

قال تعالى:

﴿بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ ﴾(١) رَبُّ الْعَالَمِينَ ﴿٢﴾ نِرَحِيمٌ ﴿٣﴾ يَوْمٌ
إِيَّاكَ نَدْعُونَ ﴿٤﴾ إِيَّاكَ نَسَاهْدُونَ نَبِيَّنَا الطَّيِّبَ ﴿٥﴾ أَطَالْمَسْتَقِيرِيمَ أَطَالْذِينَ أَذْعَمْتَ
عَلَيْهِمْ غَيْرَ الْمَغْضُوبِ عَلَيْهِمْ وَلَا الضَّالُّينَ ﴿٦﴾ ﴿٧﴾

صدق الله العظيم

سورة الفاتحة الآيات {1-7}

DEDICATION

To my Mother,

To the soul of my father,

To my husband,

To my sisters and brother, without their help, support, and patience, I could not have done this effort.

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First, I would like to thank Uncle ALI to his support and encouragement .

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Without the support and encouragement of my family, and friends I would never have finished my degree.

Last, I would like to thank my dead father to his believe on me.

ABSTRACT

This research presents a performance based comparative study fuzzy PI controller to control the speed of squirrel-cage induction motor (SCIM) by replacing the conventional proportional–integral (PI) controller.

Performances of fuzzy PI controller also compared with the conventional PI speed controller in terms of several performance measures such as peak overshoot (Mp%), settling time (Ts).

The indirect vector control is simulated both with PI and Fuzzy pi controller and results are analyzed and compared. Fuzzy pi controller is found to perform better than the conventional PI controller.

المستخلص

هذا البحث يقيم اداء المحرك الحثى عند استخدام المتحكم التكاملى التاسبى الغامض بدلا عن المتحكم التكاملى التاسبى.

المتحكم التكاملى التاسبى الغامض تم مقارنته بالمتحكم التكاملى التاسبى وقياس الاداء بواسطة اقصى قيمة لتجاوز الحد وزمن الاستقرار.

نظام التحكم بتوجيه المجال تم تمثيله بواسطة المتحكم التكاملى التاسبى الغامض والمتحكم التكاملى التاسبى والنتائج تم تحليلها ومقارنتها.

وجد ان المتحكم التكاملى الغامض افضل من اداء المتحكم التكاملى التاسبى.

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LIST OF SYMBOLS

| Symbol | Description |
|-----------------------------------|---|
| N_s | Synchronous speed |
| R_r | Rotor resistance |
| R_s | Stator resistance |
| J | inertia |
| ΔT | Change of Torque |
| i_q, i_q | Direct & Quadrature axis current |
| L_s | Stator inductance |
| L_r | Rotor inductance |
| ψ | The multiplication of the flux linkage λ by the rated angular Speed |
| p | The d/dt operator |
| λ | The flux linkage |
| ω_e | Stator frequency |
| ω_r | Rotor electrical speed |
| $v_{qs}, v_{ds}, v_{qr}, v_{dr}$ | The voltages of stator and rotor in dq reference frame |
| $i_{qs}, i_{ds}, i_{qr}, i_{dr}$ | The currents of stator and rotor in dq reference frame |
| $\psi_{qs}, \psi_{ds}, \psi_{qr}$ | The flux linkages of stator and rotor in dq reference |
| p | Number of poles |
| T_e | The electromagnetic torque |
| Δi_{qs}^* | The components of stator current producing by torque |
| i_{qs}^* | The actual control signal U or current |
| L_d | Direct axes inductance |

| | |
|--------------------------|--|
| L_q | Quadrature axes inductance |
| k_p, k_i | The proportional and integral gain factors respectively |
| ω_2^* | The slip speed |
| ω_r^* | The reference command speed |
| E, e | the error |
| $CE, \Delta E, \Delta e$ | derivative of error |
| T^* | The output torque |
| T_s | The sampling time |
| n_p | The motor's pole-pair |
| T_L | The load torque |
| I_a I_b I_c | Three phase currents |
| i_{qs}^s, i_{ds}^s | The currents of stator and rotor in stationary dq reference frame |
| i_{qs}^e, i_{ds}^e | The currents of stator and rotor in synchronous dq reference frame |
| ρ | Angular position |
| θ_2 | The slip speed angle |
| θ_r | The rotor angle |

LIST OF ABBREVIATIONS

| | |
|---------|--|
| DTC | Direct torque control |
| MOSFET | Metal Oxide Silicon Field Effect Transistor |
| IGBT | Insulated Gate Bipolar Transistor |
| PWM | pulse width modulation |
| PWM-VSI | pulse width modulation-voltage Source inverter |
| SVPWM | space vector pulse width modulation |
| VFD | variable frequency drive |
| FOC | field oriented control |
| IFO | indirect field oriented control |
| DFO | direct field oriented control |
| DTC | direct torque control |
| IM | induction machine |
| FLC | fuzzy logic controller |
| MF | membership function |
| COA | centre of area |
| MP% | over shoot |
| Ts | settling time |

