Covex Surface Milling Mechanism

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Abstract- *Milling is one of the most important machining processes in manufacturing. This process is used to shape solid materials especially metals. It is mostly used in shaping flat and irregular surfaces. It can be used for drilling, cutting gears, boring, and producing slots. Milling a curved surface falls under the umbrella of profile/ contour CNC milling. It involves machining irregularly shaped profiles or continuous curves with various degrees (slanted, concave, or convex). This is a crucial process in getting most of the uniquely shaped bespoke parts done, which requires the CNC machining services providers to have advanced knowledge of the fundamental machining principles and programs. The Curved Surface milling machine, a project which demonstrates the set up for milling a flat surface to curved surface without CNC. The Drilling machine is stationary. A flat platform is provided upon which the material can be placed. The platform is set upon two inclined rods which is mounted on slider that allows the platform to move back & forth but in a curved way according to its arrangement. The reciprocating motion of the platform is done manually with the help of a lead screw mechanism.*

Keywords- CNC Milling, Drilling, Gear Cutting, Milling, Slotting

I. INTRODUCTION

Milling is a crucial machining process for shaping metals and other solid materials, often used in aerospace, automotive, and actuator industries. It involves the removal of metal through the cutting action of a rotating milling cutter, which can hold multiple tools and operates at high speeds for efficient material removal. Milling machines are classified as vertical or horizontal and can be further categorized into knee-type, ram-type, manufacturing or bed type, and planer-type. Key factors influencing milling quality include cutting conditions, cutting geometry, workpiece specifications, and tool geometry. With high accuracy and superior surface finish, milling machines are essential for precise and high-rate metal removal, making them widely used in production environments.

II. IDENTIFY, RESEARCH AND COLLECT IDEA

Isabela da Costa Castanhera and Anselmo Eduardo Diniz (2016)- Presented the contribution to hardened tool steel milling studies. High speed milling is largely utilized to substitute some EDM and polishing operations, mainly in hardened tool steel finishing. Tool path strategy may either enable good surface finish or contributes to generate high roughnessvalues and poor surface finish.

Parmar Navdeep andet.al., (2019)- presented industries CNC machines are widely used but they are costly. So, commonly simple lathe machines are being used for cost reduction purpose of any product. But the radius part can only be done with the help of special CNC lathe machine. So, overcome this limitation we are design a fixture for convex-concave tool on simple lathe machine and more over it can be also used for the knurling process.

Andrei Oșan, Mihai Bănică and Vasile Năsui (2018)- Presented to analyses the processing of convex complex surfaces with toroidal milling cutters compared to spherical milling cutters. As comparison terms, surface roughness and processing time are considered. The main purpose of the paper is to demonstrate the usefulness of the toroidal milling tool that can be replaced in case of spherical milling cuts to improve the working time as well as the surface quality, these terms playing an important role in the processing of convex complex surfaces.

Xiaole Hao and et al.(2020)-Presented the model for predicting the surface topography of convex curved die steel machined by a ball-end milling cutter was established. In addition, the surface spring back of the work piece is considered. According to the surface characteristics of the convex curved work piece, the vector algorithm and transformation matrix are applied to calculate the milling cutter motion trajectory equation. Then, the influence of dynamic factors on the tool path is calculated, and finally the surface topography of the work piece is simulated through the Z-map model. The simulation error of three-dimensional surface roughness Sa at different positions of the curved surface is between 10% and 16%. After considering the dynamic factors, the simulation error is reduced by about 50%.

Sunil Dhondiba Dhebeand et al., 2024- Presented the Milling is one of the most important machining processes in manufacturing. This process is used to shape solid materials especially metals. It is mostly used in shaping flat and irregular surfaces. It can be used for drilling, cutting gears, boring and producing slots. Milling a curved surface falls under the umbrella of profile/ contour CNC milling. It involves machining irregularly shaped profiles or continuous curves with various degrees (slanted, concave, or convex). This is a crucial process in getting most of the uniquely shaped bespoke parts done, which requires the CNC machining services providers to have advanced knowledge of the fundamental machining principles and programs.

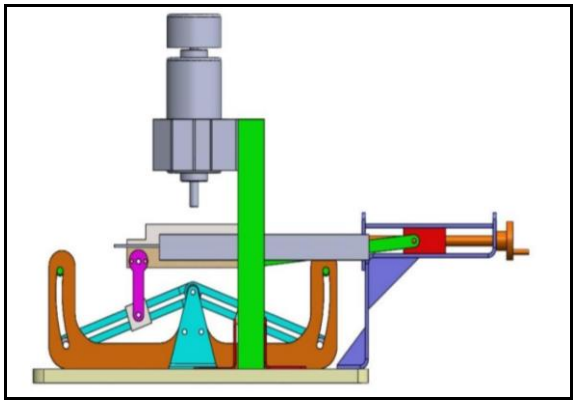
III. PROBLEM DEFINITION

"In manufacturing process, traditional milling machines often face limitations in fabricating curved surfaces efficiently, leading to increased costs and complexities when attempting to produce such components. Moreover, the transition to Computer Numerical Control (CNC) machines, while offering enhanced precision and automation, frequently entails higher expenses and longer production times when handling curved surfaces. Consequently, there exists a pressing need to develop innovative methodologies or technologies that enable the seamless and cost-effective manufacturing of curved surfaces on conventional milling machines, thereby optimizing production processes and reducing associated expenses."

IV. OBJECTIVE

a) To understand the basic principle of the milling machine.
b) To Develop the working model of convex surface milling machine.

V. WORKING PRINCIPAL



- The Curved Surface milling machine, a project which demonstrates the set up for milling of curved surface without CNC.
- The Drilling machine is stationary and a flat platform is provided upon which the material/object can beplaced.The platform is set upon two inclined rods which is mounted on slider that allows the platform to move back & forth motion but in a curved way. The reciprocating motion of the platform is done manually with the help of a lead screw mechanism.
- When the material/object is placed on the flat platform and use fasteners to fix the material on platform for milling.
- After that start the motor and with the help of hand crank move the object to the cutter by rotating it with the help of screw lead mechanism, we can adjust the desired milling of object in a curved surface

VI. CONCLUSION

Types of milling operation on a curved surface by adjusting the linkage at different angle on solid materials. We also achieve the following milling operation by adjusting the linkage flat is:

- Face Milling Operation
- End Milling Operation
- Gang Milling Operation
- Straddle Milling Operation
- Groove Milling Operation
- Gear Milling Operation
- Side Milling Operation and

T-Slot Milling Operation Along with curved surface milling we can also make slots on a solid surface.

VII. ACKNOWLEDGMENT

It takes me immense pleasure to thank my guide Mr.D.J.Sangale (Head of Department) without whose motivation and guidance, the completion of this project would not have been feasible. I am grateful to him for his encouragement and support right from selection of topic to the completion of this project.I would like to thank Prof. Dr. N.G. Narve (Principal, PES's College of Engineering Phaltan) for his kind support and co-operation in accomplishing this project work.I would like to express my appreciation to all my classmates, friends and well-wishers who directly or indirectly helped me at every stage to complete this work.Last and foremost, I would like to thank my family members, without

their good wishes and blessings this dissertation workcould not have been completed.

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