THE EFFECT OF DIFFERENT STATOR SLOT SIZE ON FLUX AND LOSSES DISTRIBUTION IN 0.5 HP INDUCTION MOTOR

NOR SHAFIQIN BINTI SHARIFFUDDIN

UNIVERSITI MALAYSIA PERLIS
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by

Nor Shafiqin Binti Shariffuddin
(0930910374)

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LIST OF SYMBOLS, ABBREVIATIONS OR NOMENCLATURE

Φ	Magnetic Flux
Ω	Ohm
°C	Celsius
μ	Magnetic Permeability
A	Ampere
A	Cross Sectional on the Surface of Yoke
AC	Alternating Current
Al	Aluminium
B	Magnetic Flux Density
B_{max}	Maximum Value of Flux Density
B_r	Remanence Magnetisation
B_s	Saturation Magnetisation
C	Composed
cm	Centimetre
DC	Direct Current
emf	Electromotive Force
f	Frequency
FEA	Finite Element Analysis
FEM	Finite Element Method
H	Magnetic Field Strength
H_c	Coercive Field
HP	Horse Power
IM	Induction Motor

I_R	Rotor Current
I_S	Stator Current
L_R	Rotor Inductance
L_S	Stator Inductance
m	Meter
mm	millimeter
MMF	Magneto Motive Force
N	Number of Winding Turns
NEMA	National Electrical Manufacturers Association
NO	Non Oriented
NTC	Negative Temperature Coefficient
PWM	Pulse Width Modulation
RPM	Revolution per Minute
R_R	Rotor Resistance
R_S	Stator Resistance
s	Slip
SR	Switched Reluctance
T	Tesla
t	Thickness of Yoke Lamination
V	Volt
Vs	Voltage Supply
W	Watt
w	Width of Yoke Lamination

Kesan Saiz Slot Pemegun Yang Berbeza Pada Pengagihan Flux Dan Kerugian Di dalam 0.5 Hp Motor Induksi

ABSTRAK

Satu kajian reka bentuk slot pemegun dijalankan untuk motor induksi adalah untuk meningkatkan kecekapan dan mengurangkan kerugian. Dalam tesis ini, kesan saiz slot pemegun yang berbeza pada pengagihan fluks dan kerugian di dalam 0.5 hp motor induksi telah disiasat dengan teliti melalui FEM dan kerja-kerja uji kaji. Dua model teras pemegun dengan saiz slot 6 mm dan 8 mm telah direka didalam projek ini. Skop menggunakan FEM menunjukkan parameter seperti kehilangan tembaga pemegun, jumlah kerugian dan kecekapan. Keputusan ini kemudiannya dibincangkan dari segi perbezaan di antara dua saiz slot pemegun. Teknik-teknik eksperimen telah dijalankan untuk mengukur ketumpatan fluks pengedaran setempat bagi komponen asas dan individu harmonik (perintah ganjil) dalam pemegun dengan menggunakan kaedah search coil dan pengagihan kehilangan kuasa setempat di seluruh teras pemegun dengan menggunakan kaedah termistor. Ketumpatan fluks setempat dibandingkan dengan garis magnet yang berpotensi (FEM) untuk mengesahkan persamaan pengagihan fluks dalam teras pemegun. Pengagihan fluks adalah menurun ke arah kawasan luar teras pemegun dan pada gigi pemegun; ketumpatan fluks adalah lebih tinggi daripada yang lain bagi kedua-dua pengedaran dan barisan potensi magnet fluks setempat . Rata kehilangan kuasa setempat adalah berkadar rata dengan ketumpatan fluks setempat disebabkan oleh kehilangan kuasa setempat dipengaruhi oleh kandungan harmonik agihan fluks. Perbezaan saiz slot pemegun boleh memberi kesan ke atas ketumpatan fluks magnet teras pemegun. Keputusan menunjukkan bahawa komponen asas dan individu harmonik dalam ketumpatan fluks inplane dan fluks normal pada pemegun slot saiz 8 mm adalah lebih rendah berbanding dengan saiz slot pemegun 6 mm . Ia juga menunjukkan bahawa ketumpatan fluks setempat dan kehilangan kuasa yang minimum berlaku pada saiz slot 8 mm berbanding untuk 6 mm. Keputusan dari FEM menunjukkan bahawa dengan meningkatkan saiz slot pemegun 6 mm untuk 8 mm, 2.92% kecekapan boleh diperbaiki. Hasil keseluruhan menyimpulkan bahawa slot pemegun 8 mm lebih rendah kerugian dan meningkatkan kecekapan motor induksi.

The Effect of Different Stator Slot Size on the Flux and Losses Distribution in 0.5 Hp Induction Motor

ABSTRACT

A study of stator slot design is conducted for induction motor in order to improve the efficiency and reduce the losses. In this thesis, the effect of different stator slot size on the flux and losses distribution in 0.5 hp induction motor have been thoroughly investigated via FEM and experimental work. Two stator core models with the slot size of 6 mm and 8 mm have been designed and fabricated in this project. The scope of using FEM reveals parameters such as the stator copper loss, total loss and efficiency. This result is then discussed in terms of differences between two stator slot sizes. The experimental techniques have been performed in order to measure the localised flux density distribution of fundamental and individual harmonic components (odd order) within the stator by using search coil method and the localised power loss distribution throughout the stator core by using the thermistor method. The localised flux density is compared with the magnetic potential line (FEM) in order to verify the similarity of the flux distribution in the stator core. The flux distribution is decreased towards the outer region of the stator core and at the stator teeth; the flux density is much higher than others for both localised flux density distribution and magnetic potential line. The localised power loss distribution is proportional with the localised flux density distribution due to the influence of localised power loss towards the harmonic content of flux distribution. The differences of the stator slot size can affect the magnetic flux density at the stator core. Results shows that the fundamental and the individual harmonic components of in-plane and normal flux density at the stator slot size 8 mm were lower compared to the stator slot size 6 mm. It also reveals that the minimum localised flux density and power loss occurs at 8 mm slot size compare to 6 mm. FEM result shows that increasing the stator slot size 6 mm to 8 mm had improved the motor's efficiency by 2.92%. Overall concrete result concludes that the 8 mm stator slot does lower the losses and increase the induction motors efficiency.