الاستهلال

قال تعالى : (و تَرَى الْجِبَالَ تَحْسَبُهَا جَامِدَةً و هِيَ تَمُرُ مَرَ السَّحَابِ صَلْعَ اللهِ الَّذِي أَثْقَنَ كُلَّ شَيْءٍ) صُنْعَ اللهِ الَّذِي أَثْقَنَ كُلَّ شَيْءٍ)

صدق الله العظيم

Dedication

Every challenging work needs self-efforts as well as guidance of elders especially those who were very close tour heart. My humble effort I dedicate to my sweet and loving

Mother & Father

Whose affection, love, encouragement and prays of dayand night make me able toget such success and honor, Along with all hard working and respected

Teachers

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In preparing this thesis, I was in contact with many people, researchers, academicians, and practitioners. They have contributed towards my understandingand thoughts. In particular, I wish to express my sincere appreciation to my mainthesis supervisor. Musabmohammedsaleh, for encouragement, guidance, critics and friendship. Without his continued support and interest, this thesis would not have been the same as presented here.

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Abstract

This project describes speed control of separately excited DC motor using Chopper as power converter and PID controller as current controller tuned using fuzzy self tuning PID. The separately excited DC motor can becontrolled from below and up to rated speed. Optimization filter of speed is obtained using Modulus Hugging Approach. After obtaining the complete model of DC drive system, the model is simulated using MATLAB. The simulation is doneand analyzed under varying speed and load torque conditions like rated speed and load torque, half the rated load torque and half speed.

المستخلص

يوضح البحث طريقة السيطرة علي سرعة محرك تيار مستمر ذو اثاره مستقلة باستخدام مقطع (مغير قدرة) باستخدام مسيطر تناسبي تكامليالتحكم في بهذه الطريقة يمكن السيطرة علي سرعة المحرك للوصول للسرعة المطلوبة وموالفة المعاملات عن طريق الموالفة الذاتية باستخدام نظرية المنطق الغامض. تستام دائرة قدح المقطع الإشارة من المسيطر لتجهيز فولتية متغيرة الي منتج المحرك للوصول للسرعة المطلوبة. تم تصميم وتنفيذ مسيطرين الأول للسرعة والثاني للتيار وذلك للحصول علي سرعة دوران ذات استجابة جيدة و باستقراريه عالية. تم اخذ نموذج لمحرك تيار مستمر ذو اثارة مستقلة وتمثيلة بنموذج محاكاة باستخدام الماتلاب. تم تنفيذ المحاكاة وتحليل النتائج والعلاقات بين السرعة وعزم الحمل مثل علاقة السرعة المطلوبة مع عزم الحمل الكامل والعلاقة بين نصف السرعة المقررة مع نصف الحمل بوجود ملف تحسين السرعة مره وبعدمة مره اخرى.

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List of Symbols

| $\Delta 	ext{I}_{	ext{qs}}$ | reference current change |
|-----------------------------|--|
| В | Viscous friction constant |
| \boldsymbol{C} | Controller |
| F | sensor |
| Ia | Armature current |
| If | Field current |
| J | Inertia of the motor |
| K Kd | Gain Derivative gain |
| KE | A constant based on motor construction |
| Ki | Integral gain |
| Kp | Proportional gain |
| Kt | Torque constant |
| Kv | Motor constant |
| La | Armature inductor |
| Lf | Field inductor |
| $P \\ r(t)$ | plant reference value |
| Ra | Armature resistor |

| Rf | Field resistor |
|-----------|---|
| S | Standard deviation |
| T | Period |
| Td | Derivative time |
| Td | Developed torque |
| Ti | Integral time, or reset time |
| TL | Load torque |
| и | The inputs to the system |
| V_{al1} | first edge Triangle membership functions limits |
| V_{al2} | midterm Triangle membership functions |
| V_{al3} | last edge Triangle membership functions limits |
| W | Motor speed |
| W_{ce} | change in speed error |
| W_e | speed error |
| y(t) | output of the system |
| φ | Magnetic flux |

List of Abbreviations

COA Center of area method DC direct current Derivative portion of controller output Dout Error eFuzzy logic controller **FLC GTO** gate turn on hysteresis current controller **HCC Iout** Integral portion of controller output Multi-Input-Multi-Output **MIMO** Negative Big NB NM Negative Medium **Negative Small** NS Positive Big PB Proportional Derivative PD P-I Proportional Integral PIC Proportional-Integral controller PID proportional, integral, and derivative PM Positive Medium Proportional portion of controller output Pout Positive Small **PS**

| PWM | pulse width modulation |
|---------|-----------------------------|
| rpm | Rotation per minute |
| S.E.D.C | separately excited dc motor |
| SISO | single-input-single-output |