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FINITE ELEMENT METHOD A SOLUTION FOR THE PLANETARY GEARS TO IMPROVE THE QUALITY MATRIX

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Abstract: *Finite Element Method give by virtual simulation the answer to different situation which can be find in practice.Not at last this theoretical model can be a important tool for the design machine and for a better improvement of quality. Also to discover and prevent the wear gear, or to use the low noise design of machine and implemented in this way a higher quality.*

Keywords*: quality matrix, quality wear*

1.INTRODUCTION

The description of the friction becomes body with the balance of two stiffer touches under normal and tangentially action by virtue with help of the third Newton law and the classical Coulomb law enforced.

From here the balance condition gets the friction-by virtue under different points between the contact-bodies, planetary gear and solar pinion tooth.

One point on to or outside of the cone surface friction contact meant that the appropriate edge contact on the against body slides.

The classical friction law considers the contact area as its whole bearing area with the neglect that the contact pressing within the contact range by those upper surface unevenness and ripples punctually often can be increased. The solution of such wear problems leads to a not-classical friction law.

Classical friction law in this situation is not indicated, for a better understanding the work of Oden - Pires and Attia give the solution- the non-local friction law which is not different of classical friction laws. In figure 1 for the planetary gear in many situation the microscopic slip is crucially for that upper surfaces which can cause damage and failures because of the material fatigue or a fretting corrosion at the friction bodies.

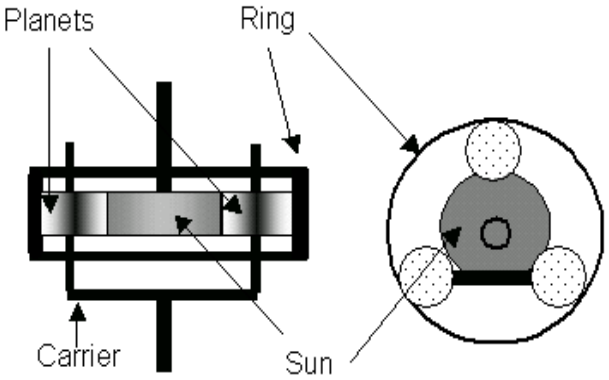

Fig.1.*The scheme of planetary gear*

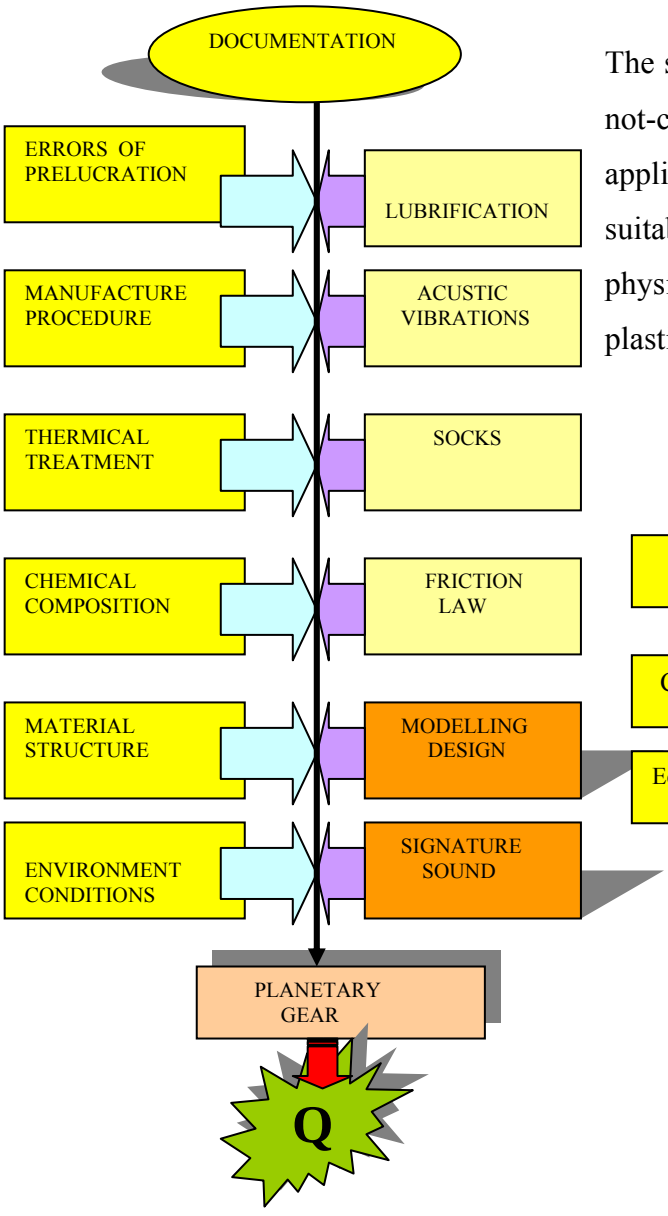

Fig.2. *Quality Matrix for planetary gears*

The solution of such wear problems leads to a not-classical friction law. For technical applications the nonlinear friction law is more suitable than the others, waves it a simpler physical basis for the numeric elastic-ideally plastic investigations. The nonlinear friction

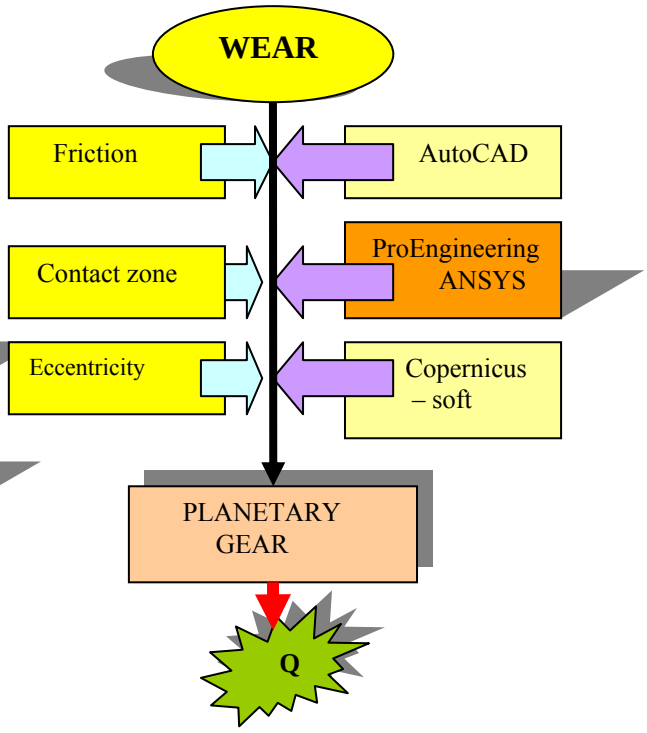

Fig. 3. *Wear Matrix*

law represents the reason for the determination the wear of problems on tooth-waves connections. The treatment of the fatigue wear with the friction work on such connections is made possible by application of this friction law.

2. The Quality Matrix for planetary gears

The Quality Matrix figure 2 show that the improuvement of quality depends of different factors which can induce the first sign of wear and the fatigue of the planetary gears and not only.

Because the wear and quality are in a very strong relation of influence my atention was focus to the aperence of the eccentricity and the short life of gears.

After my investigations I realise the theoretical matrix of wear which show the potential solution for a improuvment manufacture quality and reliability of the planetary gear.

Figure 3. give the answer, in frame of the available work the nonlinear friction law for the numeric investigations FEM for the determination of the direct influence between eccentricity of the connections and wear.

3.Finite elements method for the solution of the contact problems of basic knowledge of planetary gears

In the FE – simulation the flexible deformations of the pairs of teeth are along-regarded the connections point under any transverse force load the slip movements in the pairs of flanks to adhesion are neglected.

The deformation-induced eccentricities result in then friction work on connections under predominant torque load.

For the view of the wear characteristics of connections tooth-wave the wear intensities for the friction wear and fretting the fatigue damage parameters FFDP for the fatigue wear from the friction work are determined.

The nonlinear friction law represents the reason for the determination the wear of problems on tooth-waves connections.

The treatment of the fatigue wear with the friction work on such connections is made possible by application of this friction law .

The FEM nowadays a matured and indispensable aid for engineers of all fallow became.

Almost any setting of tasks can further be worked on hereby to FEM to order set so for example for the simulation of firmness problems or to bear by temperature field computations, electromagnetic field problems, acoustic investigations and current to simulation..

The computations can be accomplished for almost all structures with large accuracy, whereby the computer model of the reality can be very well adapted.

This concerns both de geometry and the boundary conditions of the structure.

3.1 Eccentricity connections tooth-wave

Due to the flanks centred function mode tooth-wave connections react to flanks deviations division, profile, line, with decentring and uneven distribution of load in axial and circumferential direction.

The relative contact in the flanks are determined to pair in the FE program ANSYS.

A middle eccentricity for the entire connecting mash component ends is evaluated from the relative displacements.

The numeric investigation points will show an eccentricity e, which depends of the variation angel of the three planetary gears.

My topic was the solar pinion which is under the action of the three planetary gear and their action can increased the power of wear action.

After the realisation of the bidimesional solar pinion in the second stage of investigation research ANSYS program give the solution using the mathematical modell obtain in figure 4.

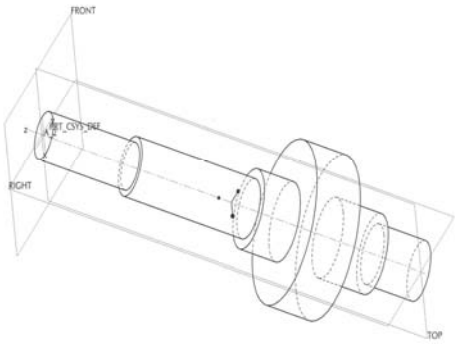

Fig..4. *Mathematical modell for solar solar pinion from a planetary gear I.P.*

.I choose the SOLID 45 element, volume elements, with three liberty degree Ux, U_Y , U_Z, take in consideration the all transmission system figure 5.

The elements was consider like functions wit three mouvment directions X,Y, Z.

The elasticity module E and the transversal contraction fraction ν for the determination of material matrix [D] need a adaptation in concordance with the matrix for the material (Müller, G. FEM for practical, 2001).

Using this matrix the investigation of the body elements in contact, the conection zone from the teeth flanks and pairs gears it is usefull.

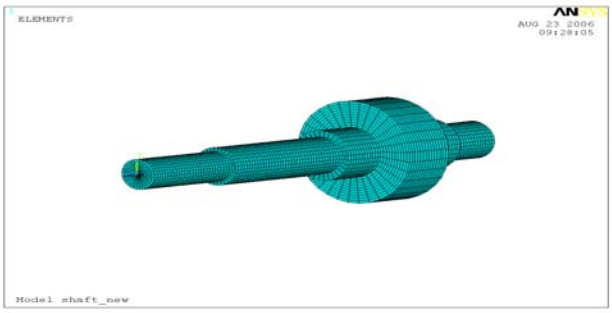

Fig.5. *The volume mesh*

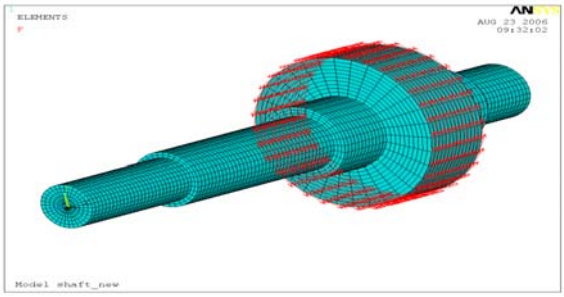

Fig.6.*Volum-force shaft*

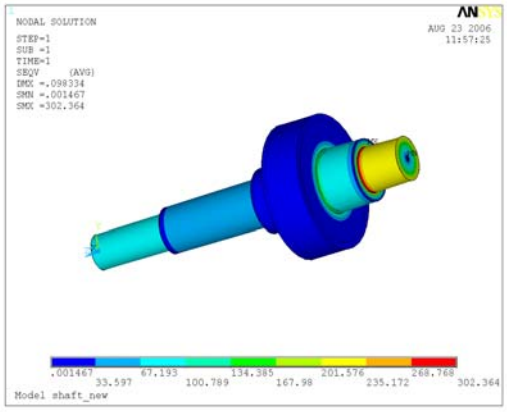

Fig.7.*The results after - YZ*

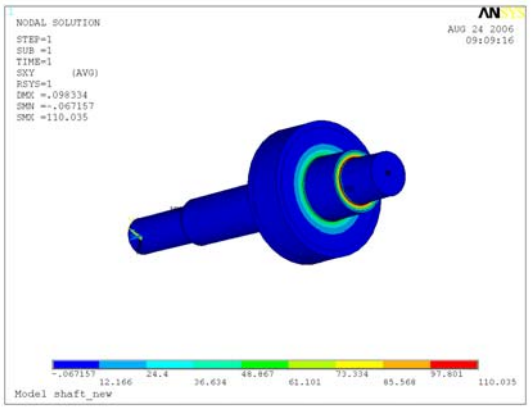

Fig.8. *The results after – XY*

4. The influence of Von Misses stress under the solar pinion

The research investigation on different axes system X,Y,Z, create the virtual image of the most important zone from the solar pinion and especially the reaction on the fluctuant values of torques internal or external.

The following figure 7, 8, 9 obtain in ANSYS program give the solution for the influence of different torques on the axes X,Y,Z and shape of the values under the influence of the external actions.

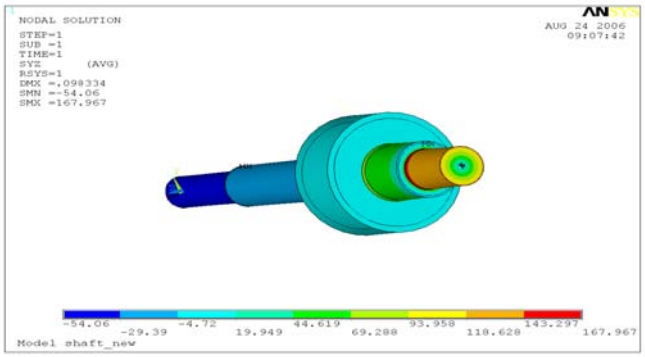

Fig.9.*The results after -YZ*

5. CONCLUSIONS

The solar pinion it is under the influence of the three planetary gears, the FEM method will give us the solution of the appearance of eccentricity.

The investigation of the contact tooth flanks between solar pinion and planetary gears will explain the influence of the assembly angel for the planetary gear.

The angle has influence upon the tooth shape contact flanks and create the opportunity for the incipient born signals of the future damage and fatigues of all system.

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