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# Review Paper On Analysis Of Spur Gear

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***Abstract:*** *The gears while transmitting the power generates high stresses at the mating positions over the teeth as they amend the rate of rotation of machine shaft. The axis of rotation for high speed machinery is the optimal medium for low energy loss and high accuracy. Toothed spur gears are used to transmit the power with high velocity ratio. Various methods are used to find out contact stresses such as Hertz contact stresses, Lewis bending Equation, AGMA Equation. Most of the research work attempted on mathematical contact stress analysis and compared with finite element analysis. In few papers the work was focused on the stress redistribution technique by introducing the stress relieving features in the stressed zone for minimization of stresses in spur gear.*

*The purpose of this dissertation work is to identify the magnitude of the stresses for a spur gear used in lathe machine for operations such as boring, facing. Various case studies are going to perform. For simulation we are going to use FEA tools such as Hypermesh, abaqus. For validation we can go for experimental stress analysis i.e. photo elasticity method. Before going for FEA and Experimental we will go for analytical analysis. The contact stresses and deformations obtained by experimentally and compared with the results of FEA.*

***Keywords-****Stresses, shaft, velocity ratio, hertz-contact stress, FEA.*

## I. Introduction

Gears are the most commonly used in industrial applications to transmitting motion and power. They are vary from small size used in watches to the large size of gears in the lifting devices. Spur gear is easy to manufacture. The spur gear is widely used to transmit power from one shaft to another. It is used to vary the speed and torque e.g. lathe machine, watches etc. when the gears are in mating contact then the stresses are developed on the tooth of gear. Due to this stresses tooth failure is occurring like pitting, scoring, and creep. Tooth failure is the major factor of gear causes breakdown the system which used the spur gear. To avoid this failure the important factor is to increase the strength of gear.

## II. Literature Survey

Seok-Chul Hwanga et al. [1] studied the contact stress analysis for a pair of mating gears during rotation. He investigated respective variation of contact stress analysis for helical and spur gear with the different contact position in a pair of mating gears. Compares the variation of contact stresses during rotation at the lowest point of single tooth contact (LPSTC) & the AGMA (American Gear Manufacturers Associated) equation for the contact stress. Select the design that considered the contact stress is stricter than the AGMA Standard. By using FEA analysis calculate the contact fatigue strength of material for the appropriate strength & safety. He carried out FEA analysis using AGMA equations.

In other study by Prashant Kumar Singh et al. [2] the thermal and wear behaviour of gears of different thermoplastic materials like Acrylonitrile Butadiene Styrene (ABS), High Density Polyethylene (HDPE) and Poly Oxymethelyne (POM) were examined at different torque levels and different rotational speeds. The authors found that the wear rate of polymer gears increases with torque but decreases with rotational speed.

R. Prabhu Sekar et al. [3] studied minimize wear of the gear teeth by adopting the non-standard gear. Discussed the parametric study between standard and non-standard gear. Detailed study of standard and non-standard gears on wear by using or comparing the results between FEM and analytical approach. Suggested the one possible solution for the enhancement of wear resistance and load carrying capacity of the gear tooth in bending and contact. Judging the change in gear and drive parameters of non-standard pinion and gear. He carried out Analytically use of Hertz equation and FEA.

I.S. Al-Tubi et al. [4] investigated the micropitting initiation and propagation when subjected to varying torques load under a constant rotational speed. For affecting the micropitting the main factors are surface roughness, excessive loading (contact stresses), gear tooth micro-geometry and lubricant film thickness are found. On the both addendum and Dedendum of the pinion and wheel the contact stresses and minimum specific film thickness occurs by analytical method and the micropitting observed by experimentally. He carried methodology by Analytically (ISO/IR) and experimentally.

Xiang Dai et al. [5] Using FEA/contact approach studied that the static and dynamic tooth root strains in spur gear pairs. Investigate by analytically and experimentally vibration of spur gear pair. The FEA result and experimental results are compared.

Shuting Li et al. [6] in this paper studied the method for exact bending strength and contact strength calculations of a thin walled gear at high speed by using FEM s/w. It was found that when gear speed exceeds 10000 rpm the centrifugal load-deformed thin-walled gear has greater effects on tooth contact pattern, tooth surface contact stress, root bending stress and tooth load-sharing ratio. The calculation of strength design of a high speed thin-walled gear problem has not been solved, but gives the idea, method and steps of the calculation for this problem.

Xihui Liang et al. [7] studied the mesh stiffness of gears with tooth pitting by analytical method. Also studied the three level of pitting i.e. slight pitting, moderate pitting and severe pitting. And the results of analytical method is compared with FEA. Compares the mesh stiffness with pitting level to the single-tooth pair mesh period and double-tooth pair mesh period. The author found that the pitting effect on gear tooth.

T. Osman et al. [8] in this paper studied the interactions between contact fatigue and dynamic tooth loads on gears. Objective of this project is to examine the dynamic tooth loads to pitting in spur gears. In this comparison between experimental and simulated surface failure had done.

Santosh S. Patil et al. [9] in this paper studied about the strain on the gear tooth at the connecting helical gear pairs by experimentally. He done the experimental testing and analysis of contact stress in helical gear. FEA analysis done and comparing with the experimental results and the result was good. Hence they found the gear dynamic stress test rig (GDSTR) experimental setup proved to be a suitable method for contact stress evaluation on gear tooth flank. From the experimental study the effect of friction on gear contact stresses is significant and cannot be eliminated. Limitation is the experimental setup found wear misalignments and slight vibrations.

Ankur Saxena et al. [10] studied the effect of shaft misalignment and friction force on mesh stiffness for spur gear pair. This effect was also studied for cracked gear pair and results are discussed.

Miryam B. Sánchez et al. [11] in this paper studied the contact stress and bending strength of spur gear at load conditions. To solved minimization problem the model has been obtained from the minimum elastic potential energy criterion according to ISO 6336. He carried out analytical and Finite Element Analysis.

Yang Yu et al. [12] in this paper discussed the fault crack of gear analysis is by using firstly, a new time frequency analysis method called local oscillatory-characteristic decomposition (LOD) and secondly, an analytical-Finite element (analytical FE) method which is called assist-stress intensity factor (assist-SIF) gear contact model. The result indicated this method is effective and feasible to diagnosis method of crack. This is a higher accuracy method.

P.B. Pawar et al. [13] investigated the contact stress and bending stress between the different material gears i.e, Alloy steel, Nylon and Al-sic by analytical and FEA. The composite material Al-sic shows the better result than other. And suggest the Al-sic gear because shows chances of failure. The theoretical and FEA values shows less difference.

Marina Franulovic et al. [14] studied the influence of pitch deviations on the loading capacity of high contact ratio of spur gear by experimentally and analytically. The experimental method was done by the photoelastic investigation. In this paper analytical calculations are presented and this will considerably improve the loading capacity calculations of high contact ratio gears and also provide further optimization of their design.

Naresh k. Raghuwanshi et al. [15] discussed the results of back-side contact which affect the mesh Stiffness of spur gear pair by using FEM. From the observation, shows the result, when the back-side contact occur the mesh stiffness value is slightly increased. The back-side contact may affect the vibration response.

Paras Kumara et al. [16] studied the bending and contact stress of spur gear tooth by using AGMA equation for the purpose of investigated of fatigue failure. The result shows in single tooth contact zone the maximum chance of contact/bending fatigue failure occurs. In comparison of bending fatigue life the contact fatigue life is less. He comparedanalytical results to the FEA.

Miryam B. Sánchez et al. [17] in this paper studied at any point of the path of contact (approximate point) of spur gear evaluate the meshing stiffness by analytically. Also studied about the bending and contact stresses by hertz equations. The result compares with the FEA result & it was good. Hence we can improve the accurately meshing stiffness, dynamic behavior.

Putti Srinivasa Rao et al. [18] calculated the contact stresses of spur gear by using ANSYS and by analytically hertz equation. For investigated purpose author taken a three types of material gears like Aluminium, Grey cast iron, Structural steel. The author aims to minimization of contact stress and deformation and select one best. From the both results ANSYS and theoretical shows the low contact stresses in aluminium and is used as a both driver and driven gear.

Deepika Potghan et al. [19] in this paper studied the stress analysis of spur gear with three different materials to determine the contact stresses in the gear tooth. The materials were grey cast iron, high carbon steel and medium carbon steel. The result of analytical solution i.e by hertz equation and by FEA results are comparing, the less difference between the values of contact stresses found.

Abhijit M. Sankpal et al. [20] studied about the contact stresses of spur gear by FEM and experimental method. The contact stresses of spur gear found by the photoelastic techniques as an experimental method. This result compared with FEM. With the help of result it was helpful to theSelection of proper module size an important factor before designing gear maximum contact stress decreases with increasing module.

Tushar Narawade et al. [21] he calculated the contact stress at the tooth of the gear by analytical, Experimental and FEA. The experimental is done by using strain gauge. From the result it was found that the contact stresses of the gear are reducing by increasing the module of the gear from 2 to 3 and adding the correction factor.

Sanjay K. Khavdu et al. [22] by using FEA investigated contact stress when acting same load on metallic spur gear and hybrid spur gear. And also investigated the weight optimization on ANSYS workbench V11. The result shows instead of metallic gear the hybrid gear shows better result. The result found that the stresses developed within hybrid gears are near about stresses in metallic gears. By using hybrid gear there advantage was reduced the weight of mechanism.He carried analysis using FEA

Dattatray B. Vaitkar et al. [23] author found that contact stresses by using FEA software and experimentally. The experimental is done by photoelastic method. It also put forward the role of pressure angle, contact ratio, bending stresses on the performance of gear. Role of gear geometry, for enhancing gear life for reducing contact stresses.

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