Middle-East Journal of Scientific Research 20 (3): 362-363, 2014
ISSN 1990-9233

DOI: 10.5829/idosi.mejsr.2014.20.03.11340

Contact Analysis of Spur Gear Using Composite Material (NYLO CAST)

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Abstract: Over metals in Plastics gears have so many advantages at the same time we have some limitation, but the functional and economic points in their favour outweigh their limitation in many use sections. *Certain* plastic are suitable and it is the engineering thermoplastics. They are important in this sector. these thermoplastics capable of being used as alternative have been designated" engineering plastics" and it is this materials which are primarily of value in the fabrication of plastic gears it is difficult to categorise these materials in a precise way since option valid to some extent ass to the definition of the term "Engineering plastics". The main of this project deals regarding use of alternate material for gears. All the engineering material is non – renewable source and its costs are increasing day by day. To resolve this problem composite material with cheaper cost is used to design and model a gear. In this project design and analysis of a spur gear with the Nylo Cast material is to be carried out. The static stress results are to be compared with the stress results of steel gears, which are widely in use.

Key words: Engineering plastics · Plastic gears · Static stress results

INTRODUCTION

Plastic gears perform very well under unlubricated condition. Wear oil and grease contamination is to be avoided. Plastic commonly used today's industry and not only for lightly loaded applications like household appliances, tools and toys, but also in more demanding automotive applications like electronic power steering, electronic throttle control and starter motors [1, 2]. However,today the fundamental knowledge on plastic gear design and engineering does not seem pace with the number of gear applications in plastics.

In this paper I mainly concentrated on the module of the gear. Relatively attention was paid to stress analysis how these changed under varying conditions. The standardized calculations were used to calculate stresses in the field of plastic gears, this does not seem to have resulted in generally accepted design rules specific for plastic gears. Today's plastic gear designs still seem to be based on empirics, experience and comparative calculations based on metal gear standards.

Objective: This paper describes the results of the effect of modulus on the kinematics and stresses in a gear pair. The gears were modelled with Linear elastic deformation behaviour was assumed for all materials. In this study the focus was on a gear transmission, consisting of a plastic pinion and gear, made up of nylon cast materials.

Nylocast products offer extremely good wear resistance, coupled with high tensile strength and modulus of elasticity. Nylocast product also has high impact resistance, a high heat distortion temperature and good resistant to wear, abrasion and vibration. In addition, nylocast can sustained contact with a wide variety of chemicals, alkali, dilutes acids or oxidizing agents. Another important factors, both economically and mechanically, is the relatively lighter weight of nylocast (approximately 1/8 the weight of bronze, 1/7 the weight of the cast iron and 1/2 the weight of aluminum), which reduces both the inertial and static loads and eases the handling of large components during maintenance or replacement procedures.

Our calculations and other studies in literature show that during meshing of two plastic gears. For the modelling purpose PRO/ENGINEER software is used. The following meshed models generated during first phase:

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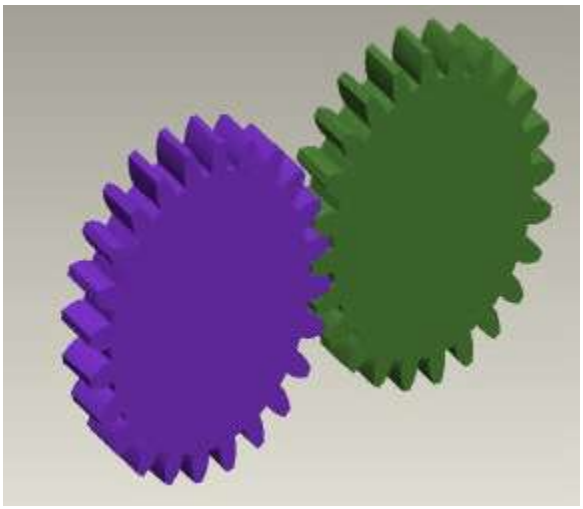

Fig. 1: Meshing Model A Of Pinion And Gear For 1:1 Gear Ratio

Literature Review: This has already been reported in literature in analytical [1] and numerical studies [2]. For a reinforced plastic gear (Nylo cast), the single-tooth contact period is approximately halved, compared to a steel-steel combination. For an unfilled plastic gear (E=3GPa) and an unfilled plastic gear at elevated temperature (E=0.7GPa), single-tooth contact no longer occurs during meshing. With decreasing modulus the maximum load share decreases.

Tooth stresses is not solely determined by the modulus of the gear, but by a combination of stiffness (Young's modulus) and loading. As the ratio of Young's modulus and yield stress (i.e. loading limit) for polymers is roughly an order of magnitude lower than for steel, tooth stresses plays a much more importent role in plastic gearing [3].

For the root stresses, this is less evident as the stress level in theory only depends on geometry and load. Nevertheless a decrease is seen for plastic gears, which is the subject of further investigation in the next sections. For an unfilled plastic gear at elevated temperature the peak stresses around the pitch have completely disappeared It is expected that a decrease of the modulus will not result in a further decrease of the root stress level. For an Nylo castd plastic gear the value of the contact stress reaches 500MPa at room temperature and 220MPa at elevated temperature [4].

Further Work Proposal: According to above investigation it clearly demostrated, the root stresses are only dependent on load and geometry. In this phase modeled a pair of gear and pinion for module 9, for different gear and pinion ratio 1:1, we taken the standard no of teeth 23, for this modelling all the calculation methods and formulas considered from.

Dr.T.J. Prabu (2005), "Design of Transmission Element".

The following modelling is done by using PRO/ENGINEER software, further in this project i am going to import this following models in analysis software to generate the all kinds stress related values, After that the following values i am going to compare other standard plastic materials to further difference will shown by using graphs and tables,with the help of that following generated data.

Than at the end going to show the significance of plastics, and up to what extent we can implement the use of plastic gears in today s engineering.

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