where the edges of the page are parallel to two of the three dimensions and the third dimension is depicted through overlapping, diminishing size and other techniques called the perspective.

4.8.2 Design Tools

The tool which are used to create the geometrical model in a designing software are design tools. CAD, or computer-aided design and drafting (CADD), is the use of computer technology for design and design documentation. CAD software replaces manual drafting with an automated process.

4.8.3 CREO

Creo is a family or suite of Computer-aided design (CAD) apps supporting product design for discrete manufacturers and is developed by PTC.

V.RESULT DISCUSSION

5.1 RESULT

The distributions of Equivalent Stress and strain in different milling and drilling tools considered with total deformation. The following table consists oftotal deformation, equivalent stress, equivalent strain and strain energy values obtained from ANSYS at M08 and M12 Drill bit and M10 End Mill Cutter.

5.2 ANALYSIS

The analysis of combination of cutting tool parameters and its result are found using ANSYS software and various graph are plotted using the results obtained above.

5.3 STATISTICAL ANALYSIS

It is a completely convenient device to get faulty answers when the authentic technique could be very complex or now not identified in its actual shape. It additionally gives an most excellent set of input parameters to identify the effect of every on a given output. Taguchi approach emphasizes over the selection of the maximum first-rate solution over the set of specific inputs with a reduced fee and magnified high-quality. Thus, the trendy day method to are searching for out the fantastic output over a hard and fast of given input are often virtually function out via the employment of Taguchi method.

5.4 TAGUCHI METHOD

The Taguchi technique could be a control tool to identify the results of different greatly reduced variance for experiments with optimal parameter settings for method management. During this work L9 orthogonal array mixed was accustomed do the experiments and therefore the experimental result was analyzed mistreatment Taguchi tech Since the investigational layout is orthogonal, it turned into likely to wonderful out the realization of every parameter at modified levels. Graph plotted among Input parameter (speed, feed, and intensity of cut) and output the usage of above. So as to measure the variability of the outcomes among a predefined vary.

5.5 GRAPH

The various graphs are plotted by the given results of total deformation, equivalent stress and strain and strain energy for the combination of cutting tool parameter analysis results.

VI.CONCLUSION

The project we can conclude that effect of cutting forces on tool during machining process place a vital role in highspeed machining process. In order to obtain greater accuracy, surface finish and tool life we need to select the appropriate combination of cutting tool parameters. The best cutting tool parameter combination were found on different cutting tools we suggest this combination of cutting parameters will increase the machining capacity, machinability, accuracy, surface finish and tool life. Each combination of cutting tool parameter will decrease stress acting on the tool thus it improves the tool life to a greater extend. Various graph is interpreted from that we conclude Level 3 has highest values of total deformation, Equivalent strain and stress, strain energy. Level 8 has the lowest values of total deformation, Equivalent strain and stress, strain energy for end mill cutter (M10) and Level 7 for drill bit (M08).

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APPEXDIX