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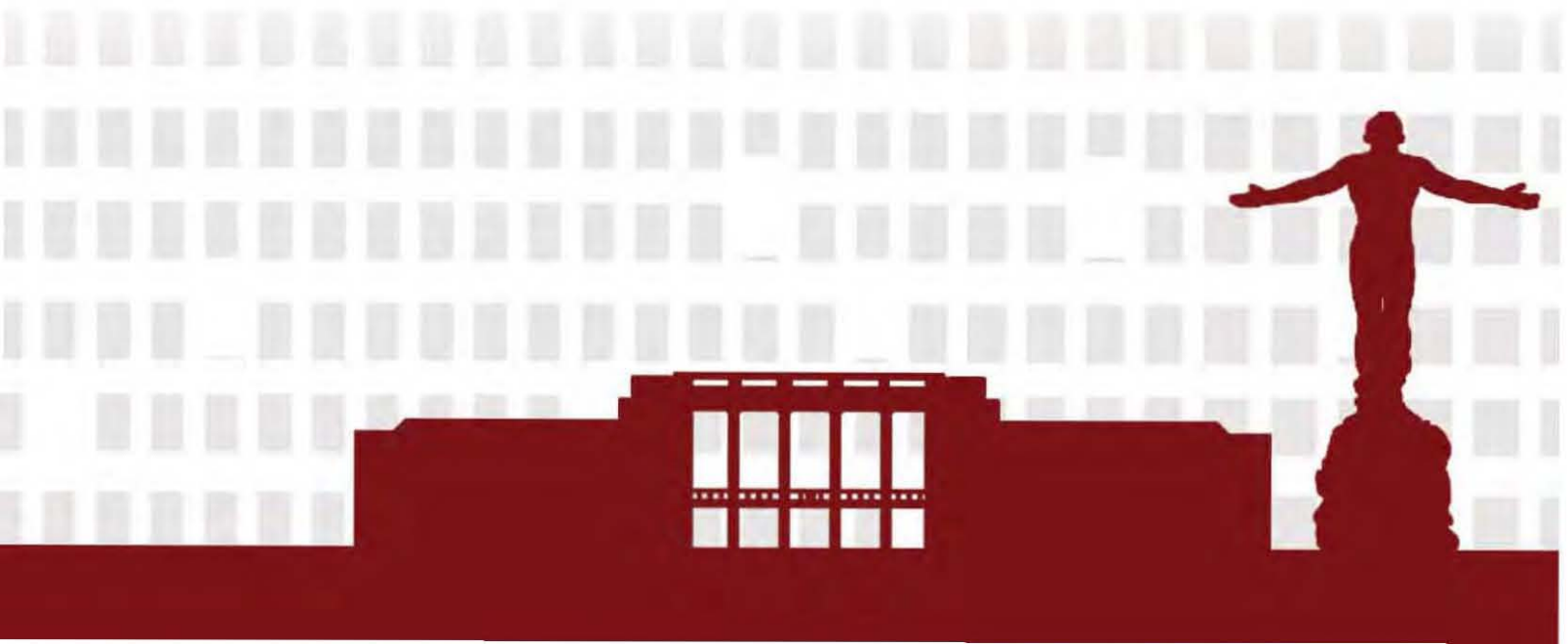

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DETERMINATION SHORT CIRCUIT FAULT AND UNBALANCE VOLTAGE SOURCE OF INDUCTION MOTOR USING PARK VECTOR MODULUS AND WAVELET TRANSFORM

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ABSTRACT
In this study, winding short circuit fault and unbalance voltage source in induction motor are detected. Stator current is recorded and converted into a Park's Vector Modulus (PVM) signal. PVM signal is then processed using the Discrete Wavelet Transform (DWT). Power Details Density (PDD) signal of wavelet transform is used to detect disturbances that occur in stator. The result shows that the proposed method is able to detect short circuit fault and unbalance voltage source. Winding short circuit is detected as higher value of PDD level D1, D2 and D3, while unbalanced voltage source is detected from D6, D7 and D8

Keywords : Short Circuit fault, Unbalance voltage, DWT, PDD.

Introduction

This paper is examined the differences of fault caused by the stator winding short circuit and unbalanced voltage source in induction motor. This study is interesting because both of faults are produces similar stator current spectrum. Therefore we need further analysis to identify the fault so that the appropriate corrective actions can be planed [1]. Experiments are carried out on two conditions; the motor with a modified stator windings to create a short circuit conditions and induction motors supplied by unbalanced voltage source.

Proposed Method

Park transformation is used to transform the three-phase stator current induction motor into two-phase (Id, Iq). The formula of Park transformation is shown in following equation [1].

$$Id = \sqrt{\frac{2}{3}}\, Ia - \frac{1}{\sqrt{6}} Ib - \frac{1}{\sqrt{6}} Ic \quad ; Iq = \frac{1}{\sqrt{2}} Ib - \frac{1}{\sqrt{2}} Ic \tag{1}$$

The next process is calculates PVM signal,

$$\mathrm{PVM} = \sqrt{Id^2 + Iq^2} \tag{2}$$

While the wavelet transformation of signal PVM can be calculated as

$$d_j(k) = SVM \cdot W_k^j \,,\; c_j(k) = SVM \cdot V_k^j \tag{3}$$

where $d_j(k)$ and $c_j(k)$ are high and low signal of wavelet decomposition at level j respectively. W_j^k is high pass filter, while V_j^k is low pass filter wavelet transform. The next step is calculate power detail density of high frequency signal as follow.

$$Dj = \frac{\Sigma_1^k \left(d_j(k)\right)^2}{HPF}. \tag{4}$$

HPF is high pass filter represent to j level transformation of wavelet transform. Induction motor that used in experiment is a three-phase induction motor 1 hp, 1390 rpm, 4 pole, 380 V. Table 1 shows the cases variation of laboratory testing.