ABSTRACT

The static load sharing mainly deals with the amount of load being shared by tooth pairs along the line of action. Involute toothed internal-external standard gear sets are modeled for load sharing by the teeth pairs in mesh along the line of contact. An analytical solution is proposed. The solution is based on the assumptions that (a) considering rigid body in rotation, angular rotation of a gear with respect to the other gear, due to deformation along the line of contact is equal and (b) the sum of the normal loads in all tooth pairs in contacts, which equals to the total transmitted load, is considered constant. All possible deformations such as, tooth bending deflection, tooth compressive (contact) deformation, tooth foundation deflection and tooth shearing deflection are considered in analyses. Detailed tooth geometries are incorporated in modeling. Ultimately, the map of load sharing by tooth pairs in contacts, at different angular position, over a cycle of similar contact pattern, is established. Finally, considering thin rimmed gears, the effects of the rim thickness on load sharing, which is the aim of the present investigation are analyzed and the results are presented in terms of backup ratios. Furthermore, while considering thin rim gear, a special type of gear namely strain wave gearing/Harmonic drive is considered for the analysis, which is having thin rim, flexible external involute gear. Harmonic Drive (HD) gear which is basically an internal and non-circular external gear pair having only two teeth difference, encountered improper teeth mating and as a consequence teeth interference occur. These are inherent and obvious. During the load distribution analysis of HD gear, the teeth interference and its amount have been considered. Using the method of developed analytical solution, the load distribution in Harmonic drive is estimated.

Stresses in flex spline/gear (FG) cup in harmonic drives (HDs) with involute toothed gear pair and conventional strain wave generating (SWG) cam are analyzed using FEM in ANSYS ® environment and experiments. The aim of this investigation is establishing the evidence of secondary contacts and probable load shared by those contacts experimentally over the FEA. Aiming at the performance improvement of gearing in HDs, with involute toothed gear pair, the investigations are carried out through following analyses in steps. (a) initial stresses in flex-gear cup due to cam insertion only. (b) stresses in flex-gear cup at no load in fully assembled

harmonic drive components i.e., flex-gear, ring gear and SWG cam. (c) stresses in flex-gear cup at full load passing through the two pitch points, i.e. the intersection points of ring gear pitch circle, flex-gear pitch curve, and major axis on both sides, finally, (d) stresses in flex-gear cup at full load distributed over all possible primary and secondary contacts, in proportion to their contact intensities. Recorded strains of the FG cup, with cam rotation, is compared with the results obtained by FEA with proper modeling of loading. Furthermore, the effect of analytically obtained load sharing with multiple teeth engagement on the stress on flex spline curve is also shown by Ansys and verified experimentally.