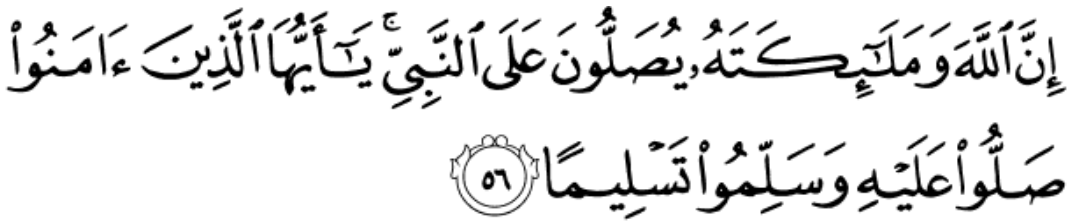
# الآيـــة

**قال تعالى:**




صدق الله العظيم

[سورة الاحزاب: الاية 56]

# DEDICATION

I dedicate this work to the most precious human beings without whom this project wouldn't be possible, my mother and my father. And I will love to thank them for their continuous believe and support. I also would like to dedicate this piece of work to the rest of my family members for always being there and there unconditional love and faith. My friends who have always support me and have a real faith on me. Thank you to everyone who helped me through this journey and believes in this project till it reaches to this point. Thank you from the heart I dedicate this work to you.

# ACKNOWLEDGEMENT

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# ABSTRACT

Since the beginning of the 19th century progress has increased in scientific and practical life. There are many requirements, including control systems. The Brushless DC motor is one of the most commonly used engines in the working life due to high efficiency and high resolution. Due to the remaining magnetism and the speed error of the motor, the control methods such as the differential integral proportional control are used to adjust the speed and estimate the error, making the motor very suitable for applications requiring precise speeds such as small aircraft and motor winding. This study use PID controller tuned manually to adjust these PID controller parameters.

# المستخلص

منذ بداية العصر التاسع عشر ازداد التقدم في الحياة العلمية والعملية فأصبح هنالك كثير من المتطلبات من بينها أنظمة التحكم . ومحركات التيار المستمر خالية الفرش تعتبر من المحركات الأكثر استخداما وشيوعا في الحياة العملية نظرا للكفاءة والعزم العالي الذي يعتبر أكثر ما يميزها. نظرا للمغناطيسية المتبقية ومقدار الخطأ في سرعة المحركات تستخدم طرق التحكم مثل المتحكم التناسبي التكاملي التفاضلي في ضبط السرعة وتقدير الخطأ مما يجعل المحرك مناسب جدا للتطبقيات التي تحتاج الى سرعات دقيقة مثل الطائرات الصغيرة و لف المحركات. هذه الدراسه تستخدم المتحكم التناسبي التكاملي التفاضلي بطريقة الضبط اليدوي لتحديد قيم المتحكم.

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| | |
|---|---|
| $K_p$ | Proportional gain |
| $K_i$ | Integral gain |
| $K_d$ | Derivative gain |
| $T_i$ | Integral time |
| $T_d$ | Derivative time |
| E | Set point-process value |
| T | Instantaneous time |
| $V_r, V_b, V_y$ | Terminal phase voltage |
| R | Armature resistance |
| $i_r$,$i_b$,$i_y$ | Motor input current |
| L | Armature-self inductance |
| $e_r$ | Motor back EMF |
| $K_w$ | Back EMF constant |
| $\theta_e$ | Electrical rotor angle |
| $\omega$ | Rotor seed |
| P | Pole pairs |
| $\theta_m$ | Mechanical rotor angle |
| $T_e$ | Total torque output |
| F | Frequency |

# LIST OF ABBREVIATIONS

| | |
|---|---|
| DC | Direct Current |
| BLDC | Brushless Direct Current |
| AC | Alternating Current |
| PID | Proportional-Integral-Derivative |
| EMF | Electro Motive Force |
| N | North |
| S | South |
| EMI | Electro Magnetic Interference |
| FOC | Field Oriented Control |
| CPU | Central Process Unit |
| RAM | Random Access Memory |
| ROM | Read Only Memory |
| $I/O$ | Input and Output |
| $A/D$ | Analog to Digital |
| $D/A$ | Digital to Analog |
| VCR | Video Cassette Recording |
| USB | Universal Serial Bus |
| KB | Kilo Byte |
| EEPROM | Electrical Erasable Programmable Read Only Memory |
| SISO | Single Input and Single Output |
| MIMO | Multiple Input and Multiple Output |
| PI | Proportional Integral |
| PD | Proportional Derivative |
| PCB | Printed Circuit Board |
| IDE | Institute of Devolving and Economies |
| IR | Infrared |
| AMP | Ampere |
| LED | Light Emitting Diodes |
| PWM | Pulse Width Modulation |
| PAN | Personal Area Network |
| ID | Identity Document |
| ESC | Electronic Speed Controller |
| MATLAB | Matrix Laboratory |