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Fault Diagnosis of Gear Box by Using MCSA Technique

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***Abstract*— An efficient and new but non-intrusive method to detect the fluctuation in gear load may be the motor current signature analysis (MCSA). In this paper, a multi-stage transmission gearbox (with and without defects) has been studied in order to replace the conventional vibration monitoring by MCSA. It has been observed through FFT analysis that low frequencies of the vibration signatures have sidebands across line frequency of the motor current whereas high frequencies of vibration signature are difficult to be detected. Hence, discrete wavelet transform (DWT) is suggested to decompose the current signal, and FFT analysis is carried out with the decomposed current signal to trace the sidebands of the high frequencies of vibration**

***Index Terms*—MCSA, FFT, DWT.**

I. INTRODUCTION

The detection of common faults of gearbox with help of signal processing techniques is main focus of this project. A variety of faults can occur within gearbox during the normal operation. These faults can lead to a potentially catastrophic failure if undetected. Consequently, a variety of fault diagnosis techniques has been developed for the analysis of abnormal condition. Signal processing techniques are also very effective for fault detection. Due to continuous advancement of signal processing techniques and related instruments, online monitoring with signal processing techniques has become very efficient and reliable for mechanical equipment's. The objective of this chapter is to present the different gearbox faults and various advanced signal processing techniques for fault diagnosis of mechanical equipment.

II. GEAR TEETH FAILURES

Gear failure can occur in various modes. In this chapter details of failure are given. If care is taken during the design stage it to prevent each of this failure a sound gear design can be evolved.

A. Scoring

Scoring is due to combination of two distinct activities: First, lubrication failure in the contact region and second, establishment of metal to metal contact. Later on, welding and tearing action resulting from metallic contact removes the metal rapidly and continuously so far the load, speed and oil temperature remain at the same level.

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B. Wear

As per gear engineer's point of view, the wear is a kind of tooth damage where in layers of metal are removed more or less uniformly from the surface. It is nothing but progressive removal of metal from the surface. Consequently tooth thins down and gets weakened. Three most common causes of gear tooth wear are metal-to-metal contact due to lack of oil film, ingress of abrasive particles in the oil and chemical wear due to the composition of oil and its additives. Wear is classified as adhesive, abrasive and chemical wear.

C. Pitting of gears

Pitting is a surface fatigue failure of the gear tooth. It occurs due to repeated loading of tooth surface and the contact stress exceeding the surface fatigue strength of the material. Material in the fatigue region gets removed and a pit is formed. The pit itself will cause stress concentration and soon the pitting spreads to adjacent region till the whole surface is covered. Subsequently, higher impact load resulting from pitting may cause fracture of already weakened tooth

D. Tooth fracture

Tooth fracture is the most dangerous kind of gear failure and leads to disablement of the drive and frequently to damage of other components (shafts, bearings, etc.) by pieces of the broken teeth.

E. Tooth breakage – bending fatigue

Bending fatigue failure occurs over a long period of time. The initiation of crack takes place at the weakest point, normally at the root of the tooth or at the fillet where high stress concentration exists together with highest tensile stress from bending

F. Gear noise

The gear noise arises due to several reasons. At the contact point due to error in the gear profile, surface roughness, impact of tooth and sliding and rolling friction; bearings, churning of the lubricant, and windage.

III. BEARING FAULTS.

Ideally, roller bearings cause little vibration. However, varying contact forces and surface roughness always give some vibration. A defect in a bearing, such as a crack or a spall, generates a vibration impulse each time it enters a contact zone. This impulse is very short compared to the time between impulses.

IV. SHAFTS

Vibrations from shaft related defects mainly appear at the shaft frequency and some of its harmonics. Unbalance, misalignment and cracked shaft are examples of such defects. It is often difficult to distinguish these defects from each other.

V. VIBRATION ANALYSIS

All electric machines generate noise and vibration, and the analysis of the produced noise and vibration can be used to give information on the condition of the machine. Even very small amplitude of vibration of machine frame can produce high noise. Noise and vibration in electric machines are caused by forces which are of magnetic, mechanical and aerodynamic origin . The largest sources of vibration and noise in electric machines are the radial forces due to the air gap field.

Details of further improvement with different another process with detail procedure will described in next paper

VI. CONCLUSION

The various types of current based condition monitoring and fault diagnosis techniques are reviewed. The main aim of the research work is to diagnose the common mechanical faults experimentally

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