Matt McVay

2/9/11

ES502 Background Research Assignment (not in alphabetical order)

1. Gonzalez, A.; Mahtani, R.; Bejar, M.; Ollero, A.; , "Control and stability analysis of an autonomous helicopter," Automation Congress, 2004. Proceedings. World , vol.15, no., pp.399-404, June 28 2004-July 1 2004

doi: 10.1109/WAC.2004.185252

Abstract: This paper presents some results from the research on autonomous helicopter control conducted in the framework of the COMETS project. The paper presents both linear and non-linear control laws. A two-time scale decomposition of the helicopter dynamic has been used to analyse the dynamic behaviour of the system. The fast subsystem copes with the rotational dynamics, while the slow subsystem represents the translational dynamics. The stability of the fast dynamics is demonstrated by means of a Lyapunov function. Furthermore, a feedback linearization technique is proposed to stabilize the slow dynamics. Moreover, the drawbacks of the linear control laws are pointed out and a new nonlinear control law is proposed. This control law is able to control the helicopter when large variations occur in the orientation angles and position of the helicopter

URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=1438584&isnumber=30979>

1. Peng Kemao; Dong Miaobo; Chen Ben, M.; Cai Guowei; Lum Kai Yew; Lee, T.H.; , "Design and Implementation of a Fully Autonomous Flight Control System for a UAV Helicopter," Control Conference, 2007. CCC 2007. Chinese , vol., no., pp.662-667, July 26 2007-June 31 2007

doi: 10.1109/CHICC.2006.4347398

Abstract: An autonomous flight control law applicable to full-envelope was designed in this manuscript for a small-scale unmanned aerial vehicle (UAV) helicopter to fly autonomously. The UAV helicopter was constructed based on a radio-controlled hobby helicopter by assembling an avionic system. The autonomous flight control law applicable to full-envelope was designed using a decentralized design methodology incorporating a newly developed nonlinear control techniques as well as dynamic inversion. The designed autonomous flight control law was implemented and verified in flight tests with the UAV helicopter. The flight test results demonstrate that the designed autonomous flight control law successfully drives the small-scale UAV helicopter to fly autonomously. The scheme of the autonomous flight control is applicable to flight control design of other UAVs.

URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=4347398&isnumber=4346753>

1. Shanjie Wu; Zheng Zheng; Kai-Yuan Cai; , "Indoor autonomous hovering control for a small unmanned coaxial helicopter," Control and Automation (ICCA), 2010 8th IEEE International Conference on , vol., no., pp.267-272, 9-11 June 2010

doi: 10.1109/ICCA.2010.5524402

Abstract: For the nonlinear and open-loop unstable characteristics of the small helicopter, autonomous flight control is a challenging problem. In order to reduce the complexity of the helicopter autonomous control, this paper constructs an indoor autonomous flight control platform for a small coaxial helicopter ESky LAMA4, which is convenient for data collection, data analysis and control law design. Firstly, the Vicon Mx Motion Capture System is installed to obtain the attitudes and positions of the coaxial helicopter. Secondly, a PCTx converter for the radio controller is used to convert the control commands into PPM signals which are sent into the radio controller. Hence the attitude and translational motion can be controlled. Then in the inner attitude loop and outer translational loop, several PID controllers are designed for the autonomous hovering control of the small coaxial helicopter. Finally the flight results demonstrate the feasibility of the proposed approach, which can be adopted into the study of small unmanned helicopters in the future.

URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=5524402&isnumber=5523980>

1. Shaorong Xie; Jun Luo; Pu Xie; Zhenbang Gong; Hairong Zou; , "Biomimetic Control of Pan-tilt-zoom Camera Mounted on an Autonomous Helicopter," Mechatronics and Automation, 2007. ICMA 2007. International Conference on , vol., no., pp.2003-2008, 5-8 Aug. 2007

doi: 10.1109/ICMA.2007.4303858

Abstract: This paper describes a novel control strategy of pan-tilt-zoom camera for tracking a ground moving object from an autonomous helicopter. Because the active camera is mounted on a moving helicopter, and the tracked object is moving at same time, and there exists the vibration influence of the helicopter, image stabilization becomes poor, and all pixels are running. Therefore, a biomimetic control strategy of on-board pan-tilt-zoom camera is presented. In this paper, the biomimetic oculomotor control model is obtained based on physiological neural path of eye movement control. In order to validate the functions of the biomimetic control model, simulation experiments were done under the same condition as the physiological experiments in physiological researches. Then the biomimetic controller of on-board pan-tilt-zoom camera is developed. The results of flight tracking experiments show that the biomimetic controller can compensate the deflection caused by the flight platform, and enhance the system performance.

URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=4303858&isnumber=4303488>

1. Sanders, C.P.; DeBitetto, P.A.; Feron, E.; Vuong, H.F.; Leveson, N.; , "Hierarchical control of small autonomous helicopters," Decision and Control, 1998. Proceedings of the 37th IEEE Conference on , vol.4, no., pp.3629-3634 vol.4, 16-18 Dec 1998

doi: 10.1109/CDC.1998.761744

Abstract: Autonomous air vehicles have numerous applications, all of which require the vehicle to have stable and accurate control of its motion. In the paper, a hierarchical control system for small autonomous helicopters is described. The control system consists of four components: a navigation filter, an inner-loop hover control system, a waypoint guidance system, and a ground-based flight manager. All four elements of the control system have been verified with flight tests of the Draper small autonomous air vehicle

URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=761744&isnumber=16324>

1. Lai, G.; Fregene, K.; Wang, D.; , "A control structure for autonomous model helicopter navigation," Electrical and Computer Engineering, 2000 Canadian Conference on , vol.1, no., pp.103-107 vol.1, 2000

doi: 10.1109/CCECE.2000.849679

Abstract: A hierarchical design for the guidance and control of a small autonomous helicopter system and some preliminary results are presented. At the top of the hierarchy is a navigation manager which specifies mission requirements via a flight path controller to the actual aerial vehicle. The entire design is based on a nonlinear model of the helicopter that accounts for the rotary wing dynamics, the force and moment generation mechanism and the rigid body dynamics. A time-varying optimal control scheme is applied to the nonlinear model to achieve attitude stabilization while a PI outer loop is used for height control. Simulation results demonstrate the performance of the system for some representative mission scenarios

URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=849679&isnumber=18407>

1. Saripalli, S.; Montgomery, J.F.; Sukhatme, G.S.; , "Visually guided landing of an unmanned aerial vehicle," Robotics and Automation, IEEE Transactions on , vol.19, no.3, pp. 371- 380, June 2003

doi: 10.1109/TRA.2003.810239

Abstract: We present the design and implementation of a real-time, vision-based landing algorithm for an autonomous helicopter. The landing algorithm is integrated with algorithms for visual acquisition of the target (a helipad) and navigation to the target, from an arbitrary initial position and orientation. We use vision for precise target detection and recognition, and a combination of vision and Global Positioning System for navigation. The helicopter updates its landing target parameters based on vision and uses an onboard behavior-based controller to follow a path to the landing site. We present significant results from flight trials in the field which demonstrate that our detection, recognition, and control algorithms are accurate, robust, and repeatable.

URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=1206795&isnumber=27157>

1. Kendoul, F.; Fantoni, I.; Lozano, R.; , "Modeling and Control of a Small Autonomous Aircraft Having Two Tilting Rotors," Robotics, IEEE Transactions on , vol.22, no.6, pp.1297-1302, Dec. 2006

doi: 10.1109/TRO.2006.882956

Abstract: This paper presents recent work concerning a small tiltrotor aircraft with a reduced number of rotors. The design consists of two propellers which can tilt laterally and longitudinally. A model of the full birotor dynamics is provided, and a controller based on the backstepping procedure is synthesized for the purposes of stabilization and trajectory tracking. The proposed control strategy has been tested in simulation

URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=4020365&isnumber=4020348>

1. Feng Lin; Xiangxu Dong; Chen, B.M.; Kai-Yew Lum; Lee, T.H.; , "A Robust Real-Time Embedded Vision System on an Unmanned Rotorcraft for Ground Target Following," Industrial Electronics, IEEE Transactions on , vol.59, no.2, pp.1038-1049, Feb. 2012

doi: 10.1109/TIE.2011.2161248

Abstract: In this paper, we present the systematic design and implementation of a robust real-time embedded vision system for an unmanned rotorcraft for ground target following. The hardware construction of the vision system is presented, and an onboard software system is developed based on a multithread technique capable of coordinating multiple tasks. To realize the autonomous ground target following, a sophisticated feature-based vision algorithm is proposed by using an onboard color camera and navigation sensors. The vision feedback is integrated with the flight control system to guide the unmanned rotorcraft to follow a ground target in flight. The overall vision system has been tested in actual flight missions, and the results obtained show that the overall system is very robust and efficient.

URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=5940220&isnumber=6046172>

1. Youn-Sik Hong; Hwa-Seok Lim; Jun-Sik Hong; , "A Cost Effective Rate Control for Streaming Video Dedicated to Wireless Handheld Devices," Multimedia and Ubiquitous Engineering, 2008. MUE 2008. International Conference on , vol., no., pp.537-542, 24-26 April 2008

doi: 10.1109/MUE.2008.21

Abstract: In a recent VoD application, a stationary VoD server delivers video stream to a mobile device, particularly PDA, over wireless. Typically, the sending rate at the server is faster than the playback rate at a handheld device. Therefore, it can't receive streaming video as possible as the sending rate even if there is no congestion and extremely low BER over wireless. Our objective is to develop a simple cost effective rate control scheme using a buffer level at a mobile device. We classify the buffer at a mobile device into three distinct states depending on its level (occupancy). For each of these states a different rate control scheme is formulated. Since the sending rate increases as the inter-packet delay (IPD) at the sender decreases, we vary IPD to control the rate with its state. Adjustable parameters used in our proposed method are calibrated using our empirical results. These measurements were carried out on a test-bed which reproduces a real prototype of the wired-cum-wireless topology.

URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=4505783&isnumber=4505671>

1. Blasch, E.; Kahler, B.; , "Multiresolution EO/IR target tracking and identification," Information Fusion, 2005 8th International Conference on , vol.1, no., pp. 8 pp., 25-28 July 2005

doi: 10.1109/ICIF.2005.1591865

Abstract: Simultaneous target tracking and identification through feature association, attribute matching, or blob analysis is dependent on spatio-temporal measurements. Improved track maintenance should be achievable by maintaining coarse sensor resolutions on maneuvering targets and utilizing finer sensor resolutions to resolve closely-spaced targets. There are inherent optimal resolutions for sensors and restricted altitudes that constrain operational performance that a sensor manager must optimize for both wide-area surveillance and precision tracking. The advent of better optics, coordinated sensor management, and fusion strategies provide an opportunity to enhance simultaneous tracking and identification algorithms. We investigate utilizing electro-optical (EO) and infrared (IR) sensors operating at various resolutions to optimize target tracking and identification. We use a target-dense maneuvering scenario to highlight the performance gains with the multiresolution EO/IR data association (MEIDA) algorithm in tracking crossing targets.

URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=1591865&isnumber=33512>

1. Ksienski, A.A.; Lin, Y.; White, L.J.; , "Low-frequency approach to target identification," Proceedings of the IEEE , vol.63, no.12, pp. 1651- 1660, Dec. 1975

doi: 10.1109/PROC.1975.10033

Abstract: This paper presents a low-frequency method for target identification, and its effectiveness is demonstrated for a large variety of objects varying in complexity from spheres and cubes to modern airplanes. The selection of an appropriate discrete set of frequencies led to a low misclassification error. A number of classification methods are examined using this discrete set of frequencies. It is shown that simple objects can be adequately classified by a linear discriminant method. For more complex targets, such as aircraft, a nearest neighbor approach is required. The introduction of phase and orthogonal polarization components further decreased misclassification error. A discussion of the tradeoff between the increased complexity and improved performance of various classification alternatives is provided.

URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=1451962&isnumber=31199>

1. Brown, M.M.; Jamali, M.M.; , "Detection and tracking of multiple targets within a three-dimensional medium," Signals, Systems and Computers, 2004. Conference Record of the Thirty-Eighth Asilomar Conference on , vol.1, no., pp. 1247- 1251 Vol.1, 7-10 Nov. 2004

doi: 10.1109/ACSSC.2004.1399341

Abstract: One of today's problems in signal processing is the identification of direction of arrival (DOA). The need for estimating direction-of-arrival (DOA) of energy wave fields within a three-dimensional medium has led to great interest in areas outside of military use. For most real-world applications however, a target tends to lie within three-dimensional medium. A method for detection and tracking of multiple moving targets within a three-dimensional medium has been developed.

URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=1399341&isnumber=30419>