Name of Candidate: Devendra Singh

Name of Supervisor: Dr. Mohd. Suhaib, *Professor*

Department: Mechanical Engineering

Title: IMPROVED DESIGN OF THE GEAR DRIVES

ABSTRACT

Gear drives has found the history of their use since ancient times, and get pace in its development as the industrialization and the field of automobiles catches in nineteenth and twentieth century. There are several developments has taken place in the field of design of gear drives to satisfy the essential properties of a gear drive. Various profiles have been developed to achieve the conjugate action and for the ease of the manufacture like cycloidal profile first and then involute profile. Trochoidal profile and various systems of teeth have developed to prevent the interference in internal gears or external gears with involute profile. A good amount of work is available in the literature for increasing the efficiency a of gear drives, strength and as well as efficient manufacturing methods for gears. Thus, the available various design algorithms for kinematic and dynamic design of the gear drives made it difficult to select one, since these algorithms having some common and some different assumptions and giving different inferential results.

It is found during the review of the literature that the sliding friction is the most prominent factor in addition to the increased load for the failure of the gear tooth or poor performance. This work is carried out to incorporate the sliding friction in terms of sliding coefficient to develop a gear tooth profile for better performance of gear drives and validate the same with the help of numerical data. The gear assembly model of the gear pair with the developed profile is made in Solid Works 2013, and IGES file imported to ANSYS workbench for stress analysis to validate the design profile. Sliding coefficient is the indicator of relative sliding between the mating gear teeth.

Based on the review and study it is found that a little modification in the profile of the gear tooth the performance in terms of their strength, life, reduction loss of power etc., can be improved. Two relations of sliding coefficient are used in this research. One relation contains the transmission ratio, pitch circle radii of driving and driven gear as well as the intercept of the normal to the line of action at the point of contact with the ordinate axis. Second relation of sliding coefficient as a cubic polynomial function of radial distance of point of contact from the center of rotation from respective gears. The line of action is synthesized by using these two relations of sliding coefficient and polar coordinates of line of action is determined. Using the relationships available between the polar coordinate, the angle of rotation, the equation of existing profile has been modify to get the equation of developed profile in this research work. These equations for the gear pair has been developed and validated through numerical data. Through ANSYS software using the static structural module the existing and developed profiles are analyzed under the same boundary conditions and loading of 105 N-mm.

The results of ANSYS shows an improvement of Von-Misses stresses, pressure at contact point, frictional stresses, shear stresses, and total deformation by 46.00 %, 55.99%, 17.42%, 15.58% and 78.95 % respectively for case 1 with assumed sliding coefficients for driven gear ranges between -2.0 to 0.5. The improvement achieved in Von-Misses stresses, pressure at contact point, frictional stresses, shear stresses, and total deformation by 2.26 %, 3.11%, 2.87%, 2.75% and 2.24 % respectively in case 2 with assumed sliding coefficient between -1.5 to 0.5. It is shown in the results that the suggested profile is effective for the larger sliding coefficient ranges.

KEY WORDS: Gear tooth profile, Sliding coefficient, Line of action, Von-Misses stresses, Frictional stresses