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ANSYS & AGMA Standards for Helical Gear Design & Development: A Review Paper

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***Abstract*— This Review Paper provides information on the analysis of bending and contact stress in helical gear. As a result, the main focus of this review paper is on ANSYS, finite element methods, and AGMA standards for computing bending and contact stress on a helical gear's root. The gear failure in a gear set is believed to be mostly caused by the bending stress and contact stress of the gear tooth, which are examined in this work. Hence, in order to prevent or diminish failures and for the best gear design, the analysis of stresses has gained popularity as a field of gear research.**

Finite Element Analysis, AGMA Standards, and ANSYS have all been used by the authors to achieve their main goal of determining the reasons of gear failure and contact stresses under static conditions. This review article includes theoretical, numerical, and analytical techniques for the examination of helical gear pairs.

***Keywords*— Helical gear; Ansys; AGMA Standards; Creo; FEA analysis; Bending strength; Helix angle; Pressure angle**

I. INTRODUCTION

In the field of modern mechanical engineering, gears are the most often used kind of power transmission. With the advancement of science and technology, gears are now used more frequently across all emerging industries. One of the most effective ways to transmit power and rotating motion is through gearing. Because of their huge weight bearing capacity, faster operating speed, and comparatively quiet operation, helical gears are now being used as a power transmission gear more frequently. Due to the wide helix angle that lengthens the contact lines, helical gears operate more quietly and smoothly than spur gears. In comparison to spur gears with a comparable module and equivalent width, helical gears will be better able to transmit load between two parallel shafts.. Designing highly loaded helical gears for power transmission systems that are good in strength and low level in noise necessitate suitable analysis methods that can easily be put into practice and also give useful. Helical gears are used in fertilizer industries, printing industries and earth moving industries. Helical gears are also used in steel rolling mills, section rolling mills, power and port industries. Helical gears have more advantages than other gears especially spur gears like it has smoother engagement of teeth, silent in operation, can handle heavy loads and power can be transferred between non parallel shafts, high efficient etc. Due to these advantages it has wide range of applications in high speed high power mechanical systems.

Fig. Helical gear

II. LITERATURE REVIEW

Haider Shahad Wahad, Ajeet Kumar Rai and Prabhat Kumar Sinha[1] This work investigates the characteristics of an involute helical gear system mainly focused on bending stresses using ANSYS. To estimate the bending stress, modeling is generated by CATIA5 and numerical analysis is done by ANSYS. The analytical study is based on Lewis formula. Study is conducted by varying the face width to find its effect on the bending stress of helical gear. The face width is an important geometrical parameter in design of helical gear as it is expected in this work the maximum bending stress decreases with increasing face width. In this the stresses are found out by Lewis equations, AGMA results and ansys results . graph of this three results are compared. Effects of facewidth on the stresses are shown.

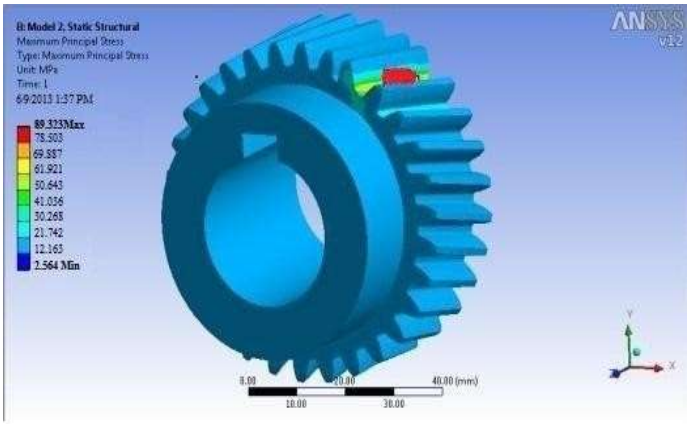

Fig Static Structural Analysis of Helical Gear Having 32 Teeth (face width = 32mm)

Dr. M. S. Murthy and Pushpendra Kumar Mishra[2] This paper presents a detailed study of different techniques proposed and used by various researchers to optimize and to calculate the stresses involved in the helical gear design. In this paper the analysis and modelling is done by using ansys and creo The stresses are checked at varying face width and helix angle. in this work a study is conducted on various works in which the effect of varying face width and helix angle on the bending stress of helical gear are studied. A critical study is also conducted on the tools or methods like FEM, TCA etc. that are utilized in carrying out studies on face width and helix angle to identify if the existing methods are the optimal methods or any suitable methods can be suggested to improve the existing methods or support them in making the methods more users friendly.

BabitaVishwakarma, Upendra Kumar Joshi [3] 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 modelled 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 are generated by modeling software CATIA V5 and simulation is done by finite element software package ANSYS 14.0. Analytical method of calculating gear bending stresses uses Lewis and AGMA bending equation. For contact stresses Hertz and AGMA contact equation are used. Study is conducted by varying the face width to find its effect on the bending stress of helical gear. It is therefore observed that the maximum bending stress decreases with increasing face width. The stresses found from ANSYS results are compared with those from theoretical and AGMA values.

S. Jyothirmai, R. Ramesh, T. Swarnalatha, D. Renuka [4] presented a comparative study on helical gear design and its performance based on various performance metrics through finite element as well as analytical approaches. The theoretical analysis for a single helical gear system based on American Gear Manufacturing Association (AGMA) standards has been assessed in Matlab. The effect of major performance metrics of different helical gear tooth systems such as single, herringbone and crossed helical gear are studied through finite element approach (FEA) in ANSYS and compared with theoretical analysis of helical gear pair. Structural, contact and fatigue analysis are also performed in order to examine the performance metrics of different helical gear systems. The advantage of such a comparison is rapidly estimating the stress distribution for a new design variant without carrying out complex theoretical analysis as well as the FEA analysis gives less possibility for labour-intensive errors while scheming complex formulas related to theoretical analysis of gears. It will significantly reduce processing time as well as enhanced flexibility in the design performance. It was initiate that the overall performance of crossed helical gear was found to be the best in terms of stress as well as tooth strength at low loads whereas herringbone and single helical gear systems are employed for optimum values of speeds and loads.

Raghava Krishna Sameer.B, V.Srikanth[5] In this paper research has been made on gears to minimize the vibrations, bending stresses and also reducing the mass percentage in gears. These stresses are used to find the optimum design in the gears which reduces the chances of failure. The model is generated by using CATIAV5 and ANSYS is used for numerical analysis. The analytical study is based on Hertz's equation. Study is conducted by varying the geometrical profile of the teeth and to find the change in contact stresses between gears. The contact stresses which are acting on the modified helical gears are more when compared to the standard helical so These paper pretends to be failure theory by which the design aspects are to no changed to reduce the contact stresses. The two different result obtained by the ansys with different geometries are compared. Based on the result from the contact stress analysis the hardness of the gear tooth profile can be improved to resist pitting failure.

Tribhuwan Singh, Mohd. Parvez[6] This thesis is to investigates the characteristics of an involute helical gear system mainly focused on bending and contact stresses using analytical and finite element analysis. To estimate the bending stress using ProE that is a powerful and modern solid modeling software and the numerical solution is done by ANSYS, which is a finite element analysis package. The analytical investigation is based on Lewis stress formula. Present method of calculating gear contact stress uses Hertz's equation. Face width and helix angle are important geometrical parameters in determining the state of stresses during the design of gears. The theoretical calculations were made by lewis stress formula and for calculating contact stress by Hertz's equation and the result obtained by it is compared with the experimental results of ansys This paper is about says that maximum bending stress decreases with increasing face width and it will be higher on gear of lower face width with higher helix angle. As a result, based on this finding if the material strength value is criterion then a gear with any desired helix angle with relatively larger face width is preferred.

J. Venkatesh & Mr. P. B. G. S. N. Murthy[7] The analysis of stresses has become popular as an area of research on gears to minimize or to reduce the failures and for optimal design of gears In this paper bending and contact stresses are calculated by using analytical method as well as Finite element analysis. To estimate bending stress modified Lewis beam strength method is used. Pro-e solid modeling software is used to generate the 3-D solid model of helical gear. Ansys software package is used to analyze the bending stress. Contact stresses are calculated by using modified AGMA contact stress method. In this also Pro-e solid modelling software is used to generate contact gear tooth model. Ansys software package is used to analyze the contact stress. Finally these two methods bending and contact stress results are compared with each other In this work analytical and Finite Element Analysis methods were used to predicting the Bending and contact stresses of involute helical gear. Bending stresses are calculated by using modified Lewis beam strength equation and Ansys software package. Contact stresses are calculated by using AGMA contact stress equation and Ansys software package.

III. CONCLUSION

IV. This paper provided a brief review of the design, modelling, and analysis of high speed helical gear using AGMA and ANSYS with various face width and helix angle and found their effect due to bending and contact stress and its value compared with ANSYS and AGMA. This conclusion is drawn from the paper on the design and development of helical gear using ANSYS and AGMA standards. Helix angle is a crucial element in the determination of the state of the stress during gear design since the contact stresses are inversely proportional to it.

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