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A SOLUTION TO IMPROVE QUALITY PRODUCTS

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Abstract: *The paper describes the development of the noise generation by coupling the mechanical structures with the physical noise generation mechanism. Finite Element Method gives by virtual simulation the answer to different situation which can be found in practice. Also this theoretical model can be an important tool for the design machine and for a better improvement of quality. Also to discover and prevent the wearing out of gears and used the low noise designs of machine we can implemented in this way a higher quality. The acoustic behavior of technical products is predominantly defined in the design stage, although the acoustic characteristics of machine structures can be analyze and give a solution for the actual products and create a new generation of quality products.*
Key words: *quality, reliability, noise, wear, design*

1. INTRODUCTION

Can we improve the quality from the beginning for the new product? The idea of research was how we can use model design for products as an instrument for determination of the vibration considering sound as a parameter for the wear.

The paper present the results obtained by using different research methods, how we can use theme in technological process and which of theme from economical point of view can improve also the quality and reliability of product.

This method present a new solution using sound as a tool for simulation and determination of vibrations, capable to give an answer regarding the wear in the contact zone and give signals for future and possible products failures.

In recent years there has been an increasing demand for more comfort concerning noise.

As we can know quality gears depend not only of manufactured tolerance quality, material, but also in the last few years a lot of research investigations show that the vibration and acoustic problem can also influence the gear quality.

Because the trend is new in our manufacture industry, it is a good opportunity to give a more carefully attention to this problem.

Noise can influence not only the environment but also can help to predicted the gears failures.

Learning Machine "Sign Language" by learning how vibration signals reveal problems from planetary gear it is important from reliability point of view, as we know the bath curve also can give us a sign about the health of system.

The topic of this paper is to show that a solution to improve quality is to follow the idea**:** Unlike people who have verbal skills, machines use sign language to communicate what hurts or what has invaded their system.

Recognizing the signs or symptoms that the machine conveys is a required skill for those who work with machines and are responsible for their care and feeding.

2. RESEARCH COURSE

Which is the connection between noise and quality? The answer it is in time the noise it is done by the first sign of wear which modify the life cycle of the product. But the most important thing it is that it is not necessary to wait until the product will failed and determine the causes, we can improve the quality and reliability from the design faze.

Planetary gears sounds problems and vibrations still remains unsolved problems. Knowing the effect (noise, vibrations) by using fish bone diagram, it is possible to identify the causses. The theoretical Quality Matrix (figure 1) show the potential solutions to improve the manufacture quality and reliability of the planetary gear.

The investigation was realized taking in consideration the life cycle of planetary gears as a mechanical system with connecting elements in series and each part can influence the entire system reliability and quality.

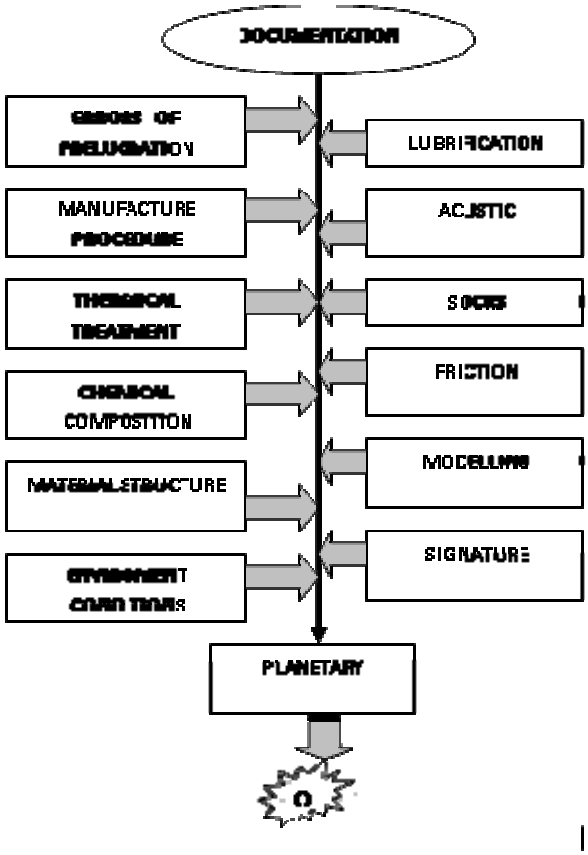

Fig. 1. *Quality Matrix for planetary gears*

A complete analyze from this point of view it is a little complicated because of satellites and their action upon the solar gear.

How we can improve quality product ?

Signature sound can be eliminate for planetary gear if we will take in consideration constructive details and replace the bearings (rigid solution) with a new solution with floating montage of solar gear.

FEM method can give solutions regarding the entire system and for solar gear, in different situations of assembly (free-free, free-fix, fix-fix), and identify the noise and vibration problems.

In function of the constructive needs having the model it is possible to create and find the ideal solution.

3. RESEARCH METHODS

This paper aims to launch new directions of research in theoretical and experimental modeling graphic for planetary gears, modeling graphic as a method of investigation of the static and dynamic on improving quality and reliability.

There are different methods used in diagnosis but not all are suitable worldwide for planetary gear.

The research topic was to identify some methods and solutions to improve quality and reliability and to identify the connection between noise and quality.

To obtain information about the wearing gears and noise problems one from following methods can be used:

- analytical method to determine the wearing speed on the contact line between gears tooth;
- informatics program COPERNICUS to establish the difference between the constructive solutions for solar gear montage in rigid and floating version;
- finite element method using FEM, ANSYS programs for model 2D, 3D;
- experimental methods to diagnose the noise condition for planetary gear and quantify the correlations noise-vibration through C_z curves for both constructive solution with rigid and free solar gear;
- classical method for noise measurement (dB);
- optimization program TOSCA to redesign the product (IMW Clausthal).

Mathematical models used in gear dynamics, used a large variation in objectives in dynamic modeling of planetary gear system, the concept covers in general all issues related to vibrations and noise in train gears.

The conclusion is that the wear it is present even from the design solution, which make us once again to think that only the analytical method and theoretical part will not improve the quality. Each method can give some information's about the mechanical system but only some of theme about some particular aspects regarding system reliability and quality. After the statistical interpretation of results obtain using all the methods above, the interpretation results take values between ±3 %.

4.MEASURE METHODOLOGY–DESIGN MODEL FOR RESEARCH

Engineering perspectives on life and reliability planetary gears shown that it is necessary to identify the noise sources (active and passive) of the system.

The measurements were taken for both constructive version of planetary gear to determine the functional characteristics of planetary gear 3P, with fixed mounted solar gear and floating solar gear.

The confirmation of non-conformities from quality point of view, can be realize using optimization program TOSCA, using same dates and matrix model and redesign from this stage the product and find new constructive solutions.

We can improve quality from the first stage of product design using modeling and virtual simulation of the product for different situations, define and determine the limits for the new products, discover in an earlier stage some factors who can influence the good function of products and improve his quality with low costs.

5. MEASURING INTERPRETATION

Each individual issue requires typically dedicated analyses and modeling tools, which leads to the introduction of various fields of application and corresponding domain and research.

I summaries the analysis dedicated to some of the following interest:

- bending and contact stresses in teeth, wear and contact zone, loads on supporting planetary gear components, reliability and durability, natural frequencies, vibratory motion, radiated noise, transmission efficiency;
- analyses the transfer path from the vibration source to the noise planetary gear, design and implementation of control, development of control algorithms, to reduce loads, noise, to optimize the efficiency to guard the planetary gear system.

Experimental research determine the sound and frequencies for the rigide planetary gear and compare with the results obtain using the modal analyze to confirm the vibration as a measure of the wear.

The influence of Manufacturing Quality upon gears – transmission using low noise design, can offer a solution for a future increasing of reliability of planetary gear, a way for a better maintenance of the system machinery, a permanent and quickly diagnosis for wear signals.

6. CONCLUSION

The Quality Matrix replace the long and empirical methods use until now with the new method using simulation and modeling product before manufacture.

The final conclusion in terms of quality regarding the noise operation of planetary gear :

- the new constructive solution change the solar gear montage from rigid (rolling bearing) to floating montage and eliminate noise and vibration problems of the product;
- the solution improve acoustic pressure values with 32% ;
- the noise decrease with 5dB, in the operation to empty and load planetary assembly with free solar gear;
-the proposed solution improve quality by increasing planetary gears coefficient on the base tooth leg safety S_F with 29.90%,
- increase the pressure contact, safety factor S_H with 29.20%, for the floating solar gear solution.

Future research it is focus on carrier problem, improve the shape of carrier who also have a big influence on planetary gears sounds and vibrations.

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