Quadrotor Modeling And Control

Proceedings of the ASME Dynamic Systems and Control Division 2006
Proceedings of the 2nd International Conference on Electronic Engineering and Renewable Energy Systems Bekkay Hajji 2020-08-14 This book includes papers presented at the Second International Conference on Electronic Engineering and Renewable Energy (ICEERE 2020), which focus on the application of artificial intelligence techniques, emerging technology and the Internet of things in electrical and renewable energy systems, including hybrid systems, micro-grids, networking, smart health applications, smart grid, mechatronics and electric vehicles. It particularly focuses on new renewable energy technologies for agricultural and rural areas to promote the development of the Euro-Mediterranean region. Given its scope, the book is of interest to graduate students, researchers and practicing engineers working in the fields of electronic engineering and renewable energy.
International Integrated Engineering Summit 2014 Al Emran Ismail 2015-07-15 Selected, peer reviewed papers from the 1st International Integrated Engineering Summit (IIES 2014), December 1-4, 2014, Batu Pahat, Malaysia
Dynamics Modeling and Control of a Quad-rotor Helicopter Mohammed Raju Hossain 2010
Dynamic Modeling and Control of a Quadrotor Using Linear and Nonlinear Approaches Heba talla Mohamed Nabil Elkholy 2014 Abstract: With the huge advancements in miniature sensors, actuators and processors depending mainly on the Micro and Nano-Electro-Mechanical-Systems (MEMS/NEMS), many researches are now focusing on developing miniature flying vehicles to be used in both research and commercial applications. This thesis work presents a detailed mathematical model for a Vertical Takeo ff and Landing (VTOL) type Unmanned Aerial Vehicle(UAV) known as the quadrotor. The nonlinear dynamic model of the quadrotor is formulated using the Newton-Euler method, the formulated model is detailed including aerodynamic effects and rotor dynamics that are omitted in many literature. The motion of the quadrotor can be divided into two subsystems; a rotational subsystem (attitude and heading) and a translational subsystem (altitude and x and y motion). Although the quadrotor is a 6 DOF underactuated system, the derived rotational subsystem is fully actuated, while the translational subsystem is underactuated. The derivation of the mathematical model is followed by the development of four control approaches to control the altitude, attitude, heading and position of the quadrotor in space. The fi rst approach is based on the linear Proportional-Derivative-Integral (PID) controller. The second control approach is based on the nonlinear Sliding Mode Controller (SMC). The third developed controller is a nonlinear Backstepping controller while the fourth is a Gain Scheduling based PID controller. The parameters and gains of the forementioned controllers were tuned using Genetic Algorithm (GA) technique to improve the systems dynamic response. Simulation based experiments were conducted to evaluate and compare the performance of the four developed control techniques in terms of dynamic performance, stability and the effect of possible disturbances.
Modeling and Control of a Quadrotor with Dynamic Inertia Jared D. A. Becker 2013 As the support and technology for unmanned vehicles has increased, so have the possible applications for Unmanned Aerial Vehicles (UAVs). From military intelligence gathering missions, to civilian search and rescue missions, the demand for highly capable UAVs is high. Drawing inspiration from biological examples such as the hawkmoth, this research investigates the use of dynamic inertia as a control mechanism for small quadrotor helicopters. Using Lagrangian mechanics, a nonlinear 3D model and a nonlinear 2D model are developed for a quadrotor with dynamic inertia modeled as an actuated pendulum mounted beneath the vehicle. Designing a linear quadratic controller for a linearization of the system about the hovering flight condition and applying this controller to the nonlinear model results in a stabilizing dynamic inertia controller capable of adequate trajectory tracking for a simple desired trajectory. Additional simulations also show that the linear controller has favorable robustness properties to compensate for modeling errors and nonlinearities.
Robot Motion and Control 2007 Krzysztof R. Kozlowski 2007-06-01 Robot Motion Control 2007 presents very recent results in robot motion and control. Forty-one short papers have been chosen from those presented at the sixth International Workshop on Robot Motion and Control held in Poland in June 2007. The authors of these papers have been carefully selected and represent leading institutions in this field.
Modeling and Control Simulation for Autonomous Quadrotor Idris Eko Putro 2011-03 The use of Quadrotor UAVs has been widely well known. It has capability to hover, vertical take-off and landing (VTOL) with having less complexity in vehicle dynamics compared with small helicopter. It is basically an unstable system and exhibits nonlinear behavior. This book describes the development of nonlinear model of quadrotor dynamics derived from Newton-Euler formulation and presented under Matlab/Simulink environment. The Model is equipped by Stability Augmentation System (SAS) to maintain the quadrotor level flight (attitude stability). The autonomous mission for this vehicle is fixed for trajectory following. LQR Optimal control was chosen to accomplish this mission.
Artificial Neural Networks for Engineering Applications Alma Y Alanis 2019-02-13 Artificial Neural Networks for Engineering Applications presents current trends for the solution of complex engineering problems that cannot be solved through conventional methods. The proposed methodologies can be applied to modeling, pattern recognition, classification, forecasting, estimation, and more. Readers will find different methodologies to solve various problems, including complex nonlinear systems, cellular computational networks, waste water treatment, attack detection on cyber-physical systems, control of UAVs, biomechanical and biomedical systems, time series forecasting, biofuels, and more. Besides the real-time implementations, the book contains all the theory required to use the proposed methodologies for different applications.
Modeling and Control of a Quadrotor in a Wind Field Nguyen Khoi Tran 2016 "In recent years, there has been a surge of interest in the use of small unmanned air vehicles (UAVs) for various civilian and military applications. Many of the proposed applications are outdoor and may include environments with high wind. The relatively small size of quadrotors means that wind gusts can destabilize the quadrotor if the on-board flight controller is not equipped to deal with wind effects. This work investigates the ability of a quadrotor to maneuver in a wind field and develops a method to cope with wind disturbances. A dynamic model of a quadrotor is presented to model its motion. The quadrotor model includes a wind effect model to quantify the effect of wind on the dynamics of a quadrotor. A proportional-integral-derivative (PID) controller is shown as a baseline controller typically used on quadrotors. A LQR controller is then shown as an alternative to a PID controller. These two controllers are compared in a simulation environment using the wind effect model and simulated wind disturbances. Both controllers are found to have similar performance in a wind field, though the LQR controller is found to be easier to tune. These experiments were then repeated using the AscTec Pelican quadrotor platform in an indoor environment. A feedforward controller was developed which uses the wind effect model and a custom onboard wind sensor to generate control inputs that oppose the disturbance forces and moments. In simulation, the feedforward controller was effective in improving control performance while experimentally, the feedforward control was not effective due to wind sensing errors." --
Applied Mechanics and Mechatronics II František Trebuňa 2015-11-30 Special topic volume with invited peer reviewed papers only.
Applied Computer Sciences in Engineering Juan Carlos Figueroa-García 2017-09-13 This book constitutes the refereed proceedings of the Forth Workshop onEngineering Applications, WEA 2017, held in Cartagena, Colombia, inSeptember 2017. The 59 revised full papers presented were carefully reviewed and selectedfrom156 submissions. The papers are organized in topical sections such as computerscience; computational intelligence; simulation systems; internet of things; fuzzy sets and systems; power systems; logistics and operations management; miscellaneous applications.
Instruments, Measurement, Electronics and Information Engineering J.Z. Ma 2013-08-08 Selected, peer reviewed papers from the 2013 International Conference on Precision Mechanical Instruments and Measurement Technology (ICPMIMT 2013), May 25-26, 2013, Shenyang, Liaoning, China
Modeling, Design, and Control of Multiple Quadrotors Abdullah E. Altawaitan 2019 In the last few decades, with the revolution of

availability of low-cost microelectronics, which allow fast and complex computations to be performed on board, there has been increasing attention to aerial vehicles, especially rotary-wing vehicles. This is because of their ability to vertically takeoff and land (VTOL), which make them appropriate for urban environments where no runways are needed. Quadrotors took considerable attention in research and development due to their symmetric body, which makes them simpler to model and control compared to other configurations. One contribution of this work is the design of a new open-source based Quadrotor platform for research. This platform is compatible with both HTC Vive Tracking System (HVTS) and OptiTrack Motion Capture System, Robot Operating System (ROS), and MAVLINK communication protocol. The thesis examined both nonlinear and linear modeling of a 6-DOF rigid-body quadrotor's dynamics along with actuator dynamics. Nonlinear/linear models are used to develop control laws for both low-level and high-level hierarchical control structures. Both HVTS and OptiTrack were used to demonstrate path following for single and multiple quadrotors. Hardware and simulation data are compared. In short, this work establishes a foundation for future work on formation flight of multi-quadrotor.

Modeling and Optimization of the Aerospace, Robotics, Mechatronics, Machines-Tools, Mechanical Engineering and Human Motricity Fields Adrian Olaru 2014-06-30 Selected, peer reviewed papers from the 9th International Conference on Modeling and Optimization of the Aerospace, Robotics, Mechatronics, Machines-Tools, Mechanical Engineering and Human Motricity Fields, (OPTIROB 2014), June 26-29, 2014, Mangalia, Romania

Vibration Engineering and Technology of Machinery José Manoel Balthazar 2021-03-03 This volume gathers the latest advances, innovations and applications in the field of vibration and technology of machinery, as presented by leading international researchers and engineers at the XV International Conference on Vibration Engineering and Technology of Machinery (VETOMAC), held in Curitiba, Brazil on November 10-15, 2019. Topics include concepts and methods in dynamics, dynamics of mechanical and structural systems, dynamics and control, condition monitoring, machinery and structural dynamics, rotor dynamics, experimental techniques, finite element model updating, industrial case studies, vibration control and energy harvesting, and MEMS. The contributions, which were selected through a rigorous international peer-review process, share exciting ideas that will spur novel research directions and foster new multidisciplinary collaborations.

Modelling and Control of a Quadrotor Àlex Martín Alay 2013 The aim of this project is to model and control a quadrotor. The project starts introducing the quadrotor and its parts. After that, the project provides the modelling of the dynamics of the quadrotor using the Lagrange-Euler and the Newton-Euler's approaches. The next part focuses in the design of a controller for the main actions of the quadrotor using the equations of the dynamics. The chosen controller is a PD, for its simplicity and acceptable performance. With the controller designed, the aircraft was tested to verify the simplifications made on the controller. To that, first some simulations using Simulink (Matlab) were done. After that, further experiments were done with the real quadrotor. The good results of the simulations justified the validity of the simplifications and the controller. Furthermore, although it was necessary to add other PD to the previous one, forming a cascaded PID controller, the results of the real experiments were acceptable. Finally, the project contains the explanation and application of a method to optimize the parameters of the controller, and to find the real values of parameters of the model dificult to measure directly, as the inertia.

Modeling and Neural Control of Quadrotor Helicopter Yasir Amir Khan Niazi 2010-08 Quadrotor is a rotorcraft with four vertically oriented propellers. Two of the propellers spin in clockwise direction and the other two in the counter clockwise direction. For a Quadrotor Helicopter a stabilizing controller is always needed. In this book Artificial Neural Networks based Control Methodology to stabilize the a Quadrotor Helicopoter, has been explained. Firstly a mathematical model of Quadrotor is developed. A simplified approach is adopted using momentum theory, where the gyroscopic effect and air friction on machine s body has been neglected, resulting in a simplified model which is useful in designing a controller to stabilize the machine in hover state. The proposed model is nonlinear since the rotor dynamics are function of square of motor inputs. In the controller designing, Direct Inverse Neural Network Control methodology is employed. For that matter 16,8,4-MLP, 16,16,4-MLP and 16,64,4-MLP are used to control the Quadrotor plant. There performance is compared using simulation results. Direct Inverse Control using 16,64,4-MLP gives the best performance amongst all the other considered.

Manufacturing Science and Technology, ICMST2011 Wu Fan 2011-11-22 Selected, peer reviewed papers from the 2011 International Conference on Manufacturing Science and Technology, (ICMST 2011), September 16-18, 2011, Singapore

Convergent Cognitive Information Technologies Vladimir Sukhomlin 2020-01-31 This book constitutes the refereed proceedings of the Third International Conference on Convergent Cognitive Information Technologies, Convergent 2018, held in Moscow, Russia, in December 2018. The 26 revised full papers and 9 short papers were carefully reviewed and selected from 147 submissions. The papers of this volume are organized in topical sections on theoretical questions of computer science, computational mathematics, computer science and cognitive information technologies; cognitive information technologies in control systems; big data and applications; the Internet of Things (IoT): standards, communication and information technologies, network applications; smart cities: standards, cognitive-information technologies and their applications.- cognitive information technologies in the digital economics.- digital transformation of transport.

Quadrotor Modeling And Control

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