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STATOR WINDINGS SHORT-CIRCUIT FAUT DIAGNOSIS IN INDUCTION MACHINE USING VIBRATION AND EXTERNAL MAGNETIC FIELD ANALYSIS

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ABSTRACT

All machines in operation produce vibrations, these are images of dynamic forces generated by moving parts. Hence, a new machine in excellent working condition produces very little vibration. Deterioration in the functioning most often leads to an increase in the level of vibration. By observing the evolution of this level, it is possible to obtain very useful information on the state of the machine. These vibrations occupy a privileged place among the parameters considered when making a diagnosis. The modification of the machine vibration is often the first physical manifestation of an anomaly, potential cause of damage or even fault.
The vibrations have been widely used for electrical machines diagnosis. Numerous studies, in this field, show that the vibratory analysis is very useful for displaying faults, especially those which are of mechanical origin, such as eccentricity, unbalance and rolling fault. With regard to electrical fault detection, it seems that the preferable technique is current and external magnetic field analysis. In fact, the external magnetic field analysis found its interest in the rotating electrical machine diagnosis. The advantage of this method is that it is completely transparent with respect to the use of the machine. Contrary to the invasive methods commonly used (current or internal field measurement…), it does not require either to open the machine or to cut its supply circuit to install or change a sensor.

Only one measurement is generally not sufficient to obtain a reliable diagnosis. Consequently, as the vibrations from magnetic origin, and the external radial magnetic field result both from the airgap flux density, it is interesting to correlate the spectra of each measure, to improve the analysis.

In this way, the paper presents the correlation between the vibrations and the external radial magnetic fields on a healthy induction machine and a machine with stator short-circuit fault in order to improve and to make an accurate diagnosis.

An analytical and mechanical model calculating the external magnetic field, along with the electromagnetic forces and vibrations are presented. The theoretical results in the healthy and faulty conditions are then validated by experimental measurements.