

الآية

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

وَعَايَةٌ لَهُمُ اللَّيْلُ نَسْلَخُ مِنْهُ النَّهَارَ فَإِذَا هُمْ مُظْلَمُونَ ﴿٢٧﴾

وَالشَّمْسُ تَجْرِي لِمُسْتَقَرٍّ لَهَا ذَلِكَ تَقْدِيرُ الْعَزِيزِ الْعَلِيمِ ﴿٢٨﴾

وَالْقَمَرَ قَدَرْنَاهُ مَنَازِلَ حَتَّىٰ عَادَ كَالْعُرْجُونِ الْقَدِيمِ ﴿٢٩﴾ لَا

الشَّمْسُ يَنْبَغِي لَهَا أَنْ تُدْرِكَ الْقَمَرَ وَلَا اللَّيْلُ سَابِقُ النَّهَارِ

وَكُلٌّ فِي فَلَكٍ يَسْبَحُونَ ﴿٣٠﴾

صدق الله العظيم

سورة يس الآيات (37 – 40)

DEDICATIONS

This thesis is lovingly dedicated to my parent, my brothers, my sisters and my friends whose has been constant source of inspiration for me. They have given me the drive and discipline to tackle any task with enthusiasm and determination. Without their love and support this project would not have been made possible.

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ABSTRACT

This thesis presents a comparative study of various controllers for the speed control of DC motor. The most commonly used controller for the speed control of DC motor is conventional Proportional- Integral- Derivative (PID) controller. However, the PID controller has some disadvantages such as: the high starting overshoot, sensitivity to controller gains and sluggish response due to sudden disturbance. So, the relatively design PID controller with computational optimization approach method is proposed to overcome the disadvantages of the conventional PID controller. Further, two fuzzy logic based controllers namely; fuzzy control and neuro-fuzzy control are proposed in this study and the performance of these controllers are compared with PID controller performance. Simulation results are presented and analyzed for all controllers. It is observed that neuro-fuzzy controller gives a better response than other controllers for the speed control of DC motor drives.

المستخلص

يقدم هذا البحث مقارنة دراسية بين متحكمات مختلفة للتحكم في سرعة محرك التيار المستمر . أغلب المتحكمات المستخدمة للتحكم في السرعة لمحرك التيار المستمر هي المتحكمات التقليدية المعروفة بالمتحكم التناسبي التكاملي التفاضلي (PID). ولكن رغم ذلك نجد أن المتحكم التناسبي التكاملي التفاضلي لديه بعض العيوب مثل البداية بمجازرة عالية للهدف، حساسيتها لكسب المتحكممة والإستجابة البطيئة للتغيرات المفاجئة وعليه فإن تصميم المتحكم PID بالطريقة الحسابية التقريبية الأمثل تتغلب على بعض عيوب المتحكم PID التقليدي.وللمزيد إثنين من المتحكمات تعتمد علي المنطق الغامض وهما المتحكم الغامض والمتحكم العصبي الغامض تم إقتراحهما في هذه الدراسة وتمت مقارنة أداء هذه المتحكمات مع المتحكم التناسبي التكاملي التفاضلي . تم عرض نتائج المحاكاة وتحليلها لكافة المتحكمات. لوحظ أن المتحكم العصبي الغامض له الإستجابة الأفضل من بين المتحكمات الأخرى للتحكم في سرعة محرك التيار المستمر.

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LIST OF ABBREVIATIONS

AC	Alternative Current
ANFIS	Adaptive Neural Fuzzy Interface System
DC	Direct Current
e.m.f	Electro Motive Force
FIS	Fuzzy Interface System
FL	Fuzzy logic
FLC	Fuzzy Logic Control
GUI	Graphical User Interface
HP	Horse Power
MF	Membership Function
PID	Proportional Integral Derivative

LIST OF SYMBOLS

v_f	Field voltage
ω_m	Angular velocity
Φ	Magnetic flux
I_f	Field current
G	Transfer function
K_p	Proportional gain
K_i	Integration gain
K_d	Derivative gain
V	Voltage across the coil of the armature
E_b	Back emf electrical motion force
I_a	Rotor's current
R_a	Armature resistant
L_a	Armature inductance
K_M, K_b	Velocity constant and back electromotive force constant
T_M	The electromagnetic torque
J	Moment of inertia of the rotor

B_m	Coefficient of friction
Θ_m	Angular position
G_c	Transfer function of DC motor
$C_e, \Delta e$	Error change
ω_n	Undamped natural frequency
ζ	Damping ratio
MP	Maximum overshoot
T_s	Settling time
T_r	Rise time