

## الآية

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قال تعالى :

وَأَيُّ لَّهُمُ اللَّيْلُ نَسَلَخُ مِنْهُ النَّهَارَ فَإِذَا هُم مُّظْلَمُونَ ﴿٣٧﴾  
وَالشَّمْسُ تَجْرِي لِمُسْتَقَرٍّ لَهَا ذَلِكَ تَقْدِيرُ الْعَزِيزِ الْعَلِيمِ ﴿٣٨﴾  
وَالْقَمَرَ قَدَرْنَا مَنَازِلَ حَتَّىٰ عَادَ كَالْعُرْجُونِ الْقَدِيمِ ﴿٣٩﴾ لَا  
الشَّمْسُ يَنْبَغِي لَهَا أَنْ تُدْرِكَ الْقَمَرَ وَلَا اللَّيْلُ سَابِقُ النَّهَارِ  
وَكُلٌّ فِي فَلَكٍ يَسْبَحُونَ ﴿٤٠﴾

صدق الله العظيم

[ سورة يس: الآيات 37-40 ]

## **DEDICATIONS**

This study is lovingly dedicated to our parents for their emotional and financial support , our brothers , our sisters and our friends whose has been constant source of inspiration for us.

They have given us 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.

## **ACKNOWLEDGEMENT**

We wish to express our profound gratitude to our Supervisor assistant **Galal Abd-Alrahman Mohammed** for his valuable guidance , continues encouragement , worthwhile suggestions and constructive ideas throughout this project . His support, pragmatic analysis and understanding made this study a success and knowledgeable experience for us.

## ABSTRACT

This thesis presents a comparative study of various controllers for the position control of DC servomotor. The position control system is one of the interesting terms in control system engineering. Proportional-Integral-Derivative (PID) controller is a well-known controller and widely used in feedback control in industrial processes.

The most commonly used controller for the position control of DC servomotor 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.

In position control system, PID controller sometimes cannot make this application accurate because of nonlinear properties. Therefore, in this thesis the fuzzy logic controller is proposed to overcome the problem of PID controller. Fuzzy logic controller has ability to control the nonlinear system because of the algorithm is implementing in language. Based on the simulation result the fuzzy logic controller designed is able to improve the performance of the position control system compared to the PID controller in term of rise time ( $T_r$ ) and settling time ( $T_s$ ).

## مستخلص

يقدم هذا البحث مقارنة دراسية بين متحكمات مختلفة ، للتحكم في وضع محرك خدمة التيار المستمر .وتعتبر أنظمة التحكم في الوضع ، من الفروع المهمة في هندسة نظم التحكم و يعتبر المتحكم التناسبي التفاضلي التكاملي من المتحكمات المعروفة ، و المستخدمة بكثرة في التحكم عن طريق التغذية العكسية في المجال الصناعي .

إن أغلب المتحكمات المستخدمة للتحكم في الوضع ، هي المتحكمات التقليدية المعروفة بالمتحكم التناسبي التفاضلي التفاضلي، لكن رغم ذلك نجد أن المتحكم التناسبي التفاضلي التفاضلي ، لديه بعض العيوب ، مثل البدء بتجاوز عالي للهدف ، حساسية لكسب المتحكمة و الإستجابة البطيئة للتغيرات الفجائية . و عليه فان مقترح تصميم المتحكم التناسبي التفاضلي بالطريقة الحسابية المثلي هو يتغلب علي بعض عيوب المتحكم التناسبي التفاضلي التقليدي .

عند استخدامه للتحكم في أنظمة التحكم في الوضع ، وجد أنه لا يعطي الدقة المطلوبة ، نسبة لخواصها غير الخطية . و لذلك في هذا البحث تم تصميم المتحكم الغامض لتفادي هذه المشكلة . للمتحكم الغامض القدرة علي التحكم في الأنظمة غير الخطية ، لأن الخوارزمية المستخدمة تنفذ بتعليمات لغوية. و اعتماداً علي نتائج المحاكاة ، نجد أن المتحكم الغامض له القدرة علي تحسين أداء النظام المتمثل في تقليل زمن الصعود و زمن السكون، مقارنة بالمتحكم التناسبي التفاضلي .

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## LIST OF ABBREVIATIONS

AC	Alternating Current
CPU	Central Processing Unit
DC	Direct Current
EEPROM	Electrically Erasable Programmable Read Only Memory
EMF	Electromotive Force
EPROM	Erasable Programmable Read Only Memory
Hz	Hertz
LED	Light Emitted Diode
MMF	Magnetic Motive Force
PD	Proportional Derivative controller
PI	Proportional Integral controller
PID	Proportional Integral Derivative
PROM	Programmable Read Only Memory
PWM	Pulse Width Modulation
RAM	Random Access Memory
ROM	Read Only Memory
RX	Receiver mode
TX	Transmitter mode

## LIST OF SYMBOLS

$K_p$	Proportional gain
$K_i$	Integral gain
$K_d$	Derivative gain
$T_i$	Integral time
$T_d$	Derivative time
$T$	Motor torque
$i$	Armature Current
$K_t$	Torque constant
$e$	Electromotive force
$\dot{\theta}$	Angular velocity of the shaft
$K_b$	Electromotive force constant
$K$	Motor torque and back EMF constant
$J$	The moment of inertia of the rotor
$b$	The motor viscous friction constant
$L_a$	Electric inductance
$R_a$	Electric resistance
$V$	Voltage source
$K_g$	Gears ratio
$\theta$	Servo gear angle