

THE INFLUENCE OF MANUFACTURING QUALITY UPON GEARS– TRANSMISSION USING LOW NOISE DESIGN

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Abstract: 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 products.

The paper describe the development of the noise generation by coupling the mechanical structures with the physical noise generation mechanism.

Keywords: low design products, low noise product, techniques design education.

1.INTRODUCTION

In recent years there have been an increasing demand for more comfort concerning noise. As we can know gears-quality 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 it is a good opportunity to give a more carefully attention to this problem, as a matter of fact that noise problem influence not only the environment but also can help to predicted the failure of gears. Manufacturing Quality is very important, so the study of wear of gear contact is becoming one of the emerging areas in gear technology.

My research was focus in low noise design, the dynamic analysis can give us the solutions which are essential for eliminating noise and vibration problems of the production Until now a lot of investigations found different solutions for the improvement of quality, but the problem of low design solution remaining an open field.

Using the theoretical knowledge well known on this hour, we can consider the noise source of entire machine and identify each part of the machine which has a major influence and improved the manufacturing quality upon the gear transmission.

The methods are useful for the determination of sound influence and also in discovering the damage and the future failure of transmission. The theoretical model for the wear and manufacturing quality can also give a solution from technical point of view .

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. So it is useful to discover and prevent the wear gear, or to use the low noise design of machine and implemented in this way a higher quality. We can identify after a good attention the following noise transmission for a machine system, like in the following scheme from figure 1 (SAVOYAN 1999).

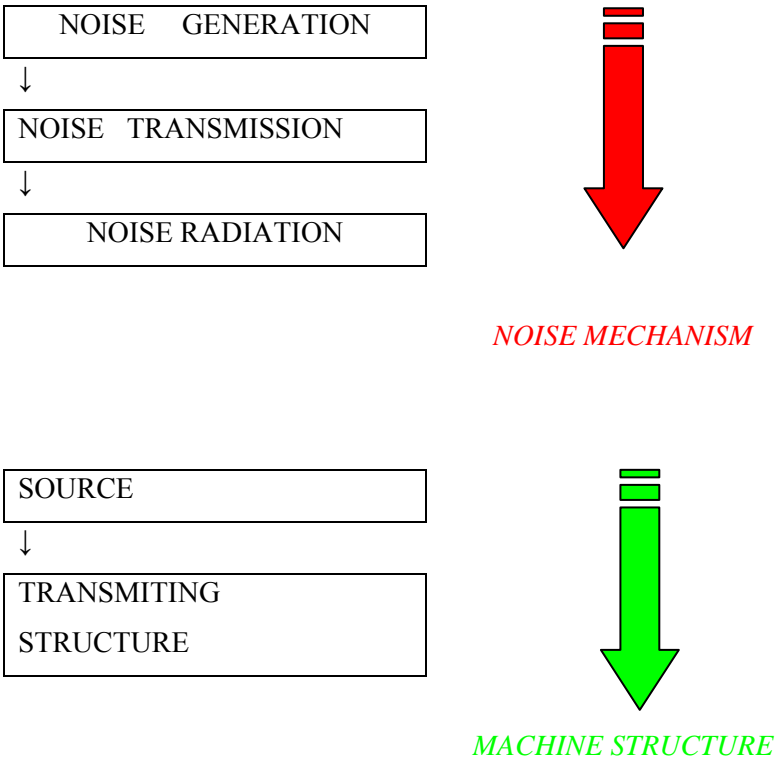


Fig.1. Noise transmission for a planetary gear.

The mechanism by which the noise is transmitted from the source through the structure of the machine are show on the third ring from the inside of the diagram ring (figure 2.) denotes the processes by which the noise is radiated from the surface of the machine.

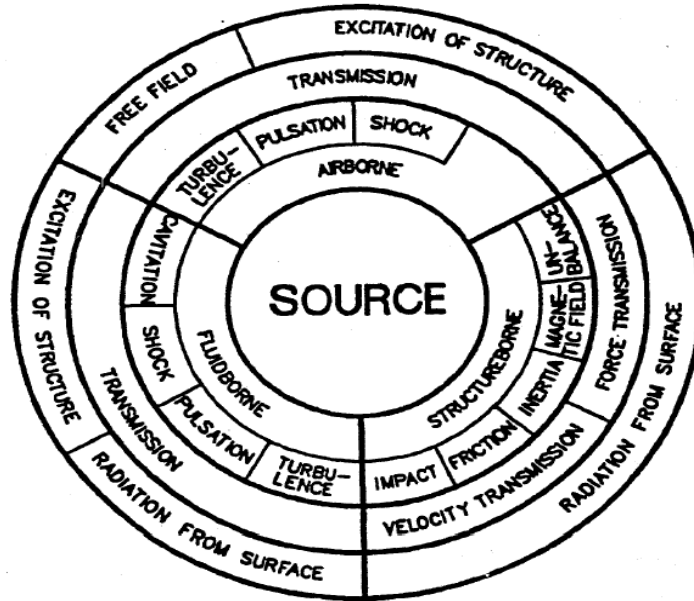


Fig.2. Basic model of noise generation in machines [1]

The diagram also shows that every type of noise and transmission has its own unique characteristics. To diagnose a machine with various noise sources and transmission paths, it is necessary to examine its entire noise generation chain. For the transmission gears the noise reduction was the first priority. The primary noise reduction was affecting the gear meshing, but also the design and development places (chaise of helix angel, gearing precision). The solution from technical point of view was an additional capsule which can protect the machine noise. Also using the design principle of splitting the tasks between force transmission and structure borne noise transmission has as a result a *new gear*, contains strong inner sitting which enables a short distance, between bearings and a direct force transmission and data also walls designed as capsules. Starting from the diagram and investigating the gears noises sources we have not resolve yet the problem.

A careful investigation show us that design process is highly complex because of the various criteria which must be satisfied, restrictions complied with other conditions, standards, production options etc, must to be maintained.

Even the design solution resolve a part of noise problems, there are other factors which can influence the noise problem.

2. NOISE SOURCES

Most planetary gears can be regarded as an assembly of components :

-the active components- are those which contain the energy sources,

-the passive noise components -such as panels, oil tanks, members for carrying loads, etc.

To be able to do an acoustic model of planetary system, the first thing to do is to list the active and passive noise components.

The method is based on model and can give due about sound behavior because sound dimensions are dependent on frequency.

As we can see the source of noise is investigated in function of the type source figure 3:



Fig.3.Type of source for noise investigation back [24]

Acoustic modeling of the machine, divided the components in assembly of components which can be source sound.

The simple scheme of planetary gear is like in the following scheme figure 4.

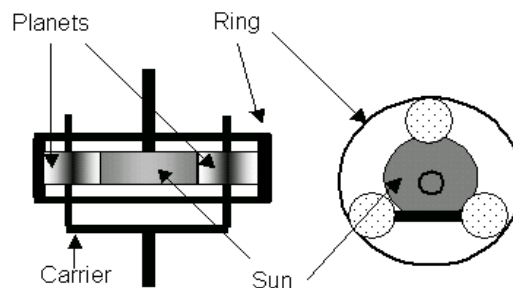


Fig..4. Scheme of planetary gears

For our planetary gears if we will make a complete analyses of all the components we can separate them in two big groups : active parts and the passive parts.

The possible noise sources which can be identify but also if we will consider the elements grouped in series from the reliability point of view we can obtain the road sound power like in figure 5.

If we analysis the different noise mechanism we can identify the following source: *airborne, liquid-borne and structure borne.*



Fig.5. *The road power of sound to a planetary gear*

The planetary gears work in heavy environment conditions and very fine particles of sand get inside of the gears and cause a abrasive wear of planetary bearings. Many machines produce vibration signatures which contain amplitude modulation, and as we have seen in the introduction to vibration section, amplitude modulation causes sidebands to occur in the vibration spectrum. Several types of machine problems can be diagnosed by detailed examination of these sidebands. The sound formation with the tooth-intervened different causes was investigated too, the sound is in assurance with six standing mechanism (Dietz 1999):

- flanks form yielding;
- change of tooth-feather stiffness as well as parameter stimulation;
- impact seized;
- transmission rattle;
- frictional forces;
- air pocketing.

Several types of machine problems can be diagnosed by detailed examination of these sidebands. The conclusion regarding the influence of flank form yielding to sound formation show that a low quality of the coordination are essentially, as well production-conditional deviations of debit –geometry like in the following distinguished fazes:

- flank-irregularities distinguish themselves through periodicities, that are independently from the tooth –intervention frequency;
- index errors, that level sharpens with the harmonic of speed lie;
- intervention angle mistakes and reason circle mistakes do themselves a notice particularly with low burdens,

- higher specific tooth causes an increase of the sound level with the specific tooth by virtue;
- distortions from waves, stores and casings on the basis from softness to vibrations.

The primary noise generating mechanism is given by the fluctuating meshing forces.

Gear wheels and transmission steps are considered as matured and well calculated calculable mechanical components, like all machines possess gear, a oscillation able structure show in the following figure 6.

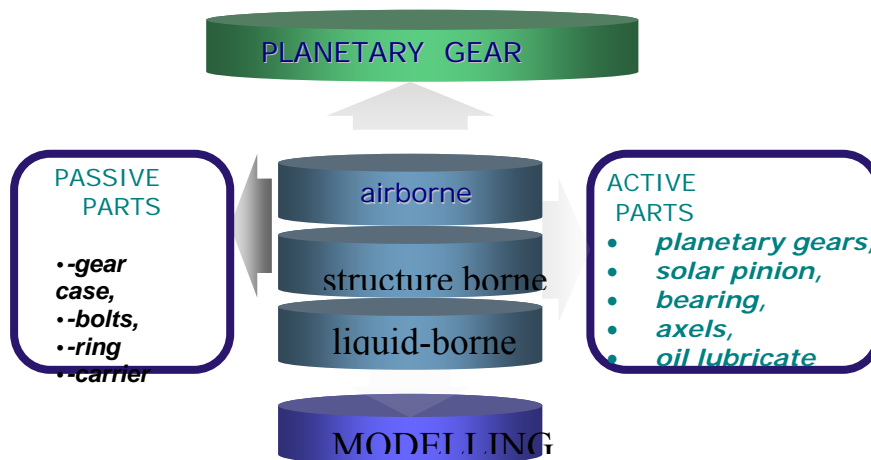


Fig.6. The sound source influence for a planetary gear

3. CONCLUSION

The influence of Manufacturing Quality upon gears –transmission using low noise design will give us a solution for a future increasing reliability for the planetary gears, a way for a better maintenance of the system machinery, a permanent and quickly diagnosis for the new born signature sign of wear.

4. REFERENCES

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