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KEY=RESEARCH - PATRICIA CUEVAS

RECENT ADVANCES IN RESEARCH ON UNMANNED AERIAL VEHICLES

Springer 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.

ADVANCES IN UNMANNED AERIAL VEHICLES

STATE OF THE ART AND THE ROAD TO AUTONOMY

Springer Science & Business Media 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.

UNMANNED AERIAL VEHICLES

BREAKTHROUGHS IN RESEARCH AND PRACTICE

UNMANNED AERIAL SYSTEMS

THEORETICAL FOUNDATION AND APPLICATIONS

Academic Press 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

UNMANNED AERIAL VEHICLES FOR INTERNET OF THINGS (IOT)

CONCEPTS, TECHNIQUES, AND APPLICATIONS

John Wiley & Sons The 15 chapters in this book explore the theoretical as well as a number of technical research outcomes on all aspects of UAVs. UAVs has widely differing applications such as disaster management, structural inspection, goods delivery, transportation, localization, mapping, pollution and radiation monitoring, search and rescue, farming, etc. The advantages of using UAVs are countless and have led the way for the full integration of UAVs, as intelligent objects into the IoT system. The book covers cover such subjects as: Efficient energy management systems in UAV based IoT networks IoE enabled UAVs Mind-controlled UAV using Brain-Computer Interface (BCI) The importance of AI in realizing autonomous and intelligent flying IoT Blockchain-based solutions for various security issues in UAV-enabled IoT The challenges and threats of UAVs such as hijacking, privacy, cyber-security, and physical safety.

HANDBOOK OF UNMANNED AERIAL VEHICLES

Springer The Handbook of Unmanned Aerial Vehicles is a reference text for the academic and research communities, industry, manufacturers, users, practitioners, Federal Government, Federal and State Agencies, the private sector, as well as all organizations that are and will be using unmanned aircraft in a wide spectrum of applications. The Handbook covers all aspects of UAVs, from design to logistics and ethical issues. It is also targeting the young investigator, the future inventor and entrepreneur by providing an overview and detailed information of the state-of-the-art as well as useful new concepts that may lead to innovative research. The contents of the Handbook include material that addresses the needs and 'know how' of all of the above sectors targeting a very diverse audience. The Handbook offers a unique and comprehensive treatise of everything one needs to know about unmanned aircrafts, from conception to operation, from technologies to business activities, users, OEMs, reference sources, conferences, publications, professional societies, etc. It should serve as a Thesaurus, an indispensable part of the library for everyone involved in this area. For the first time, contributions by the world's top experts from academia, industry, government and the private sector, are brought together to provide unique perspectives on the current state-of-the-art in UAV, as well as future directions. The Handbook is intended for the expert/practitioner who seeks specific technical/business information, for the technically-oriented scientists and engineers, but also for the novice who wants to learn more about the status of UAV and UAV-related technologies. The Handbook is arranged in a user-friendly format, divided into main parts referring to: UAV Design Principles; UAV Fundamentals; UAV Sensors and Sensing Strategies; UAV Propulsion; UAV Control; UAV Communication Issues; UAV Architectures; UAV Health Management Issues; UAV Modeling, Simulation, Estimation and Identification; MAVs and Bio-Inspired UAVs; UAV Mission and Path Planning; UAV Autonomy; UAV Sense, Detect and Avoid Systems; Networked UAVs and UAV Swarms; UAV Integration into the National Airspace; UAV-Human Interfaces and Decision Support Systems; Human Factors and Training; UAV Logistics Support; UAV Applications; Social and Ethical Implications; The Future of UAVs. Each part is written by internationally renowned authors who are authorities in their respective fields. The contents of the Handbook supports its unique character as a thorough and comprehensive reference book directed to a diverse audience of technologists, businesses, users and potential users, managers and decision makers, novices and experts, who seek a holistic volume of information that is not only a technical treatise but also a source for answers to several questions on UAV manufacturers, users, major players in UAV research, costs, training required and logistics issues.

UNMANNED AERIAL VEHICLES: BREAKTHROUGHS IN RESEARCH AND PRACTICE

BREAKTHROUGHS IN RESEARCH AND PRACTICE

IGI Global 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.

AUTONOMOUS VEHICLES IN SUPPORT OF NAVAL OPERATIONS

National Academies Press Autonomous vehicles (AVs) have been used in military operations for more than 60 years, with torpedoes, cruise missiles, satellites, and target drones being early examples.1 They have also been widely used in the civilian sector--for example, in the disposal of explosives, for work and measurement in radioactive environments, by various offshore industries for both creating and maintaining undersea facilities, for atmospheric and undersea research, and by industry in automated and robotic manufacturing. Recent military experiences with AVs have consistently demonstrated their value in a wide range of missions, and anticipated developments of AVs hold promise for increasingly significant roles in future naval operations. Advances in AV capabilities are enabled (and limited) by progress in the technologies of computing and robotics, navigation, communications and networking, power sources and propulsion, and materials. Autonomous Vehicles in Support of Naval Operations is a forward-looking discussion of the naval operational environment and vision for the Navy and Marine Corps and of naval mission needs and potential applications and limitations of AVs. This report considers the potential of AVs for naval operations, operational needs and technology issues, and opportunities for improved operations.

INNOVATIVE MANAGEMENT IN THE DARPA HIGH ALTITUDE ENDURANCE UNMANNED AERIAL VEHICLE PROGRAM

PHASE II EXPERIENCE

Rand Corporation The U.S. military's development of Unmanned Aerial Vehicles (UAVs) has been hampered by cost overruns, schedule slippage, and disappointing operational results. The High Altitude Endurance UAV (HAE UAV) joint program, initiated under the direction of the Defense Advanced Research Projects Agency (DARPA), incorporates several innovative elements in its acquisition strategy that depart radically from traditional acquisition approaches. The program's development phase for the Global Hawk and DarkStar air vehicles is analyzed in this research. The HAE UAV program has experienced problems that are typical of newly implemented methods, but it has produced significant benefits, and provides lessons that could improve a wide variety of future acquisition processes.

ADVANCED ROBUST NONLINEAR CONTROL APPROACHES FOR QUADROTOR UNMANNED AERIAL VEHICLE

ROADMAP TO IMPROVE TRACKING-TRAJECTORY PERFORMANCE IN THE PRESENCE OF EXTERNAL DISTURBANCES

Springer 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.

ADVANCES IN PIT WALL MAPPING AND SLOPE ASSESSMENT USING UNMANNED AERIAL VEHICLE TECHNOLOGY

As mining in open pits progresses deeper, keeping slopes stable becomes more complex. Multi-bench scale instabilities can result in significant economic loss. To address this concern, systematic documentation and evaluation of the performance of benches in open pit mines is essential for pit slope assessment. This includes collecting structural and geomechanical data for rock mass characterization as well as information on the geometry and configuration of the benches. Advances in technology have made the use of unmanned aerial vehicles (UAV) for photogrammetry data collection more feasible. This thesis presents methodologies to integrate the UAV technology in open pit mine operations for collecting high quality data. The collected data was processed and useful information was extracted for design compliance audits, blast optimization studies, and slope stability analysis. This research aims to demonstrate the advantages and limitations of using this technology to collect and process field data.

PROCEEDINGS OF UASG 2019

UNMANNED AERIAL SYSTEM IN GEOMATICS

Springer Nature This volume gathers the latest advances, innovations, and applications in the field of geographic information systems and unmanned aerial vehicle (UAV) technologies, as presented by leading researchers and engineers at the 1st International Conference on Unmanned Aerial System in Geomatics (UASG), held in Roorkee, India on April 6-7, 2019. It covers highly diverse topics, including photogrammetry and remote sensing, surveying, UAV manufacturing, geospatial data sensing, UAV processing, visualization, and management, UAV applications and regulations, geo-informatics and geomatics. The contributions, which were selected by means of a rigorous international peer-review process, highlight numerous exciting ideas that will spur novel research directions and foster multidisciplinary collaboration among different specialists.

ROBUST DISCRETE-TIME FLIGHT CONTROL OF UAV WITH EXTERNAL DISTURBANCES

Springer Nature This book studies selected discrete-time flight control schemes for fixed-wing unmanned aerial vehicle (UAV) systems in the presence of system uncertainties, external disturbances and input saturation. The main contributions of this book for UAV systems are as follows: (i) the proposed integer-order discrete-time control schemes are based on the designed discrete-time disturbance observers (DTDOs) and the neural network (NN); and (ii) the fractional-order discrete-time control schemes are developed by using the fractional-order calculus theory, the NN and the DTDOs. The book offers readers a good understanding of how to establish discrete-time tracking control schemes for fixed-wing UAV systems subject to system uncertainties, external wind disturbances and input saturation. It represents a valuable reference guide for academic research on uncertain UAV systems, and can also support advanced / Ph.D. studies on control theory and engineering.

MULTIPLE HETEROGENEOUS UNMANNED AERIAL VEHICLES

Springer 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.

DEEP LEARNING FOR UNMANNED SYSTEMS

Springer Nature This book is used at the graduate or advanced undergraduate level and many others. Manned and unmanned ground, aerial and marine vehicles enable many promising and revolutionary civilian and military applications that will change our life in the near future. These applications include, but are not limited to, surveillance, search and rescue, environment monitoring, infrastructure monitoring, self-driving cars, contactless last-mile delivery vehicles, autonomous ships, precision agriculture and transmission line inspection to name just a few. These vehicles will benefit from advances of deep learning as a subfield of machine learning able to endow these vehicles with different capability such as perception, situation awareness, planning and intelligent control. Deep learning models also have the ability to generate actionable insights into the complex structures of large data sets. In recent years, deep learning research has received an increasing amount of attention from researchers in academia, government laboratories and industry. These research activities have borne some fruit in tackling some of the challenging problems of manned and unmanned ground, aerial and marine vehicles that are still open. Moreover, deep learning methods have been recently actively developed in other areas of machine learning, including reinforcement training and transfer/meta-learning, whereas standard, deep learning methods such as recent neural network (RNN) and coevolutionary neural networks (CNN). The book is primarily meant for researchers from academia and industry, who are working on in the research areas such as engineering, control engineering, robotics, mechatronics, biomedical engineering, mechanical engineering and computer science. The book chapters deal with the recent research problems in the areas of reinforcement learning-based control of UAVs and deep learning for unmanned aerial systems (UAS) The book chapters present various techniques of deep learning for robotic applications. The book chapters contain a good literature survey with a long list of references. The book chapters are well written with a good exposition of the research problem, methodology, block diagrams and mathematical techniques. The book chapters are lucidly illustrated with numerical examples and simulations. The book chapters discuss details of applications and future research areas.

UNMANNED ROTORCRAFT SYSTEMS

Springer Science & Business Media 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.

DEVELOPMENT OF AUTONOMOUS UNMANNED AERIAL VEHICLE PLATFORM: MODELING, SIMULATING, AND FLIGHT TESTING

The Advanced Navigation Technology (ANT) Center at the Air Force Institute of Technology (AFIT) conducts extensive research in advanced guidance, navigation, and control to exploit the full potential of autonomous Unmanned Aerial Vehicles (UAV). The research in this thesis describes a UAV research platform developed to support the ANT Center?s goals. This platform is now the bedrock for UAV simulation and local flight test at AFIT. The research has three major components. The first component is development of a physical, inertial, and aerodynamic model representing an existing aircraft. A systematic analysis of the airframe leads to a complete geometric, inertial, and aerodynamic representation. The airframe analysis included the use of USAF Digital Datcom, an aerodynamic modeling software tool. Second is the development and implementation of a non-linear, six degree of freedom simulation, employing the developed model. Constructed in Matlab/SIMULINK, the simulation enables control design and pre-flight analysis through out the entire flight envelope. Detailed post-flight analysis was also performed in Matlab/SIMULINK. Additionally, Hardware in the Loop benchmark simulation was constructed and used for initial flight test plans as well as test team training. The third and final component of the research was an experimental flight test program. Both open loop and autonomous flights were conducted. Openloop flights characterized the aircraft dynamics for comparison with the Matlab simulation results. Autonomous flights tuned the autopilot controller through waypoint tracking in preparation for future advanced navigation research and provided data for Hardware in the Loop simulation validation. This report, along with other significant legacy documentation and procedures, builds the foundation from which future AFIT and ANT Center UAV simulations and flight tests are based.

COMPUTER VISION IN VEHICLE TECHNOLOGY

LAND, SEA, AND AIR

John Wiley & Sons A unified view of the use of computer vision technology for different types of vehicles Computer Vision in Vehicle Technology focuses on computer vision as on-board technology, bringing together fields of research where computer vision is progressively penetrating: the automotive sector, unmanned aerial and underwater vehicles. It also serves as a reference for researchers of current developments and challenges in areas of the application of computer vision, involving vehicles such as advanced driver assistance (pedestrian detection, lane departure warning, traffic sign recognition), autonomous driving and robot navigation (with visual simultaneous localization and mapping) or unmanned aerial vehicles (obstacle avoidance, landscape classification and mapping, fire risk assessment). The overall role of computer vision for the navigation of different vehicles, as well as technology to address on-board applications, is analysed. Key features: Presents the latest advances in the field of computer vision and vehicle technologies in a highly informative and understandable way, including the basic mathematics for each problem. Provides a comprehensive summary of the state of the art computer vision techniques in vehicles from the navigation and the addressable applications points of view. Offers a detailed description of the open challenges and business opportunities for the immediate future in the field of vision based vehicle technologies. This is essential reading for computer vision researchers, as well as engineers working in vehicle technologies, and students of computer vision.

THE NEW CLOSE AIR SUPPORT WEAPON

UNMANNED COMBAT AERIAL VEHICLE IN 2010 AND BEYOND

AUTONOMOUS CONTROL OF UNMANNED AERIAL VEHICLES

MDPI Unmanned aerial vehicles (UAVs) are being increasingly used in different applications in both military and civilian domains. These applications include surveillance, reconnaissance, remote sensing, target acquisition, border patrol, infrastructure monitoring, aerial imaging, industrial inspection, and emergency medical aid. Vehicles that can be considered autonomous must be able to make decisions and react to events without direct intervention by humans. Although some UAVs are able to perform increasingly complex autonomous manoeuvres, most UAVs are not fully autonomous; instead, they are mostly operated remotely by humans. To make UAVs fully autonomous, many technological and algorithmic developments are still required. For instance, UAVs will need to improve their sensing of obstacles and subsequent avoidance. This becomes particularly important as autonomous UAVs start to operate in civilian airspaces that are occupied by other aircraft. The aim of this volume is to bring together the work of leading researchers and practitioners in the field of unmanned aerial vehicles with a common interest in their autonomy. The contributions that are part of this volume present key challenges associated with the autonomous control of unmanned aerial vehicles, and propose solution methodologies to address such challenges, analyse the proposed methodologies, and evaluate their performance.

WIRELESS COMMUNICATIONS AND NETWORKING FOR UNMANNED AERIAL VEHICLES

Cambridge University Press "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"--

MILITARY LOGISTICS

RESEARCH ADVANCES AND FUTURE TRENDS

Springer This book highlights recent advances in the development of effective modeling and solution approaches to enhance the performance of military logistics. It seeks to further research in global defense-related topics, including military operations, governmental operations and security, as well as nation support. Additionally its purpose is to promote the global exchange of information and ideas amongst developers and users of military operations research tools and techniques. Over the course of its nine chapters, this edited volume addresses significant issues in military logistics including: a) Restructuring processes via OR methods aimed at improving the efficiency and effectiveness of the military logistics, b) Sense-and-Respond logistics prediction and coordination techniques that provide competitive advantage, spanning the full range of military operations across the strategic, operational and tactical levels of war, c) Procurement and auctioning, d) Inventory and stock control theories and applications, e) Military transport and logistical equipment, and, f) Maintenance, repair and overhaul on operational capability in general and equipment availability. The book aims to bridge the gap between the abundant literature on commercial logistics and its scarce defense & combat counterpart. This collection of useful insights into new trends and research will offer an ideal reference for practitioners and army related personnel interested in integrating scientific rigor to improve logistics management within defense organizations & agencies. Ultimately this book should provide a relevant platform for the latest contributions of operations management, operations research, and computational intelligence towards the enhancement of military logistics.

UNMANNED AERIAL VEHICLE 203 SUCCESS SECRETS - 203 MOST ASKED QUESTIONS ON UNMANNED AERIAL VEHICLE - WHAT YOU NEED TO KNOW

Emereo Publishing There has never been a Unmanned aerial vehicle Guide like this. It contains 203 answers, much more than you can imagine; comprehensive answers and extensive details and references, with insights that have never before been offered in print. Get the information you need--fast! This all-embracing guide offers a thorough view of key knowledge and detailed insight. This Guide introduces what you want to know about Unmanned aerial vehicle. A quick look inside of some of the subjects covered: Gyroscope, Cruise missile, History of unmanned aerial vehicles - Interwar period, Surveillance - Counter-surveillance, inverse surveillance, sousveillance, Unmanned ground vehicle, V-tail - Inverted, Joystick - Industrial applications, Cruise missile - Efficiency in modern warfare, Flaperon - Research, Aeroplane, Arms industry - International treaties for arms control, Remotely piloted vehicle - Domestic policing, Jet engine - Uses, Unmanned aircraft system - U.S. Air Force tiers, Solar-charged vehicle - Unmanned aerial vehicles, Mass surveillance in the United Kingdom - Drone aircraft, History of unmanned aerial vehicles - Endurance UAVs, Pteryx UAV, List of unmanned aerial vehicles, Fuel-cell vehicle - Airplanes, Aerovision Fulmar, Remote control vehicle - Military and law enforcement, Mobile robots - Classification, Aviation - Types of military aviation, History of unmanned aerial vehicles - Drones Over Canada, Quadcopter - Recent developments, NASA X-43, Dragon Eye, Korea Aerospace Research Institute - Smart Tilt Rotor UAV, First-person view (radio control), Spoileron - Research, Unmanned aircraft system - Civilian casualties, European Data Relay System, MikroKopter, Unmanned aircraft system - Endurance, Hydrogen (car) - Airplanes, Remotely piloted vehicle - Civilian casualties, Parrot AR.Drone - Reception, and much more...

INNOVATIVE MANAGEMENT IN THE DARPA HIGH ALTITUDE ENDURANCE UNMANNED AERIAL VEHICLE PROGRAM

PHASE II EXPERIENCE

Rand Corporation The U.S. military's development of Unmanned Aerial Vehicles (UAVs) has been hampered by cost overruns, schedule slippage, and disappointing operational results. The High Altitude Endurance UAV (HAE UAV) joint program, initiated under the direction of the Defense Advanced Research Projects Agency (DARPA), incorporates several innovative elements in its acquisition strategy that depart radically from traditional acquisition approaches. The program's development phase for the Global Hawk and DarkStar air vehicles is analyzed in this research. The HAE UAV program has experienced problems that are typical of newly implemented methods, but it has produced significant benefits, and provides lessons that could improve a wide variety of future acquisition processes.

RADAR COUNTERMEASURES FOR UNMANNED AERIAL VEHICLES

IET This book provides an overview of the state of the art of radar systems to monitor drone activities. The book represents a must-have for all researchers working in this field as it establishes the state of the art and a benchmark for radar systems, detection, tracking and classification capabilities of this class of targets.

ADVANCES AND INNOVATIONS IN SYSTEMS, COMPUTING SCIENCES AND SOFTWARE ENGINEERING

Springer Science & Business Media This book includes a set of rigorously reviewed world-class manuscripts addressing and detailing state-of-the-art research projects in the areas of Computing Sciences, Software Engineering and Systems. The book presents selected papers from the conference proceedings of the International Conference on Systems, Computing Sciences and Software Engineering (SCSS 2006). All aspects of the conference were managed on-line.

MOTION COORDINATION FOR VTOL UNMANNED AERIAL VEHICLES

ATTITUDE SYNCHRONISATION AND FORMATION CONTROL

Springer Science & Business Media 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

HANDBOOK OF RESEARCH ON 5G NETWORKS AND ADVANCEMENTS IN COMPUTING, ELECTRONICS, AND ELECTRICAL ENGINEERING

IGI Global The advent of the emerging fifth generation (5G) networks has changed the paradigm of how computing, electronics, and electrical (CEE) systems are interconnected. CEE devices and systems, with the help of the 5G technology, can now be seamlessly linked in a way that is rapidly turning the globe into a digital world. Smart cities and internet of things have come to stay but not without some challenges, which must be discussed. The Handbook of Research on 5G Networks and Advancements in Computing, Electronics, and Electrical Engineering focuses on current technological innovations as the world rapidly heads towards becoming a global smart city. It covers important topics such as power systems, electrical engineering, mobile communications, network, security, and more. This book examines vast types of technologies and their roles in society with a focus on how each works, the impacts it has, and the future for developing a global smart city. This book is ideal for both industrial and academic researchers, scientists, engineers, educators, practitioners, developers, policymakers, scholars, and students interested in 5G technology and the future of engineering, computing, and technology in human society.

AUTONOMOUS CONTROL SYSTEMS AND VEHICLES

INTELLIGENT UNMANNED SYSTEMS

Springer Science & Business Media 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.

ADVANCES IN GUIDANCE, NAVIGATION AND CONTROL

PROCEEDINGS OF 2020 INTERNATIONAL CONFERENCE ON GUIDANCE, NAVIGATION AND CONTROL, ICGNC 2020, TIANJIN, CHINA, OCTOBER 23–25, 2020

Springer Nature This book features the latest theoretical results and techniques in the field of guidance, navigation, and control (GNC) of vehicles and aircraft. It covers a range of topics, including, but not limited to, intelligent computing communication and control; new methods of navigation, estimation, and tracking; control of multiple moving objects; manned and autonomous unmanned systems; guidance, navigation, and control of miniature aircraft; and sensor systems for guidance, navigation, and control. Presenting recent advances in the form of illustrations, tables, and text, it also provides detailed information of a number of the studies, to offer readers insights for their own research. In addition, the book addresses fundamental concepts and studies in the development of GNC, making it a valuable resource for both beginners and researchers wanting to further their understanding of guidance, navigation, and control.

UNMANNED AERIAL VEHICLE: APPLICATIONS IN AGRICULTURE AND ENVIRONMENT

Springer Nature This book showcases how new and emerging technologies like Unmanned Aerial Vehicles (UAVs) are trying to provide solutions to unresolved socio-economic and environmental problems. Unmanned vehicles can be classified into five different types according to their operation. These five types are unmanned ground vehicles, unmanned aerial vehicles, unmanned surface vehicles (operating on the surface of the water), unmanned underwater vehicles, and unmanned spacecraft. Unmanned vehicles can be guided remotely or function as autonomous vehicles. The technology has a wide range of uses including agriculture, industry, transport, communication, surveillance and environment applications. UAVs are widely used in precision agriculture; from monitoring the crops to crop damage assessment. This book explains the different methods in which they are used, providing step-by-step image processing and sample data. It also discusses how smart UAVs will provide unique opportunities for manufacturers to utilise new technological trends to overcome the current challenges of UAV applications. The book will be of great interest to researchers engaged in forest carbon measurement, road patrolling, plantation monitoring, crop yield estimation, crop damage assessment, terrain modelling, fertilizer control, and pest control.

UNMANNED AERIAL VEHICLES IN CIVILIAN LOGISTICS AND SUPPLY CHAIN MANAGEMENT

IGI Global 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.

REAL TIME SIMULATION STUDIES OF ADVANCED DRONE AND RPV FLIGHT CONTROL STRATEGIES, PHASE 3

FINAL REPORT

In support of research in the area of hardware-in-the-loop simulation, essential for development of flight algorithms for advanced high-speed unmanned aerial vehicles, Defence Research Establishment Suffield has established a long-term technology thrust to develop facilities suitable as flight qualification tools. The core of these facilities are the Simulation Facility (SIMFAC) and the Motion Facility (MOFAC). This document details the work conducted in support of efforts to increase the capability of the flight qualification systems. The tasks conducted included upgrading of SIMFAC hardware and software, developing advanced navigation algorithms, autopilot integration and debugging, SIMFAC operator training, a SIMFAC rewrite to eliminate inefficiencies in the code, and SIMFAC host computer upgrade and replacement. The appendices include configuration files and results of simulation speed tests.

AUTONOMOUS VEHICLES IN SUPPORT OF NAVAL OPERATIONS

National Academies Press Autonomous vehicles (AVs) have been used in military operations for more than 60 years, with torpedoes, cruise missiles, satellites, and target drones being early examples.1 They have also been widely used in the civilian sector--for example, in the disposal of explosives, for work and measurement in radioactive environments, by various offshore industries for both creating and maintaining undersea facilities, for atmospheric and undersea research, and by industry in automated and robotic manufacturing. Recent military experiences with AVs have consistently demonstrated their value in a wide range of missions, and anticipated developments of AVs hold promise for increasingly significant roles in future naval operations. Advances in AV capabilities are enabled (and limited) by progress in the technologies of computing and robotics, navigation, communications and networking, power sources and propulsion, and materials. Autonomous Vehicles in Support of Naval Operations is a forward-looking discussion of the naval operational environment and vision for the Navy and Marine Corps and of naval mission needs and potential applications and limitations of AVs. This report considers the potential of AVs for naval operations, operational needs and technology issues, and opportunities for improved operations.

COOPERATIVE PATH PLANNING OF UNMANNED AERIAL VEHICLES

John Wiley & Sons An invaluable addition to the literature on UAV guidance and cooperative control, Cooperative Path Planning of Unmanned Aerial Vehicles is a dedicated, practical guide to computational path planning for UAVs. One of the key issues facing future development of UAVs is path planning: it is vital that swarm UAVs/ MAVs can cooperate together in a coordinated manner, obeying a pre-planned course but able to react to their environment by communicating and cooperating. An optimized path is necessary in order to ensure a UAV completes its mission efficiently, safely, and successfully. Focussing on the path planning of multiple UAVs for simultaneous arrival on target, Cooperative Path Planning of Unmanned Aerial Vehicles also offers coverage of path planners that are applicable to land, sea, or space-borne vehicles. Cooperative Path Planning of Unmanned Aerial Vehicles is authored by leading researchers from Cranfield University and provides an authoritative resource for researchers, academics and engineers working in the area of cooperative systems, cooperative control and optimization particularly in the aerospace industry.

INTELLIGENT AUTONOMY OF UAVS

ADVANCED MISSIONS AND FUTURE USE

CRC Press Intelligent Autonomy of UAVs: Advanced Missions and Future Use provides an approach to the formulation of the fundamental task typical to any mission and provides guidelines of how this task can be solved by different generic robotic problems. As such, this book aims to provide a systems engineering approach to UAV projects, discovering the real problems that need to be resolved independently of the application. After an introduction to the rapidly evolving field of aerial robotics, the book presents topics such as autonomy, mission analysis, human-UAV teams, homogeneous and heterogeneous UAV teams, and finally, UAV-UGV teams. It then covers generic robotic problems such as orienteering and coverage. The book next introduces deployment, patrolling, and foraging, while the last part of the book tackles an important application: aerial search, tracking, and surveillance. This book is meant for both scientists and practitioners. For practitioners, it presents existing solutions that are categorized according to various missions: surveillance and reconnaissance, 3D mapping, urban monitoring, precision agriculture, forestry, disaster assessment and monitoring, security, industrial plant inspection, etc. For scientists, it provides an overview of generic robotic problems such as coverage and orienteering; deployment, patrolling and foraging; search, tracking, and surveillance. The design and analysis of algorithms raise a unique combination of questions from many fields, including robotics, operational research, control theory, and computer science.

SENSE AND AVOID IN UAS

RESEARCH AND APPLICATIONS

John Wiley & Sons There is increasing interest in the potential of UAV (Unmanned Aerial Vehicle) and MAV (Micro Air Vehicle) technology and their wide ranging applications including defence missions, reconnaissance and surveillance, border patrol, disaster zone assessment and atmospheric research. High investment levels from the military sector globally is driving research and development and increasing the viability of autonomous platforms as replacements for the remotely piloted vehicles more commonly in use. UAV/UAS pose a number of new challenges, with the autonomy and in

particular collision avoidance, detect and avoid, or sense and avoid, as the most challenging one, involving both regulatory and technical issues. Sense and Avoid in UAS: Research and Applications covers the problem of detect, sense and avoid in UAS (Unmanned Aircraft Systems) in depth and combines the theoretical and application results by leading academics and researchers from industry and academia. Key features: Presents a holistic view of the sense and avoid problem in the wider application of autonomous systems Includes information on human factors, regulatory issues and navigation, control, aerodynamics and physics aspects of the sense and avoid problem in UAS Provides professional, scientific and reliable content that is easy to understand, and Includes contributions from leading engineers and researchers in the field Sense and Avoid in UAS: Research and Applications is an invaluable source of original and specialised information. It acts as a reference manual for practising engineers and advanced theoretical researchers and also forms a useful resource for younger engineers and postgraduate students. With its credible sources and thorough review process, Sense and Avoid in UAS: Research and Applications provides a reliable source of information in an area that is fast expanding but scarcely covered.

BOB STUMP NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 2003

REPORT OF THE COMMITTEE ON ARMED SERVICES, HOUSE OF REPRESENTATIVES, ON H.R. 4546, TOGETHER WITH ADDITIONAL AND DISSENTING VIEWS (INCLUDING COST ESTIMATE OF THE CONGRESSIONAL BUDGET OFFICE).

ADVANCES IN AIR TRAFFIC ENGINEERING

SELECTED PAPERS FROM 6TH INTERNATIONAL SCIENTIFIC CONFERENCE ON AIR TRAFFIC ENGINEERING, ATE 2020, OCTOBER 2020,WARSAW, POLAND

Springer This book offers a timely snapshot of research and developments in the area of air traffic engineering and management. It covers mathematical, modeling, reliability and optimization methods applied for improving different stages of flight operations, including both aerodrome and terminal airspace operations. It analyses and highlights important legal and safety aspects, and discusses timely issues such as those concerned with Brexit and the use of unmanned aerial vehicles. Gathering selected papers presented at the 6th edition of the International Scientific Conference on Air Traffic Engineering, ATE 2020, held in October 2020 in Warsaw, Poland, this book offers a timely and inspiring source of information for both researchers and professionals in the field of air traffic engineering and management.

UNMANNED COMBAT AERIAL VEHICLES: EVOLUTION OR POTENTIAL REVOLUTION?

This paper will deal with developmental and operational concepts of arming unmanned aerial vehicles. More specifically, I wished to explore the concept of developing an unmanned combat aerial vehicle (UCAV) that will provide the capability to greatly expand the potential of air power as an instrument of national policy. I had believed that an academic and educated discussion of this topic was still relatively new territory for the USAF. As I began to study and research the issues involved, I found that in fact there is a tremendous amount of material already written about UAVs and associated theories on how to best develop an armed capability. I also found that most of these writings were very similar in nature. Invariably the paper or article would spend the majority of its content examining the historical development of UAVs. Then the remaining portion of the paper would be spent on either a very broad theoretical justification of the future need for UAVs or a very technical and intricate conclusion detailing specific UAV systems. I have tried to break free from that mold as I wrote this paper. The purpose of this paper is to offer a guide to help develop a coherent Air Force policy on a UAV capability. It is not meant to simply advocate a specific airframe or airframe design concept. It is meant to influence the reader on what I feel is the potential to dramatically affect the capabilities and nature of airpower.