BEST: International Journal of Management Information Technology and Engineering (BEST: IJMITE)
ISSN (P): 2348–0513, ISSN (E): 2454–471X
Vol. 8, Issue 7, Jul 2020, 1–8

TOWRDS DIAGNOSING A SHORT CIRCUIT DEL'ECT IN A PMSM

AMEL.OURICI[1], LCILAMERABET[2] & WAFA TOURAB[3]

[1,2,3]Department of Electrical Engineering- Faculty of Science and Engineering, University Badji Mokhtar - Annaba, BP 12 Annaba, Algeria

ABSTRACT

Synchronous generators are used in power plants to a great extent. The reconstitution is fulfilled by a stator providing the charge and a rotor providing the magnetic field. A permanent magnet or direct current in the filed field can constitute the source of the magnetic field. In this article, the subject proposed consists in diagnosing a three-stage short-circuit in a synchronous perpetual magnet device, fielded by an inverter with three pulse width modulation voltage levels, by rues of insubstantial examination of the stator electricity. Researches show that during a short circuit, it is principally the stator resistance that rises in a considerable way. Concerning this, we will first establish the operational engine model. Then, we will give the motor attenuation model, and process the outcomes eventually to finally compare the harmonic spectra of the currents of the two designs. Prior understanding of a fault from an uncomplicated spectrogram avoids total machine malfunction

KEYWORDS: Inverter of voltage pulse width modulation on three levels, synchronous machine with permanent magnets, defect of short circuit, spectra analyzes, stator current oscillations.

1. INTRODUCTION

Perpetual magnet existing engines were a well-known kind of engine, which were utilized in several industrial implementations that needed greater efficiency, high system reliability and extended greater achievable speed operation lApostoaia14|. PMSM were commonly utilized for greater function, as well as greater productivity engine drives. Greater operation engine manage to rotate smoothly upon the whole speed scale of the engine, controls the entire nil speed, as well as can speed up and speed down, rapidly.

A reactance torque of a PMSM is produced, using the interchange of two magnetic extents (on the stator and the rotor, respectively). The magnetic flux/stator current makes the stator magnetic extend, while the magnetic flux of the permanent magnets makes the magnetic extent of rotor. It is constant, except for the field weakening operations. Inadequate installations or regular wearing can cause electrical faults. No matter what the cause is, they may have some common signs. We have listed a number of such common electrical faults:

Overload on electrical wires, excessive load on the circuit, tightly-packed wires in the main electrical case or unfastened connections inside the main panel.

In this work, we consider a three-phase short circuit in a synchronous perpetual magnet device provided by an inverter, using three pulse width modulations voltage levels, via a spectral examination of the stator electricity for the purpose of avoiding a malfunction fatal of the machine. The common diagram of our research is given in figure-1; it consists of a PWM inverter on three stages that feeds a synchronous device with permanent magnets, with important poles.

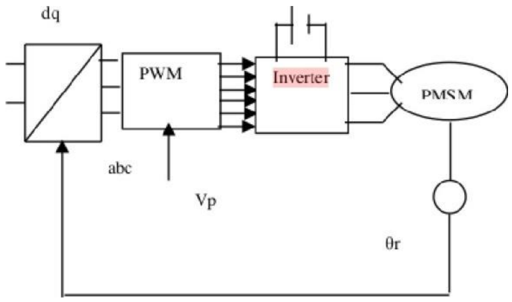

Figure 1: Relationship of a PWM Inverter with a PMSM

Inverter of voltage on three stages

Our device was provided through a three stages three-phase inverter PWM, the common illustration of which is indicated in figure I. Berkouk 95 j .

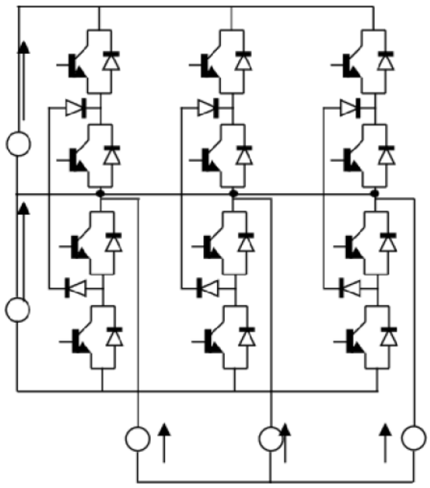

Figure 2: Principle Scheme of an Inverter Pulse Width Modulation on Three Levels

These uncomplicated voltages were acquired beginning from the succeeding states:

If(Véf V p) and (V +r>0) = >V z - + E/2

f (V réf- V p) and (V zi<0) = >V z = -E/2

If $V_{réf} = V_p \Rightarrow V_K = 0$

With

V +r: reference voltage standard; p: carrying ;

V x: potential of the node K.

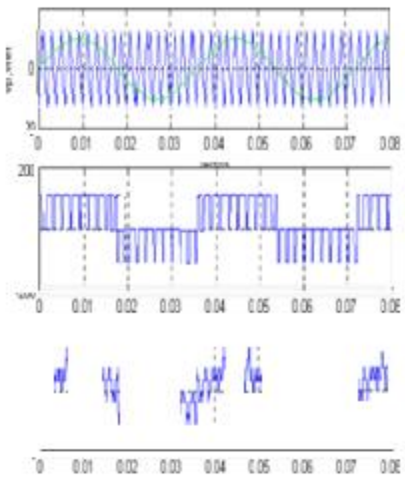

Figure 3: Carrying reference, Simple Voltage, voltage of phase

2. EQUATIONS OF THE PMSM

The device analyzed in this paper has crucial poles; the model that we have maintained was by following Pay transfiguration.

=(Va-Rdi+o,#4 I, *Dt* $\frac{dI_{ds}}{dt}$

$=(V_{qs}-R_sI_{qs}-\omega_rL_{ds}I_{ds})/L_{qs}$

$\frac{d\omega_r}{\cdot}=p(C_{em}-C_r)/J$

$C_{em}=p(\phi_r+(L_{ds}-L_{as})I_{ds})I_{as}$

The results of simulation of the safe machine are presented in the following figures:

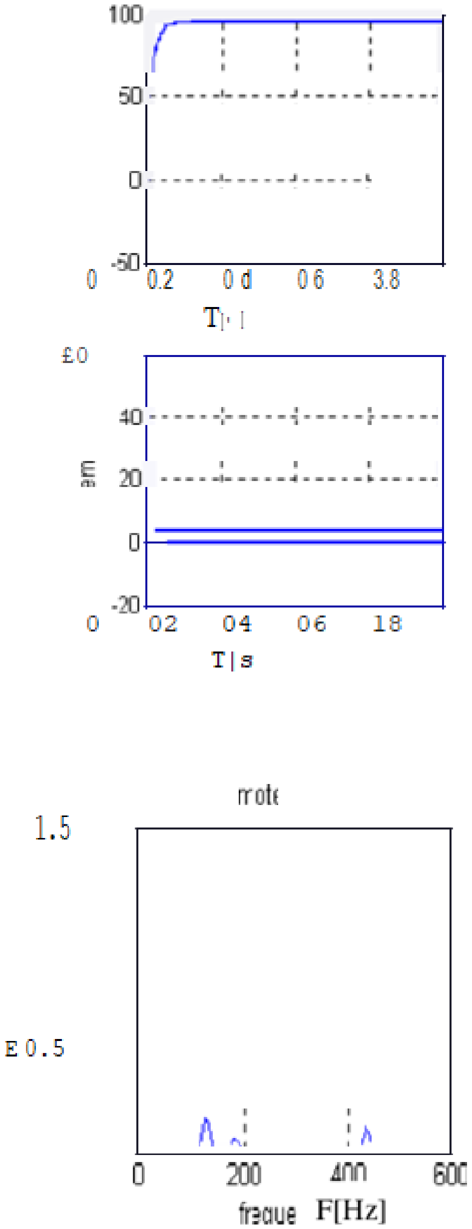

Figure 4: Speed, Torque and Spectra of the Energy of Stator Current in the Safe Motor

3. THE CASE OF THREE PHASE SHORT CIRCUIT

The reasons for short circuit faults of motor windings are; the 1ong-term overload of the motor that causes aging of the insulation, insulation damage caused by wire insertion, the damp winding reduces the insulation resistance and causes insulation breakdown, 1nsulation breakdown due to overvoltage or lightning strike, insulation damage caused by friction between rotor and stator winding ends, insulation damage caused by rotor sweeping heat.

It is first, the stator aversion that may rise in relation to the total of whorls that might be short-circuited]>oreau99 j.

30 °/e of Short Circuit in Stage a, 10 °/c in the Stage b and 20 °/e in the Stage c:

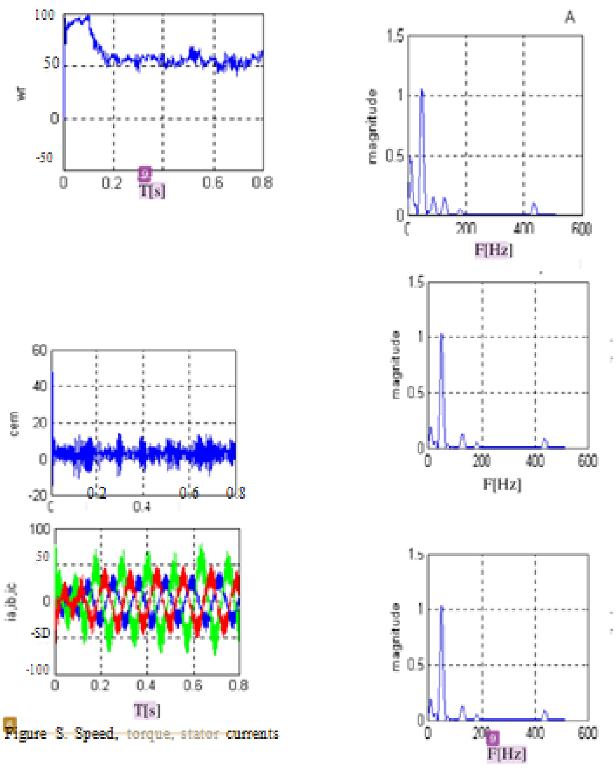

Figure 5: S. Speed, Torque, Stator Currents

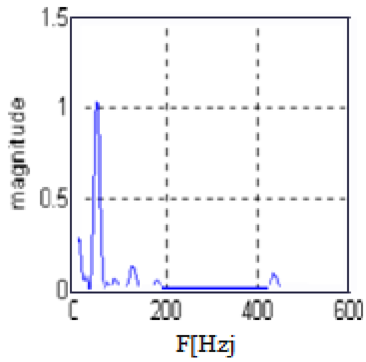

Figure 6: Spectra Energies of the Stator Currents

Case of 30°/e of Short Circuit

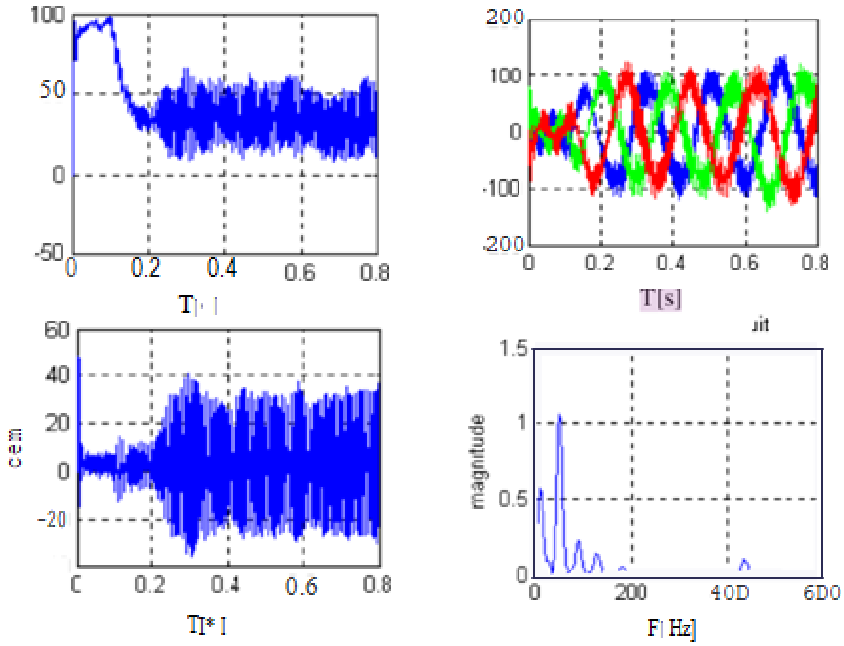

Figure 7: Speed, Torque, Stator Currents, Spectra of the Current

4. RESULTS ANALYSIS

Figure 4 illustrates the angular velocity, torque and the electricity spectra of the device, operating safely. It was noted that the spectra indicates the basic harmonic as well as some additional ones, because of the inverter.

Figure 5 represents the speed, torque and also the stator electricity of phases a, b and c in the instance of 30°/c of short-circuit at phase a , 10°/c at b as well as 20*/o at c. And, their spectra are presented on figure 6. The fresh harmonics throughout their basic volumes corresponding to the error can be noticed. In Figure 7, we have shown the instance of 30°/e short circuit in whole phases, the oscillations of torque, speed and electricity raised compared to the other instance. The stator turns inter-turn defects at perpetual. Magnet synchronous motors (PMSMs) are the major frequent faults, which are due to failure in electrical insulation. These faults create ses'eral problems owing to the presence of spinning rotor magnets that cannot be shut off at vation.

The simulation outcomes were additional pragmatic, which may be utilized to operate the device for both instances i.e. at fine condition as well as beneath defect state]Vaseghiand Al 09 j

5. CONCLUSIONS

To conclude, short circuits in the stator winding, increase currents within the stator as well as the aspect of other harmonics. The standard electromagnetic torque of the device maintains the same, even if it was interrupted, disturbed holding oscillations, relative with fault. The speeds also have oscillations throughout its perpetual; the latter reduces with increasing the extent of the fault.

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