"Design and Analysis of Special Purpose Fixture for Cutting Gears on Milling Machine

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Abstract— The key function of milling machine is to produce flat surfaces in any curved or irregular surfaces. The functions are accomplished by slowly feeding the work piece with the help of reciprocating adjustable worktable against the circular cutting tool rotating at moderately high speed. This research is based on the requirement of Pragati industries. The industry is in need of Gear cutting machine. The gear hobbing machine is very expensive and occupies large space. The industry has a conventional milling machine. So, we design a special purpose fixure for cutting gear on milling machine to fulfill the need of company.
Key words: Milling Machine, special purpose fixure

I. INTRODUCTION

Milling machine is one of the important machining operations. In this operation the workpiece is fed against a rotating cylindrical tool. The rotating tool consists of multiple cutting edges (multipoint cutting tool). Normally axis of rotation of feed given to the workpiece. Milling operation is distinguished from other machining operations on the basis of orientation between the tool axis and the feed direction, however, in other operations like drilling, turning, etc. the tool is fed in the direction parallel to axis of rotation. The cutting tool used in milling operation is called milling cutter, which consists of multiple edges called teeth. The machine tool that performs the milling operations by producing required relative motion between workpiece and tool is called milling machine. It provides the required relative motion under very controlled conditions. These conditions will be discussed later in this unit as milling speed, feed rate and depth of cut.

The most common gear-cutting processes include hobbing, broaching, milling, and grinding. Such cutting operations may occur either after or instead of forming processes such as forging, extruding, investment casting, or sand casting. Gears are commonly made from metal, plastic, and wood. Although gear cutting is a substantial industry, many metal and plastic gears are made without cutting, by processes such as die casting or injection molding. Some metal gears made with powder metallurgy require subsequent machining, whereas others are complete after sintering. Likewise, metal or plastic gears made with additive manufacturing may or may not require finishing by cutting, depending on application.

II. LITERATURE REVIEW

Govind T Sarkar, Yogesh L Yenarkar and Dipak V Bhope[1] The bending and surface stresses of gear tooth are major factor for failure of gear. Pitting is a surface fatigue failure due to repetitions of high contact stresses. This paper investigates finite element model for monitoring the stresses induced of tooth flank, tooth fillet during meshing of gears. The involute profile of helical gear has been modeled and the simulation is carried out for the bending and contact stresses and the same have been estimated. To estimate bending and contact stresses, 3D models for different helical angle, face width are generated by modeling software and simulation is done by finite element software packages. Analytical method of calculating gear bending stresses uses AGMA bending equation and for contact stress AGMA contact equation are used. It is important to develop appropriate models of contact element and to get equivalent result using Ansys and compare the result with standard AGMA stress.

Akash Tiwari Niral Panchal Parth Solanki Lalit Parmar Diptesh Patel[2] In today's world everyone wants to earn good money and raise their standard of living, people who have good degrees generally succeed in doing this. But there is also one class of people who want to work independently as an 'Entrepreneur'. These people mostly comes from lower or middle strata of society which face major problem of financing their project as they have limited budget and cannot afford more than one or two machine at initial level. Also, any product be it finished or semi-finished consists of one or more machining operations. And all processes cannot be done on same machine .So we came up with idea of designing and fabricating a multipurpose tool post for a lathe machine. The convention lathe machine only carry out the limited operation that's include, Turning(reducing diameter), Facing(reducing length), Tapering(making a conical shape), Knurling (making a diamond shaped pattern for easy grip), Grooving (making a symmetrical indentation), Parting (removing a section), Eccentric turning (turning about a point other than axis), Chamfering (creating a radially symmetrical chamfer) other than that Drilling ,reaming, can also be done only parallel to spindle axis (Operations which are perpendicular to spindle axis cannot be carried out.).Conventional lathe machine involves carrying of work piece to different machines to machine them which increases setting up time and cost. It would be very dreadful for the people who are running micro industry, because they cannot afford to have all machines at their door step.

Krishanu Gupta, Sushovan Chatterjee[3] The principle objective of this paper is the comparison study of the static stresses for spur gear with different pressure angles. The analyzed results of a symmetric type involute profiled spur gear pair at different pressure angles are compared. Gears are one of the most important and crucial component in a mechanical power transmission unit and also in most of the industrial rotating machineries. Generally, a spur gear pair in action undergoes two types of stresses: the bending stress and the contact stress. In this paper, both these stresses on the gear tooth pair are analyzed using the finite element analysis and are compared. The

stresses on the gear tooth are first analyzed using a finite element software and then those results are validated using the conventional formulae for finding stresses in gear tooth.

Prashanth P V and Sachidananda H K [4] Manufacturing industries in India have brought lot of radical changes in the manufacturing technology, because of which several improvements like CNC machine centers, flexible manufacturing systems, fabrication center, robotics etc. took place. There is a continued use of fixtures in spite of so many advancements in the manufacturing industries and the use of such special fixtures continues either in combination with other systems or autonomously. Various aspects related to the design of tool fixtures have already been well described by various eminent authors, but there has always been the need to apply all these research work in to a manufacturing industrial application. This paper unifies all the aspects and the functional approach to the designed, manufactured tool fixture. This is justified by taking a real component from an industry for our analysis. The component is cylindrical body of Automobile industry. The operations to be performed are outside diameter turning, boring and drilling, inner chamfers. The research work of this paper turned out to prove that a lot of rupees where saved in installation cost as now these operations can be performed on CNC centre instead of complicated procedures using the designed tool fixture. The paper presents the integrated approach of design for manufacturing. This research work includes the 3D assembled view of tool fixture using Solid works 2014 and also report generated from ANSYS. The present contentsof the paper are a deuce of the research work, Process planning and manufacturing. The application is real time and the tool fixture is not only designed but tested with various materials and manufactured.

Gulam Shaikh, Siddiki Arshadali, Shaikh Masood, Thakur Aditya, Juber bhai Mansuri[5] In the past a wide variety of devices designed to out such shapes has been developed but they have been so massive in construction and high in cost that the average lathe owner has not felt the purchase of such attachments would be feasible.There is always a difficulty in spherical turning on lathe. The method now used is complex and very much time consuming. There cannot occur any variation of speed and depth of cut i.e. cannot take large depth of cut. In the construction of machines or tools it is often necessary to form a small portion of a spherical surface of which the radius of curvature is very long. This is particularly the case when making lens-grinding tools. The tool employed for grinding or polishing the surface of a lens may be described as a circular disk, usually of brass or cast iron, with a hub at the center of one face by which it can be mounted on a spindle and with the other face, in special cases plane, but generally convex or concave, the radius of curvature being the same in magnitude but opposite in sense to that of the surface desired on the finished lens. This invention relates to improvements in machine lathe attachments and more particularly to a simple attachment designed to facilitate the cutting of spherical, concave and convex shapes.

III. PROBLEM FORMULATION

The scope of the project is limited to the modelling and analysis of Special purpose fixture for cutting gears on milling machine for Pragati Industries, Nagpur. This company has a conventional milling machine. This company is in need of Special purpose fixture for cutting gears on milling machine.

IV. RESEARCH METHODOLOGY

By conducting the industrial visit in Pragati industries and consulting with the technical person of the industry it has been observed that the industry is in need of Gear cutting machine. The gear hobbing machine is very expensive and occupies large space. Company has a conventional milling machine. A special purpose fixure for cutting gear on milling machine can fulfill the need of company. So, to overcome space and cost problem this project is undertaken.

V. CONCLUSIONS

The completion of this project will be benefited Pragati industries. The design of special purpose fixure for cutting gear on milling machine can fulfill the need of company. So, to overcome space and cost problem.

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