

Advances In Unmanned Aerial Vehicles State Of The Art And The Road To Autonomy Intelligent Systems Control And Automation Science And Engineering

Revolutionary advances in unmanned technologies and the prospects offered by unmanned aerial vehicles (UAVs) in surveillance, targeting and attack appear to have captured the attention of senior civilian and defense officials in the People's Republic of China (PRC). Given the PRC's expanding strategic interests, and the associated requirement for an improved command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) infrastructure, UAVs represent a transformational capability for the Chinese military. Given China's growing assertiveness in enforcing its disputed territorial claims along its periphery, these trends seem to suggest a worrisome future outlook for the region. An enhanced C4ISR network may encourage CCP leaders to accept greater risk in resolving sovereignty and territorial disputes. The Chinese People's Liberation Army appears to be fielding operational UAV capabilities that could have significant future regional security implications. In order to support China's efforts to become a world-class leader in unmanned technology, the PLA has developed an extensive and organizationally complex UAV infrastructure over the past decade. This program includes national-level organizations tasked with developing joint UAV mission requirements; an advanced military-industrial design, research and development (R & D), and production infrastructure; and a growing number of operational UAV units under the PLA Second Artillery, Air Force, Navy, and ground forces.

Few years ago, the topic of aerial robots was exclusively related to the robotics community, so a great number of books about the dynamics and control of aerial robots and UAVs have been written. As the control technology for UAVs advances, the great interaction that exists between other systems and elements that are as important as control such as aerodynamics, energy efficiency, acoustics, structural integrity, and applications, among others has become evident. *Aerial Robots - Aerodynamics, Control, and Applications* is an attempt to bring some of these topics related to UAVs together in just one book and to look at a selection of the most relevant problems of UAVs in a broader engineering perspective.

Motion Coordination for VTOL Unmanned Aerial Vehicles develops new control design techniques for the distributed coordination of a team of autonomous unmanned aerial vehicles. In particular, it provides new control design approaches for the attitude synchronization of a formation of rigid body systems. In addition, by integrating new control design techniques with some concepts from nonlinear control theory and multi-agent systems, it presents a new theoretical framework for the formation control of a class of under-actuated aerial vehicles capable of vertical take-off and landing. Several practical problems related to the systems' inputs, states measurements, and restrictions on the interconnection topology between the aerial vehicles in the team are addressed. Worked examples with sufficient details and simulation results are provided to illustrate the applicability and effectiveness of the theoretical results discussed in the book. The material presented is primarily intended for researchers and industrial engineers from robotics, control engineering and aerospace communities. It also serves as a complementary reading for graduate students involved in research related to flying robotics, aerospace, control of under-actuated systems, and nonlinear control theory

Unmanned marine vehicles (UMVs) is a collective term commonly used to describe autonomous underwater vehicles, remotely operated vehicles, semi-submersibles, and unmanned surface craft. UMVs are heavily used in the military, civilian, and scientific communities for undertaking designated missions whilst either operating autonomously and/or in co-operation with other types of vehicles. Advanced marine vehicles are increasing their capabilities and the degree of autonomy more and more in order to perform more sophisticated maritime missions. Remotely operated vehicles are no longer cost-effective since they are limited by economic support costs, and the presence and skills of the human operator. Alternatively, autonomous surface and underwater vehicles have the potential to operate with greatly reduced overhead costs and level of operator intervention. An unmanned aerial vehicle (UAV), commonly known as a drone, is an aircraft without a human pilot aboard. UAVs are a component of an unmanned aircraft system (UAS); these include a UAV, a ground-based controller, and a system of communications between the two. Compared to manned aircraft, UAVs were originally used for missions too "dull, dirty or dangerous" for humans. While they originated mostly in military applications, their use is rapidly expanding to commercial, scientific, recreational, agricultural, and other applications such as policing, peacekeeping and surveillance, product deliveries, aerial photography, agriculture, smuggling, and drone racing. Civilian UAVs now vastly outnumber military UAVs, with estimates of over a million sold by 2015, so they can be seen as an early commercial application of Autonomous Things, to be followed by the autonomous car and home robots. Nowadays, UMVs and UAVs are playing an increasingly important role in both controlling community and engineering applications. For example, UMVs and UAVs provide more efficient ways to execute various challenging tasks. However, these systems are usually featured with dynamics coupling, actuator saturation, underactuated structure, time-varying disturbance, etc., thereby resulting in great challenges and difficulties in system analysis and controller design. Recently, by employing intelligent approaches, advanced control methodologies for unmanned systems have been rapidly developed. Note that the dynamic environment is usually changing and the unmanned systems must adapt themselves accordingly. In this context, on one hand, more efforts should be focused on the methodology of the learning system. For example, fast adaptation and self-organizing capability are essentially required. On the other hand, advanced analysis tools should be deployed to enhance the control performance. Towards this end, human-like intelligence should be integrated tightly with nonlinear design for complex control tasks of autonomous systems. The main objective of this edited book is to address various challenges and issues pertinent to the intelligent control of UMVs and UAVs.

Overview of recent advances in the analysis and design of health management systems for cooperating unmanned aerial vehicles. Cooperative health management (CHM) systems seek to provide adaptation to the presence of faults by capitalizing on the availability of interconnected computing, sensing and actuation resources. Complements the proposed CHM concepts by means of case studies and application examples. and presents fundamental principles and results encompassing optimization, systems theory, information theory, dynamics, modeling and simulation.

First used in military applications, unmanned aerial vehicles are becoming an integral aspect of modern society and are expanding into the commercial, scientific, recreational, agricultural, and surveillance sectors. With the increasing use of these drones by government officials, business professionals, and civilians, more research is needed to understand their complexity both in design and function. *Unmanned Aerial Vehicles: Breakthroughs in Research and Practice* is a critical source of academic knowledge on the design, construction, and maintenance of drones, as well as their applications across all aspects of society. Highlighting a range of pertinent topics such as intelligent systems, artificial intelligence, and situation awareness, this publication is an ideal reference source for military consultants, military personnel, business professionals, operation managers, surveillance companies, agriculturalists, policymakers, government officials, law enforcement, IT professionals, academicians, researchers, and graduate-level students.

"The past few years witnessed a major revolution in the area of unmanned aerial vehicles (UAVs), commonly known as drones, due to significant technological advances across various drone-related fields ranging from embedded systems to autonomy, control, security, and communications. These unprecedented recent advances in UAV technology have made it possible to widely deploy drones across a plethora of application domains ranging from delivery of goods to surveillance, environmental monitoring, track control, remote sensing, and search and rescue. In fact, recent reports from the Federal Aviation Administration (FAA) anticipate that sales of UAVs may exceed 7 million in 2020 and many industries are currently investing in innovative drone-centric applications and research. To enable all such applications, it is

imperative to address a plethora of research challenges pertaining to drone systems, ranging from navigation to autonomy, control, sensing, navigation, and communications. In particular, the deployment of UAVs in tomorrow's smart cities, is largely contingent upon equipping them with effective means for communications and networking. To this end, in this book, we provide a comprehensive treatment of the wireless communications and networking research challenges and opportunities associated with UAV technology. This treatment begins in this chapter which provides an introduction to UAV technology and an in-depth discussion on the wireless communication and networking challenges associated with the introduction of UAVs"--

Gives an overview of current unmanned aerial vehicle research and the ways this technology is being used for developing "smart" weapons, atmosphere sampling, space probes, weather reporting, and more

This book studies selected advanced flight control schemes for an uncertain quadrotor unmanned aerial vehicle (UAV) systems in the presence of constant external disturbances, parametric uncertainties, measurement noise, time-varying external disturbances, and random external disturbances. Furthermore, in all the control techniques proposed in this book, it includes the simulation results with comparison to other nonlinear control schemes recently developed for the tracking control of a quadrotor UAV. The main contributions of the present book for quadrotor UAV systems are as follows: (i) the proposed control methods are based on the high-order sliding mode controller (SMC) and hybrid control algorithm with an optimization method. (ii) the finite-time control schemes are developed by using fast terminal SMC (FTSMC), nonsingular FTSMC (NFTSMC), global time-varying SMC, and adaptive laws. (iii) the fractional-order flight control schemes are developed by using the fractional-order calculus theory, super twisting algorithm, NFTSMC, and the SMC. This book covers the research history and importance of quadrotor system subject to system uncertainties, external wind disturbances, and noise measurements, as well as the research status of advanced flight control methods, adaptive flight control methods, and flight control based on fractional-order theory. The book would be interesting to most academic undergraduate, postgraduates, researchers on flight control for drones and applications of advanced controllers in engineering field. This book presents a must-survey for advanced finite-time control for quadrotor system. Some parts of this book have the potential of becoming the courses for the modelling and control of autonomous flying machines. Readers (academic researcher, undergraduate student, postgraduate student, MBA/executive, and education practitioner) interested in nonlinear control methods find this book an investigation. This book can be used as a good reference for the academic research on the control theory, drones, terminal sliding mode control, and related to this or used in Ph.D. study of control theory and their application in field engineering.

The past decade has seen tremendous interest in the production and refinement of unmanned aerial vehicles, both fixed-wing, such as airplanes and rotary-wing, such as helicopters and vertical takeoff and landing vehicles. This book provides a diversified survey of research and development on small and miniature unmanned aerial vehicles of both fixed and rotary wing designs. From historical background to proposed new applications, this is the most comprehensive reference yet.

Complete with online files and updates, this cutting-edge text looks at the next generation of unmanned flying machines. Aerial robots can be considered as an evolution of the Unmanned Aerial Vehicles (UAVs). This book provides a complete overview of all the issues related to aerial robotics, addressing problems ranging from flight control to terrain perception and mission planning and execution. The major challenges and potentials of heterogeneous UAVs are comprehensively explored.

Published on the occasion of the XXIst Congress of the International Society for Photogrammetry and Remote Sensing (ISPRS) in Beijing, China in 2008, *Advances in Photogrammetry, Remote Sensing and Spatial Information Sciences: 2008 ISPRS Congress Book* is a compilation of 34 contributions from 62 researchers active within the ISPRS. The book covers

Nonlinear problems in flight control have stimulated cooperation among engineers and scientists from a range of disciplines. Developments in computer technology allowed for numerical solutions of nonlinear control problems, while industrial recognition and applications of nonlinear mathematical models in solving technological problems is increasing. The aim of the book *Advances in Flight Control Systems* is to bring together reputable researchers from different countries in order to provide a comprehensive coverage of advanced and modern topics in flight control not yet reflected by other books. This product comprises 14 contributions submitted by 38 authors from 11 different countries and areas. It covers most of the currents main streams of flight control researches, ranging from adaptive flight control mechanism, fault tolerant flight control, acceleration based flight control, helicopter flight control, comparison of flight control systems and fundamentals. According to these themes the contributions are grouped in six categories, corresponding to six parts of the book.

Military drones have been part of wars for more than 100 years. Today's military unmanned aerial vehicles are packed with sensors, high-quality cameras, and even weapons. With each UAV flight, military members are kept safe away from war zones. Young readers will learn how both aerial and underwater military drones operate and get inside details about some of the missions they've completed."

Over the past three decades, a number of attempts have been made to develop unmanned aerial vehicles, but many of these efforts have met with suboptimal results. Recently, however, the Defense Advanced Research Projects Agency (DARPA), in conjunction with the Defense Airborne Reconnaissance Office, launched an effort — designated the High-Altitude Endurance Unmanned Aerial Vehicle Advanced concept Technology Demonstration (HAE UAV ACTD) program — whose objective was to overcome past constraints in UAV development through the use of a new acquisition policy. This report assesses two transitions of the HAE UAV ACTD program — the first from DARPA to Air Force management and the second from an ACTD to a Major Defense Acquisition Program (MDAP) — toward the goal of determining which elements of the program's novel acquisition strategy facilitated these transitions and which engendered problems. The authors found that in aggregate, the innovative acquisition strategy adopted in the HAE UAV ACTD program had a positive effect on program execution in that it successfully attained the program's key goals: demonstrating a new operational concept at a lower cost and in a shorter time frame than would have been possible with a traditional acquisition approach. The program's transition from the ACTD construct to an MDAP, however — although ultimately successful — posed a number of challenges, many of which stemmed directly from its acquisition strategy. To circumvent these problems in the future, the authors recommend that all organizations involved in a program, particularly operational users, be given substantive input into program planning at the earliest possible juncture.

Recent Advances in Research on Unmanned Aerial Vehicles Springer

This book focuses on the importance of human factors in the development of safe and reliable unmanned systems. It discusses current challenges such as how to improve the perceptual and cognitive abilities of robots, develop suitable synthetic vision systems, cope with degraded reliability in unmanned systems, predict robotic behavior in case of a loss of communication, the vision for future soldier-robot teams, human-agent teaming, real-world implications for human-robot interaction, and approaches to standardize both the display and control of technologies across unmanned systems. Based on the AHFE 2017 International Conference on Human Factors in Robots and Unmanned Systems, held on July 17–21 in Los Angeles, California, USA, this book is expected to foster new discussion and stimulate new advances in the

development of more reliable, safer, and highly functional devices for carrying out automated and concurrent tasks. Many industries have begun to recognize the potential support that unmanned aerial vehicles (UAVs) offer, and this is no less true for the commercial sector. Current research on this field is narrowly focused on technological development to improve the functionality of delivery and endurance of the drone delivery in logistics, as well as on regulatory challenges posed by such operations. There is a need for further attention to be applied to operational and integration challenges associated with UAVs. Unmanned Aerial Vehicles in Civilian Logistics and Supply Chain Management is a collection of innovative research that investigates the opportunities and challenges for the use of UAVs in logistics and supply chain management with a specific aim to focus on the multifaceted impact of drone delivery. While highlighting topics including non-military operations, public management, and safety culture, this book is ideally designed for government administrators, managers, industry professionals, researchers, and students.

Given significant mobility advantages, Unmanned Aerial Vehicles (UAVs) have access to many locations that would be impossible for an unmanned ground vehicle to reach, but UAV research has historically focused on avoiding interactions with the environment. Recent advances in UAV size to payload and manipulator weight to payload ratios suggest the possibility of integration in the near future, opening the door to UAVs that can interact with their environment by manipulating objects. Because rotorcraft are inherently unstable, introduce ground effects, and experience changing flight dynamics under external loads, this research addresses the difficult task of maintaining a stable UAV platform while interacting with objects using one or more dexterous arms. This thesis establishes a way forward to solve the critical gap in aerial manipulation: characterizing reactionary forces and torques and the impact of those reactions transmitted back to a 6-DoF flying robot with arms. A force control scheme is presented to achieve manipulation from an aerial vehicle with multi-degree of freedom manipulators. Through an analysis of loosely and strongly coupled interactions with the environment, such tasks as pick-and-place, peg-in-hole, and valve turning are investigated for model verification and benchmarking. Recent results in arm motions that achieve increased flight stability indicate a tested methodology to achieve control of an air vehicle while interacting with the environment. Classic controls experiments are shown on hardware, test rigs, and in simulation to demonstrate whole-body locomotion and planning for an aerial manipulator. This volume presents the contributions of the 6th International Conference on Advancements of Medicine and Health Care through Technology – MediTech 2018, held between 17 – 20 October 2018 in Cluj-Napoca, Romania. The papers of this Proceedings volume present new developments in : - Health Care Technology - Medical Devices, Measurement and Instrumentation - Medical Imaging, Image and Signal Processing - Modeling and Simulation - Molecular Bioengineering - Biomechanics

Advances in unmanned aerial vehicle (UAV) technology have enabled these tools to become easier to use and afford. In a budget-limited environment, these flexible remote sensing technologies can help address transportation agency needs in operations, maintenance, and asset management while increasing safety and decreasing cost. This project tested and evaluated five main UAV platforms with a combination of optical, thermal, and LiDAR sensors to assess critical transportation infrastructure and issues such as bridges, confined spaces, traffic flow, and roadway assets. A State of the Practice report was completed, and a series of lab testing were accomplished to ensure practicality and safe operations. Field demonstrations were completed at bridges, pump stations, and conferences. The project team gave a series of technical demonstrations at the Intelligent Transportation Systems World Congress in Detroit in September, 2014, enabling outreach to a wide domestic and international audience who gained understanding of the advanced research that MDOT is funding. These demonstrations showed that UAV technologies provide many advantages to helping MDOT cost-effectively assess, manage, and maintain its resources, providing benefit to staff and the traveling public.

The Department of Defense (DOD) has built five prototype Global Hawk reconnaissance aircraft for use in a High Altitude Endurance Unmanned Aerial Vehicle Advanced Concept Technology Demonstration. The Advanced Concept Technology Demonstration's purpose is to determine through design and construction of Global Hawk prototypes, and a subsequent assessment of their utility in military user demonstrations, if the concept is effective as an Air Force reconnaissance aircraft before DOD decides whether to acquire a production version of it. Reconnaissance aircraft such as Global Hawk are used to obtain information about the activities and resources of enemy forces. If DOD decides to acquire Global Hawk, the production version is expected to provide the Air Force with the ability to fly for 40 continuous hours and conduct reconnaissance for up to 24 hours at a radius of 3,000 nautical miles. In 1994, when the Advanced Concept Technology Demonstration was initiated, DOD established a \$10-million average unit flyaway price goal in fiscal year 1994 dollars for air vehicles numbered 11 through 20.2 The unit flyaway price covers the cost of the vehicle, its reconnaissance sensors, and the contractor's fee. Unit flyaway price excludes costs for systems engineering and program management, system test and evaluation and non-recurring tooling, engineering and manufacturing development, and non-flying support equipment such as the ground control station.

Bio-inspired Computation in Unmanned Aerial Vehicles focuses on the aspects of path planning, formation control, heterogeneous cooperative control and vision-based surveillance and navigation in Unmanned Aerial Vehicles (UAVs) from the perspective of bio-inspired computation. It helps readers to gain a comprehensive understanding of control-related problems in UAVs, presenting the latest advances in bio-inspired computation. By combining bio-inspired computation and UAV control problems, key questions are explored in depth, and each piece is content-rich while remaining accessible. With abundant illustrations of simulation work, this book links theory, algorithms and implementation procedures, demonstrating the simulation results with graphics that are intuitive without sacrificing academic rigor. Further, it pays due attention to both the conceptual framework and the implementation procedures. The book offers a valuable resource for scientists, researchers and graduate students in the field of Control, Aerospace Technology and Astronautics, especially those interested in artificial intelligence and Unmanned Aerial Vehicles.

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A team of launched and coordinated Unmanned aerial vehicles (UAVs), requires advanced technologies in sensing, communication, computing, and control to improve their intelligence and robustness towards autonomous operations. To enhance reliability, robustness, and mission capability of a team of UAVs, a system-oriented and holistic approach is desirable in which all components and subsystems are considered in terms of their roles and impact on the entire system. This volume aims to summarize the recent progress, identify challenges and opportunities, and develop new methodologies and systems on coordinated UAV control. A group of experts working in this area have contributed to this volume in several related aspects of autonomous control of networked UAVs. Their papers introduce new control methodologies, algorithms, and systems that address several important issues in developing intelligent, autonomous or semi-autonomous, networked systems for the next generation of UAVs. The papers share a common focus on improved coordination of the members of the networked system to accomplish a common mission, to achieve heightened capability in system reconfiguration to compensate for lost members or connections, and to enhance robustness against terrain complications and attacks.

Unmanned Aircraft Systems (UAS) have seen unprecedented levels of growth during the last decade in both military and civilian domains. It is anticipated that civilian applications will be dominant in the future, although there are still barriers to be overcome and technical challenges to be met. Integrating UAS into, for example, civilian space, navigation, autonomy, see-detect-and-avoid systems, smart designs, system integration, vision-based navigation and training, to name but a few areas, will be of prime importance in the near future. This special volume is the outcome of research presented at the International Symposium on Unmanned Aerial Vehicles, held in Orlando, Florida, USA, from June 23-25, 2008, and presents state-of-the-art findings on topics such as: UAS operations and integration into the national airspace system; UAS navigation and control; micro-, mini-, small UAVs; UAS simulation testbeds and frameworks; UAS research platforms and applications; UAS applications. This book aims at serving as a guide tool on UAS for engineers and practitioners, academics, government agencies and industry. Previously published in the Journal of Intelligent and Robotic Systems, 54 (1-3, 2009).

The book describes the state of the art and latest advancements in technologies for various areas of aircraft systems. In particular it covers wide variety of topics in aircraft structures and advanced materials, control systems, electrical systems, inspection and maintenance, avionics and radar and some miscellaneous topics such as green aviation. The authors are leading experts in their fields. Both the researchers and the students should find the material useful in their work.

Introduction to Unmanned Aircraft Systems surveys the fundamentals of unmanned aircraft system (UAS) operations, from sensors, controls, and automation to regulations, safety procedures, and human factors. It is designed for the student or layperson and thus assumes no prior knowledge of UASs, engineering, or aeronautics. Dynamic and well-illustrated, the first edition of this popular primer was created in response to a need for a suitable university-level textbook on the subject. Fully updated and significantly expanded, this new Second Edition: Reflects the proliferation of technological capability, miniaturization, and demand for aerial intelligence in a post-9/11 world Presents the latest major commercial uses of UASs and unmanned aerial vehicles (UAVs) Enhances its coverage with greater depth and support for more advanced coursework Provides material appropriate for introductory UAS coursework in both aviation and aerospace engineering programs Introduction to Unmanned Aircraft Systems, Second Edition capitalizes on the expertise of contributing authors to instill a practical, up-to-date understanding of what it takes to safely operate UASs in the National Airspace System (NAS). Complete with end-of-chapter discussion questions, this book makes an ideal textbook for a first course in UAS operations.

This book presents the proceedings of the 20th Polish Control Conference. A triennial event that was first held in 1958, the conference successfully combines its long tradition with a modern approach to shed light on problems in control engineering, automation, robotics and a wide range of applications in these disciplines. The book presents new theoretical results concerning the steering of dynamical systems, as well as industrial case studies and worked solutions to real-world problems in contemporary engineering. It particularly focuses on the modelling, identification, analysis and design of automation systems; however, it also addresses the evaluation of their performance, efficiency and reliability. Other topics include fault-tolerant control in robotics, automated manufacturing, mechatronics and industrial systems. Moreover, it discusses data processing and transfer issues, covering a variety of methodologies, including model predictive, robust and adaptive techniques, as well as algebraic and geometric methods, and fractional order calculus approaches. The book also examines essential application areas, such as transportation and autonomous intelligent vehicle systems, robotic arms, mobile manipulators, cyber-physical systems, electric drives and both surface and underwater marine vessels. Lastly, it explores biological and medical applications of the control-theory-inspired methods. Classical vehicle dynamics, which is the basis for manned ground vehicle design, has exhausted its potential for providing novel design concepts to a large degree. At the same time, unmanned ground vehicle (UGV) dynamics is still in its infancy and is currently being developed using general analytical dynamics principles with very little input from actual vehicle dynamics theory. This technical book presents outcomes from the NATO Advanced Study Institute (ASI) 'Advanced Autonomous Vehicle Design for Severe Environments', held in Coventry, UK, in July 2014. The ASI provided a platform for world class professionals to meet and discuss leading-edge research, engineering accomplishments and future trends in manned and unmanned ground vehicle dynamics, terrain mobility and energy efficiency. The outcomes of this collective effort serve as an analytical foundation for autonomous vehicle design. Topics covered include: historical aspects, pivotal accomplishments and the analysis of future trends in on- and off-road manned and unmanned vehicle

dynamics; terramechanics, soil dynamic characteristics, uncertainties and stochastic characteristics of vehicle-environment interaction for agile vehicle dynamics modeling; new methods and techniques in on-line control and learning for vehicle autonomy; fundamentals of agility and severe environments; mechatronics and cyber-physics issues of agile vehicle dynamics to design for control, energy harvesting and cyber security; and case studies of agile and inverse vehicle dynamics and vehicle systems design, including optimisation of suspension and driveline systems. The book targets graduate students, who desire to advance further in leading-edge vehicle dynamics topics in manned and unmanned ground vehicles, PhD students continuing their research work and building advanced curricula in academia and industry, and researchers in government agencies and private companies.

This book focuses on the importance of human factors in the development of reliable and safe unmanned systems. It discusses current challenges such as how to improve perceptual and cognitive abilities of robots, develop suitable synthetic vision systems, cope with degraded reliability of unmanned systems, predict robotic behavior in case of a loss of communication, the vision for future soldier-robot teams, human-agent teaming, real-world implications for human-robot interaction, and approaches to standardize both display and control of technologies across unmanned systems. Based on the AHFE 2016 International Conference on Human Factors in Robots and Unmanned Systems, held on July 27-31, 2016, in Walt Disney World®, Florida, USA, this book is expected to foster new discussion and stimulate new ideas towards the development of more reliable, safer, and functional devices for carrying out automated and concurrent tasks.

The International Conference on Intelligent Unmanned Systems 2011 was organized by the International Society of Intelligent Unmanned Systems and locally by the Center for Bio-Micro Robotics Research at Chiba University, Japan. The event was the 7th conference continuing from previous conferences held in Seoul, Korea (2005, 2006), Bali, Indonesia (2007), Nanjing, China (2008), Jeju, Korea (2009), and Bali, Indonesia (2010). ICIUS 2011 focused on both theory and application, primarily covering the topics of robotics, autonomous vehicles, intelligent unmanned technologies, and biomimetics. We invited seven keynote speakers who dealt with related state-of-the-art technologies including unmanned aerial vehicles (UAVs) and micro air vehicles (MAVs), flapping wings (FWs), unmanned ground vehicles (UGVs), underwater vehicles (UVs), bio-inspired robotics, advanced control, and intelligent systems, among others. This book is a collection of excellent papers that were updated after presentation at ICIUS2011. All papers that form the chapters of this book were reviewed and revised from the perspective of advanced relevant technologies in the field. The aim of this book is to stimulate interactions among researchers active in the areas pertinent to intelligent unmanned systems.

The past three decades have seen a number of less-than-successful efforts to develop high-altitude unmanned aerial vehicles. In 1994, the Defense Advanced Research Projects Agency, in conjunction with the Defense Airborne Reconnaissance Office, initiated an effort--designated the High-Altitude Endurance Unmanned Aerial Vehicle Advanced Concept Technology Demonstrator (HAE UAV ACTD) --whose goal was to facilitate the development of UAVs through the use of a new and innovative acquisition strategy. This report addresses the effect of that acquisition strategy on the flight test program of the two air vehicles: the conventional Global Hawk and the low-observable DarkStar. The authors found that because DarkStar was canceled after having logged only 6.5 flight hours, not enough flight experience was accumulated to allow for an understanding of the vehicle's flight characteristics or military utility. By contrast, Global Hawk accumulated ample experience to permit a demonstration of its military utility, achieving a level of performance that was close to predicted goals. The precise effect of the HAE UAV acquisition strategy remains the subject of debate. The strategy did, however, influence some key aspects of the flight test program, most notably its increased contractor involvement and its early operational testing in the form of user demonstrations. The flight test program also served to illustrate the vital need for early involvement of operational users to bolster the capabilities and perspective of the contractor.

Unmanned Rotorcraft Systems explores the research and development of fully-functional miniature UAV (unmanned aerial vehicle) rotorcraft, and provides a complete treatment of the design of autonomous miniature rotorcraft UAVs. The unmanned system is an integration of advanced technologies developed in communications, computing, and control areas, and is an excellent testing ground for trialing and implementing modern control techniques. Included are detailed expositions of systematic hardware construction, software systems integration, aerodynamic modeling; and automatic flight control system design. Emphasis is placed on the cooperative control and flight formation of multiple UAVs, vision-based ground target tracking, and landing on moving platforms. Other issues such as the development of GPS-less indoor micro aerial vehicles and vision-based navigation are also discussed in depth: utilizing the vision-based system for accomplishing ground target tracking, attacking and landing, cooperative control and flight formation of multiple unmanned rotorcraft; and future research directions on the related areas.

This book reports on the design and development of a system that assists remote pilots during the landing procedure. In particular, it covers a previously neglected topic, namely the search for the best pathway and landing site. It describes the system's components, such as the ultrasonic sensor, infrared sensor and optical sensor, in detail, and discusses the experimental tests carried out in both controlled laboratory and real-world environments. Providing a fascinating survey of the state of the art in the field of unmanned aircraft system electronics design and development, the book also presents recent advances in and cutting-edge methodologies for the development of acquisition systems and inexpensive sensor design for navigation data.

Unmanned Aerial Systems: Theoretical Foundation and Applications presents some of the latest innovative approaches to drones from the point-of-view of dynamic modeling, system analysis, optimization, control, communications, 3D-mapping, search and rescue, surveillance, farmland and construction monitoring, and more. With the emergence of low-

cost UAS, a vast array of research works in academia and products in the industrial sectors have evolved. The book covers the safe operation of UAS, including, but not limited to, fundamental design, mission and path planning, control theory, computer vision, artificial intelligence, applications requirements, and more. This book provides a unique reference of the state-of-the-art research and development of unmanned aerial systems, making it an essential resource for researchers, instructors and practitioners. Covers some of the most innovative approaches to drones Provides the latest state-of-the-art research and development surrounding unmanned aerial systems Presents a comprehensive reference on unmanned aerial systems, with a focus on cutting-edge technologies and recent research trends in the area

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