Dedications

This thesis is dedicated to all people who supported me

My mother

My father

My wife

And lastly to my Grandmother, who taught me to get up after a fall and startagain.

Acknowledgment

This thesis is the result of work which I have been accompanied and supported by many people. First of all, I would like to thank Allah, who gives us everything.

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مستخلص

المروحيةالرباعية طائرةبدون طيار ذات اربعة دوّارات ثابتة،حيث يوجد دوارين إثنين علي كل محور ويتعامد كل من المحورين.تدور الدوّرات بواسطة أربعة محركات كهربائية لرفع جسم الطائرة في الهواء وتعتبر من الطائرات العمودية والتي تمتلك امكانية الاقلاع و الهبوط راسياً .

إن الهدف الرئيسي من هذا البحث هو دراسة وتطوير منظومة المروحية الرباعية لتكون قادرة علي الطيران بتحكم آلـــي،وتكون نواة للبحث والتطوير المستقبلي . ولتحقيق تلك الاهداف قد تضمن البحث دراسة شاملة للديناميكيه الهوائية وعلي وجه الخصوص التركيز علي المروحيات وبالتحديد اسطح التحكم للمروحية ومكوناتها ، كما تم التطرق ايضاً الي عدد من انواع الطائرات ذات الاجنحة الدوارة.

تم عمل تحليل للنموذج الرياضي للمروحيةالرباعية وتم حساب القوي والعزوم المؤثرة عليها،ثم تم إستخراج معادلات الحركة التيتصفها.تم استخدام برنامج Matlab/Simulink بنظام التحكم في الحلقة المفتوحة للتحليق والانحدار والدوران و الانعراج للتحقق من استجابة النموزج. و قد كانت النتائج من المحاكاة التي تمت علي النموزج جيدة.

تم تصميم دائرة التحكم الالكترونية للمروحية ،بعد دراسة المكونات الالكترونية المستخدمة في بناء المنظومة مثل محركات التيار المستمر والمـراوح والحســاســات والبطـاريات والمتحكم الدقيق.تم إستخدام برنامج XcopterCalcلتحليل المكونات الالكترونية المكونة للنظام ، وقد اعطي النظام مدي طيران وكفاءة جيدين عند استخدام دافع بين المتحكم والدوار.

تم إستخدام لغة برمجة micro Cلكتابة اوامر التحكم في نظام المروحية،حيث يستقبل المتحكم الدقيق أوامر التحكم من القنوات الاربعةوتغذية العكسية للمقارنة مع المتحسسات وبذا يتم توليد إشارات التحكم للمحركات الاربعة . يتم التحكم في سرعة المحركات بواسطة التحكم بعرض النبضة للإشارة التي يتم ارسالها الي كل محرك علي حدا. كما تم إجراء محاكاة للدائرة التي تم تصميمها بواسطة برنامج Proteus .

Abstract

An autonomous quad-rotor is an unmanned aerial vehicle that has four-fixed rotors, where two rotors per axis and each of the axes are aligned with the other. Rotors are powered by four motors to lift and propel the aircraft. It is a type of a helicopter aircraft that has vertical take-off and landing capability.

The main objective of this research is to study and develop an autonomous quad-copter that is capable of flying under the control of an autopilot that's sustainable and expandable for future researches. In order to achieve that objective, this research encloses a comprehensive study of aerodynamics; focusing on helicopters in particular especially in the field of control surfaces and components, in addition to rapid survey to the history of helicopter development, as well as exploring some types of rotor-wing craft.

In addition to that, the analysis of Quad-Copter's mathematical model has been carried out; and the applied forces and moment affecting the Quad-copter has been calculated. Matlab/Simulink has been used to analyze the equations of motion that describes the mathematical model and to demonstrate the results of the open loop control system of the four movements, which are Hover, Pitch, Roll and Yaw. The results obtained from the simulation were acceptable and were as had been expected.

An electronic circuit is designed for the control of the Quad-Copter. Components used in the design and the implementation of the Quad-Copter such as DC motors, propellers, sensors, batteries and the microcontroller are all discussed in detail.TheXcopterCalc program with ± 10% accuracy was used toanalysis for a particular combination of components,and found that the system has given good duration and efficiency when design include drive between controller and rotor. The Micro C programming language has been used for writing the controlling program for the system. The microcomputer receives the Hover, Pitch, Roll, and Yawcommands plus the feedback from the sensors and generates control signals to the four motors. The movement of the motors is controlled by varying PWM signals that are sent to each of the motors.The simulation of the designedcircuithas been performed by using the Proteus program.

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