بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قال تعالى:

(وَقُل رَّبِّ زِدْنِي عِلْماً)

صدق الله العظيم

(سورة طه الاية 114)

Dedication

O my lord! So order that I may be grateful for thy favours, which thou has bestowed on me and on my parents, and that I may work the righteousness that will please thee.

Acknowledgment

I am grateful to my supervisor Dr. Martino who helped me with all hands and passed his knowledge with smile. My thanks to my manager Mr. Wang u for his great support and ease of difficulties.

Abstract

In this research, model of a three phase induction motor has been derived using mathematical modeling principles. The model has been implemented using MATLAB Simulink software.

Based on indirect field oriented control principles, the controller has been designed and implemented using MATLAB Simulink Software.

Designing controller in d-q synchronously rotating reference frame made phase variables (voltage, flux and current) appear as DC time invariant components and prevent controller from saturation.

Torque and flux linkage were targeted to be controlled independently.

Linear relationship between torque and current quadrature component I_{qs} made the control of induction similar to separately excited DC motor.

Response was dynamically and instantaneous.

المستخلص

في هذا البحث تم بناء نموذج المحرك الحثى ثلاثى الاطوار بإستخدام طريقة النمذجة الرياضية. كما تم تطبيق النموذج الرياضى على جهاز الحاسوب باستخدام لغة البرمجة MATLAB.

تم تصميم المتحكم اعتمادا على قواعد التحكم فى متجهات المجال المغناطيسى للمحرك الكهربى , كما تم تطبيق النموذج على جهاز الحاسوب باستخدام لغة البرمجة MATLAB.

تصميم المتحكم فى الإطار الدوار المتزامن جعل كل متغيرات الوجه (الجهد, المجال والتيار) تظهر على انها غير متغيرة مع الزمن كما منع المتحكم من التشبع.

إستهدف التحكم فى العزم والمجال على أن يكون التحكم بصورة مستقلة كل على حدى.

العلاقة الخطية بيت العزم والمركبة الرأسية للتيار I_{qs} جعلت التحكم فى المحرك الحثى شبيها بالتحكم فى محرك التيار المستمر ذو الإثارة المنفصلة

تمت الإستجابة بصورة لحظية.

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List of Abbreviations

IM	Induction Motor
PI-controller	Proportional Integral controller
ASD	Adjustable Speed Drive
VSD	Variable Speed Drive
VFD	Variable Frequency Drive
DSP	Digital Signal Processor
TF	Transfer Function

List of Symbols

L_m	Magnetizing Inductance
L_s	Stator Inductance
L_r	Rotor Inductance
R_s	Stator Resistance
R_r	Rotor Resistance
ω_r	Rotor Speed
d-q	Rotating Reference Frame Coordinates
α-β	Stationary Reference Frame Coordinates
V_a, V_α	Voltage component in Direct axis of Stationary Reference Frame
V_b, V_β	Voltage component in Quadrature Axis of Stationary Reference Frame
V_{ds}	Voltage component in Direct Axis of Rotating Reference Frame
V_{qs}	Voltage component in Quadrature Axis of Rotating Reference Frame
λ_{ds}	Flux Component in Direct Axis of Rotating Reference Frame
λ_{qs}	Flux Component in Quadrature Axis of Rotating Reference Frame
T_e	Electromagnetic Torque
I_{ds}	Current component in direct Axis of rotating Reference Frame
I_{qs}	Current component in Quadrature Axis of Rotating Reference Frame
I_{as}, $I_{\alpha s}$	Current component in Direct Axis of Stationary Reference Frame
I_{bs}, $I_{\beta s}$	Current component in Direct axes of Stationary Reference Frame
J	Motor Inertia
B	Viscous Friction
τ_r	Rotor Time Constant

K_{pm}	Proportional Gain for Speed
K_{im}	Integral Gain for Speed
K_{pc}	Proportional Gain for Current
K_{ic}	Integral Gain for Current