Modelling and Analysis of Gear Box of Gear Hobbing Machine

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Abstract— The gear hobbing machines are used to produce teeth in the work piece. It is the gear generating process in which gear tooth are formed by the cutting tool called as hob. The rotation of hob in relation with gear blank causes the generation of teeth in the blank gear. The purpose of this project scope is limited to the modelling and analysis of Gear hobbing machine for G.S. Industries, Nagpur. This company manufactures gear with the help of gear hobbing machines. The company facing problem relating to the quality of gears being manufactured on this machine.

Key words: Gear Hobbing Machine, Hobbing Machine

I. INTRODUCTION

Hobbing is a machining process for gear cutting, cutting splines, and cutting sprockets on a hobbing machine, which is a special type of milling machine. The teeth or splines are progressively cut into the workpiece by a series of cuts made by a cutting tool called a hob. Compared to other gear forming processes it is relatively inexpensive but still quite accurate, thus it is used for a broad range of parts and quantities. It is the most widely used gear cutting process for creating spur and helical gears and more gears are cut by hobbing than any other process as it is relatively quick and inexpensive. A type of skiving that is analogous to the hobbing of external gears can be applied to the cutting of internal gears, which are skived with a rotary cutter (rather than shaped or broached). The hob is a cutting tool used to cut the teeth into the workpiece. It is cylindrical in shape with helical cutting teeth. These teeth have grooves that run the length of the hob, which aid in cutting and chip removal. There are also special hobs designed for special gears such as the spline and sprocket gears. Hobbing uses a hobbing machine with two skew spindles, one mounted with a blank workpiece and the other with the hob. The angle between the hob's spindle (axis) and the workpiece's spindle varies, depending on the type of product being produced. For example, if a spur gear is being produced, then the hob is angled equal to the helix angle of the hob; if a helical gear is being produced then the angle must be increased by the same amount as the helix angle of the helical gear.

II. LITERATURE REVIEW

Yogesh C. Hamand, Vilas Kalamkar [1] Gearing is one of the most critical components in mechanical power transmission systems. This article ex- amines the various stresses and deflection developed in sun gear tooth of planetary gearbox which is used in Grabbing Crane. Article includes checking sun gear wear stresses and bending stresses using IS 4460 equa- tions. Also calculate various forces acting on gear tooth. In this study, perform the calculation for sun gear tooth to calculate bending, shear, wear & deflection using theoretical method. 3D model is created of circular root fillet & trochoidal root fillet of gear tooth for simulation using ProE Wildfire 3. In Pro-E, the geometry is saved as a file and then it is transferred from Pro-E to ANSYS 10 in IGES format. The results of the 3 D analyses from ANSYS are compared with the theoretical values. Comparison of ANSYS results in circular root fillet & trochoidal root fillet also carry out.

Govind T Sarkar, Yogesh L Yenarkar and Dipak V Bhope [2] The bending and surface stresses of gear tooth are major factor for failure of gear. Pitting is asurface 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.

Krishanu Gupta1, 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.

Shanavas S. [4] This paper investigates the static stress characteristics of an involute composite spur gear system including bending stresses and contact stresses of gears in mesh and comparing it with the existing involute cast iron spur gear system. The aim is to replace the cast iron spur gear with Carbon fiber epoxy composite spur gear due to its high strength, low weight and damping characteristics. A pair of involute spur gear is modelled in a CAD system (PRO/ ENGINEER) and FEA is done by using finite element software ANSYS 13. The bending stresses in the tooth root and contact stresses were examined using a 3-D FEM model. The bending stress obtained by finite element analysis method is compared with bending stress obtained by Lewis equation and the contact stress obtained by finite element analysis method is compared with contact

stress obtained by Hertzian equation. The Driving and driven gear are the most important components of the Gear box of any automotive. Modeling allows the design engineer to let the characteristic parameters of a product drive the design of that product. During the gear design, the main parameters that would describe the designed gear such as module, pressure angle, root radius, and tooth thickness, number of teeth could be used as the parameters to define the gear.

Ratnadeepsinh M. Jadeja, Dipeshkumar M. Chauhan, Jignesh D. Lakhani [5] Gears are an integral and necessary component in our day to day lives. They are present in the satellites we communicate with, automobiles and bicycles we travel with. Gears have been around for hundreds of years and their shapes, sizes, and uses are limitless. For the vast majority of our history gears have been understood only functionally. That is to say, the way they transmit power and the size they need to be to transmit that power have been well known for many years. It was not until recently that humans began to use mathematics and engineering to more accurately and safely design these gears. Bevel gears are widely used because of their suitability towards transferring power between nonparallel shafts at almost any angle or speed. The American Gear Manufacturing Association (AGMA) has developed standards for the design, analysis, and manufacture of bevel gears. The bending stress equation for bevel gear teeth is obtained from the Lewis bending stress equation for a beam and bending stress value derive for the spiral bevel gear, straight teeth bevel gear and zerol bevel gear. For above mentioned gear comparison between analytical value and value obtain by the ANSYS Workbench 14.0.

III. PROBLEM FORMULATION

By conducting the industrial visit in G.S. Industries, kamptee road, Nagpur. Consulting with the technical person of the industry it has been observed that the industry is facing problem relating to the quality of gear which they are manufacturing with the help of Gear hobbing machine. So, to overcome that problem this project is undertaken

IV. RESEARCH METHODOLOGY

First the data will be accumulated from G.S. Industries, Kamptee road, Nagpur. After this the loads calculation for Gear manufacturing operation will be calculated. Then the design calculations for the structure of the Gear hobbing machine will be done. Then the CAD modeling of the existing Gear hobbing machine will be done using CAD software SolidWorks. Then the analysis of the design of the Gear hobbing machine will be done in FEA software NASTRAN. Then the results will be discussed and the design will be finalized on the basis of the results discussed.

V. CONCLUSIONS

This solution will prevent the problem relating to the quality of gears being manufactured on this machine and product quality will be improve. The completion of this project will be benefited the G.S. Industries, Nagpur.

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