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Sensing and Control for Autonomous Vehicles
Autonomous Underwater Vehicles

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A Survey of Missions for Unmanned Undersea Vehicles Springer
The United States faces decisions requiring information about the oceans in vastly expanded scales of time and space and from oceanic sectors not accessible with the suite of tools now used by scientists and engineers. Advances in guidance and control, communications, sensors, and other technologies for undersea vehicles can provide an opportunity to understand the oceans' influence on the energy and chemical balance that sustains humankind and to manage and deliver resources from and beneath the sea. This book assesses the state of undersea vehicle technology and opportunities for vehicle applications in science and industry. It provides guidance about vehicle subsystem development priorities and describes how national research can be focused most effectively.
Unmanned Vehicle Systems & Operations on Air, Sea, Land Springer Nature
Advanced aerial mobility is a newly emerging industry that aims to develop and operate new air vehicles potentially capable of safe, reliable, and low-noise vertical flight. The world has seen a recent increase in the adoption of electric vertical lift aircraft for urban, suburban and rural operations. These new innovations and technologies change the way that we move cargo and people, affecting industries across the economy. These changes will challenge today's airspace monitoring systems and regulatory environment. The U.S. government and its regulatory agencies need technical guidance to facilitate the development of these technologies, and to create the regulatory framework to foster the growth of this vertical flight industry to the benefit of the aviation industry. Advancing Aerial Mobility evaluates the potential benefits and challenges associated with this emerging industry. This report provides recommendations that seek to foster an environment in which the nation can maintain its leading position in developing, deploying, and embracing these new technologies. This publication presents a national vision for advanced aerial mobility, market evolution, and safety and security management.
Underwater Robots Springer
Kirchhoff’s laws give a mathematical description of electromechanics. Similarly, translational motion mechanics obey Newton’s laws, while rotational motion mechanics comply with Euler’s moment equations, a set of three nonlinear, coupled differential equations. Nonlinearities complicate the mathematical treatment of the seemingly simple action of rotating, and these complications lead to a robust lineage of research culminating here with a text on the ability to make rigid bodies in rotation become self-aware, and even learn. This book is meant for basic scientifically inclined readers commencing with a first chapter on the basics of stochastic artificial intelligence to bridge readers to very advanced topics of deterministic artificial intelligence, espoused in the book with applications to both electromechanics (e.g. the forced van der Pol equation) and also motion mechanics (i.e. Euler’s moment equations). The reader will learn how to bestow self-awareness and express optimal learning methods for the self-aware object (e.g. robot) that require no tuning and no interaction with humans for autonomous operation. The topics learned from reading this text will prepare students and faculty to investigate interesting problems of mechanics. It is the fondest hope of the editor and authors that readers enjoy the book.
Autonomous Vehicles in Support of Naval Operations Springer Nature
Intelligent Control techniques are becoming important tools in both academia and industry. Methodologies developed in the field of soft-computing, such as neural networks, fuzzy systems and evolutionary computation, can lead to accommodation of more complex processes, improved performance and considerable time savings and cost reductions. Intelligent Control Systems using Computational Intellingence Techniques details the application of these tools to the field of control systems. Each chapter gives and overview of current approaches in the topic covered, with a set of the most important references in the field, and then details the author's approach, examining both the theory and practical applications.
Advancing Autonomous Systems Princeton University Press
Maritime-Port Technology and Development contains the latest research results and innovations as presented at the 2014 International Maritime and Port Technology and Development Conference (Trondheim, Norway, 27- 29 October 2014). The volume is divided into a wide range of topics: Efficient and environmentally friendly energy use in ships and port
Nonlinear Control of Vehicles and Robots RAND Corporation
Unmanned aerial vehicles (UAVs) have been widely adopted in the military world over the last decade and the success of these military applications is increasingly driving efforts to establish unmanned aircraft in non-military roles. Introduction to UAV Systems, 4th edition provides a comprehensive introduction to all of the elements of a complete Unmanned Aircraft System (UAS). It addresses the air vehicle, mission planning and control, several types of mission payloads, data links and how they interact with mission performance, and launch and recovery concepts. This book provides enough information to encourage a student to learn more; to provide a specialist with a basic appreciation of the technical issues that drive other parts of the system and interact with their specialty; or to help a program manager understand system-level tradeoffs and know what questions to ask. Key features: Comprehensive overview of all elements of a UAS and of how they interact. Introduces the underlying concepts of key subsystems. Emphasizes system-integration issues and how they relate to subsystem design choices. Practical discussion of issues informed by lessons learned in UAV programs. Introduction to UAV Systems, 4th edition is written both for newcomers to the subject and for experienced members of the UAV community who desire a comprehensive overview at the system level. As well as being a primary text for an introductory course on UAS or a supplementary text in a course that goes into more depth in one of the individual technologies involved in a UAS, this book is a useful overview for practicing engineers, researchers, managers, and consultants interested in UAV systems.
Advances in Unmanned Marine Vehicles Rand Corporation

This book provides a comprehensive overview of marine control system design related to underwater robotics applications. In particular, it presents novel optimization-based model predictive control strategies to solve control problems appearing in autonomous underwater vehicle applications. These novel approaches bring unique features, such as constraint handling, prioritization between multiple design objectives, optimal control performance, and robustness against disturbances and uncertainties, into the control system design. They therefore form a more general framework to design marine control systems and can be widely applied. Advanced Model Predictive Control for Autonomous Marine Vehicles balances theoretical rigor – providing thorough analysis and developing provably-correct design conditions – and application perspectives – addressing practical system constraints and implementation issues. Starting with a fixed-point positioning problem for a single vehicle and progressing to the trajectory-tracking and path-following problem of the vehicle, and then to the coordination control of a large-scale multi-robot team, this book addresses the motion control problems, increasing their level of challenge step-by-step. At each step, related subproblems such as path planning, thrust allocation, collision avoidance, and time constraints for real-time implementation are also discussed with solutions. In each chapter of this book, compact and illustrative examples are provided to demonstrate the design and implementation procedures. As a result, this book is useful for both theoretical study and practical engineering design, and the tools provided in the book are readily applicable for real-world implementation.

Disaster Robotics Springer Nature

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.

Navy Large Unmanned Surface and Undersea Vehicles CRC Press

The U.S. academic research fleet is an essential national resource, and it is likely that scientific demands on the fleet will increase. Oceanographers are embracing a host of remote technologies that can facilitate the collection of data, but will continue to require capable, adaptable research vessels for access to the sea for the foreseeable future. Maintaining U.S. leadership in ocean research will require investing in larger and more capable general purpose Global and Regional class ships; involving the scientific community in all phases of ship design and acquisition; and improving coordination between agencies that operate research fleets.

Dynamics and Control of Mechanical Systems in Offshore Engineering National Academies Press

This book introduces readers to the latest findings on disaster robotics. It is based on the ImPACT Tough Robotics Challenge, a national project spearheaded by the Japan Cabinet Office that focuses on developing robotics technologies to aid in disaster response, recovery and preparedness. It presents six subprojects that involve robot platforms and several component technologies used in conjunction with robots: cyber rescue canines, which are digitally empowered rescue dogs; serpent-like robots for searching debris; serpent-like robots for plant/infrastructure inspection; UAVs for gathering information on large areas struck by disaster; legged robots for plant/infrastructure inspection in risky places; and construction robots for recovery tasks that require both power and precision. The book offers a valuable source of information for researchers, engineers and practitioners in safety, security and rescue robotics, disaster robotics, and plant and infrastructure maintenance. It will also appeal to a wider demographic, including students and academics, as it highlights application scenarios and the total concept for each robot in various scientific and technical contexts. In addition to a wealth of figures and photos that explain these robots and systems, as well as experimental data, the book includes a comprehensive list of published papers from this project for readers to refer to. Lastly, an external website offers video footage and updated information from the International Rescue System Institute.

U.S. Navy Employment Options for Unmanned Surface Vehicles (USVs) SciTech Publishing

Unmanned marine vehicles (UMVs) include autonomous underwater vehicles, remotely operated vehicles, semi-submersibles and unmanned surface craft. Considerable importance is being placed on the design and development of such vehicles, as they provide cost-effective solutions to a number of littoral, coastal and offshore problems. This book highlights the advanced technology that is evolving to meet the challenges being posed in this exciting and growing area of research.

Unmanned Aircraft Systems (Uas) in the Cyber Domain: Protecting Usa's Advanced Air Assets Springer Nature

The recent development of advanced processing capabilities and higher yield power supplies means that Autonomous Underwater Vehicle (AUVs) are finding novel and increasingly advanced applications in research, military and commercial settings.

Advancing Aerial Mobility Institution of Engineering and Technology

In 1974, a scientific conference covering marine automation group and large vessels issues was organized under the patronage of the Technical Naval Studies Centre (CETENA) and the Italian National Research Council (CNR). A later collaboration with the Marine Technical Association (ATENA) led to the renaming of the conference as NAV, extending the topics covered to the technical field previously covered by ATENA national conferences. The NAV conference is now held every 3 years, and attracts specialists from all over the world. This book presents the proceedings of NAV 2018, held in Trieste, Italy, in June 2018. The book contains 70 scientific papers, 35 technical papers and 16 reviews, and subjects covered include: comfort on board; conceptual and practical ship design; deep sea mining and marine robotics; protection of the environment; renewable marine energy; design and engineering of offshore vessels; digitalization, unmanned vehicles and cyber security; yacht and pleasure craft design and inland waterway vessels. With its comprehensive coverage of

scientific and technical maritime issues, the book will be of interest to all those involved in this important industry.

Advanced Transdisciplinary Engineering and Technology Springer Nature

This textbook offers a comprehensive introduction to the control of marine vehicles, from fundamental to advanced concepts, including robust control techniques for handling model uncertainty, environmental disturbances, and actuator limitations. Starting with an introductory chapter that extensively reviews automatic control and dynamic modeling techniques for ocean vehicles, the first part of the book presents in-depth information on the analysis and control of linear time invariant systems. The concepts discussed are developed progressively, providing a basis for understanding more complex techniques and stimulating readers' intuition. In addition, selected examples illustrating the main concepts, the corresponding MATLAB® code, and problems are included in each chapter. In turn, the second part of the book offers comprehensive coverage on the stability and control of nonlinear systems. Following the same intuitive approach, it guides readers from the fundamentals to more advanced techniques, which culminate in integrator backstepping, adaptive and sliding mode control. Leveraging the author's considerable teaching and research experience, the book offers a good balance of theory and stimulating questions. Not only does it provide a valuable resource for undergraduate and graduate students; it will also benefit practitioners who want to review the foundational concepts underpinning some of the latest advanced marine vehicle control techniques, for use in their own applications.

Deep Learning for Unmanned Systems Springer

Unmanned Vehicle Systems & Operations On Air, Sea, Land is our fourth textbook in a series covering the world of Unmanned Aircraft Systems (UAS) and Counter Unmanned Aircraft Systems (CUAS). (Nichols R. K., 2018) (Nichols R. K., et al., 2019) (Nichols R. , et al., 2020)The authors have expanded their purview beyond UAS / CUAS systems. Our title shows our concern for growth and unique cyber security unmanned vehicle technology and operations for unmanned vehicles in all theaters: Air, Sea and Land - especially maritime cybersecurity and China proliferation issues. Topics include: Information Advances, Remote ID, and Extreme Persistence ISR; Unmanned Aerial Vehicles & How They Can Augment Mesonet Weather Tower Data Collection; Tour de Drones for the Discerning Palate; Underwater Autonomous Navigation & other UUV Advances; Autonomous Maritime Asymmetric Systems; UUV Integrated Autonomous Missions & Drone Management; Principles of Naval Architecture Applied to UUV's; Unmanned Logistics Operating Safely and Efficiently Across Multiple Domains; Chinese Advances in Stealth UAV Penetration Path Planning in Combat Environment; UAS, the Fourth Amendment and Privacy; UV & Disinformation / Misinformation Channels; Chinese UAS Proliferation along New Silk Road Sea / Land Routes; Automaton, AI, Law, Ethics, Crossing the Machine - Human Barrier and Maritime Cybersecurity.Unmanned Vehicle Systems are an integral part of the US national critical infrastructure The authors have endeavored to bring a breadth and quality of information to the reader that is unparalleled in the unclassified sphere. Unmanned Vehicle (UV) Systems & Operations On Air, Sea, Land discusses state-of-the-art technology issues facing U.S. UV system researchers / designers / manufacturers / testers. We trust our newest look at Unmanned Vehicles in Air, Sea, and Land will enrich our students and readers understanding of the purview of this wonderful technology we call UV.

Neural Computing for Advanced Applications National Academies Press

The Navy wants to develop and procure three new types of unmanned vehicles (UVs) in FY2020 and beyond-Large Unmanned Surface Vehicles (LUSVs), Medium Unmanned Surface Vehicles (MUSVs), and Extra-Large Unmanned Undersea Vehicles (XLUUVs). The Navy is requesting $628.8 million in FY2020 research and development funding for these three UV programs and their enabling technologies. The Navy wants to acquire these three types of UVs (which this report refers to collectively as large UVs) as part of an effort to shift the Navy to a new fleet architecture (i.e., a new combination of ships and other platforms) that is more widely distributed than the Navy's current architecture. Compared to the current fleet architecture, this more-distributed architecture is to include proportionately fewer large surface combatants (i.e., cruisers and destroyers), proportionately more small surface combatants (i.e., frigates and Littoral Combat Ships), and the addition of significant numbers of large UVs. The Navy wants to employ accelerated acquisition strategies for procuring these large UVs, so as to get them into service more quickly. The emphasis that the Navy placed on UV programs in its FY2020 budget submission and the Navy's desire to employ accelerated acquisition strategies in acquiring these large UVs together can be viewed as an expression of the urgency that the Navy attaches to fielding large UVs for meeting future military challenges from countries such as China. The LUSV program is a proposed new start project for FY2020. The Navy wants to procure two LUSVs per year in FY2020FY2024. The Navy wants LUSVs to be low-cost, high-endurance, reconfigurable ships based on commercial ship designs, with ample capacity for carrying various modular payloads-particularly anti-surface warfare (ASuW) and strike payloads, meaning principally anti-ship and land-attack missiles. The Navy reportedly envisions LUSVs as being 200 feet to 300 feet in length and having a full load displacement of about 2,000 tons. The MUSV program began in FY2019. The Navy plans to award a contract for the first MUSV in FY2019 and wants to award a contract for the second MUSV in FY2023. The Navy wants MUSVs, like LUSVs, to be low-cost, high-endurance, reconfigurable ships that can accommodate various payloads. Initial payloads for MUSVs are to be intelligence, surveillance and reconnaissance (ISR) payloads and electronic warfare (EW) systems. The Navy defines MUSVs as having a length of between 12 meters (about 39 feet) and 50 meters (about 164 feet). The Navy wants to pursue the MUSV program as a rapid prototyping effort under what is known as Section 804 acquisition authority. The XLUUV program, also known as Orca, was established to address a Joint Emergent Operational Need (JEON). The Navy wants to procure nine XLUUVs in FY2020-FY2024. The Navy announced on February 13, 2019, that it had selected Boeing to fabricate, test, and deliver the first four Orca XLUUVs and associated support elements. On March 27, 2019, the Navy announced that the award to Boeing had been expanded to include the fifth Orca. The Navy's large UV programs pose a number of oversight issues for Congress, including issues relating to the analytical basis for the more-distributed fleet architecture; the Navy's accelerated acquisition strategies and funding method for these programs; technical, schedule, and cost risk in the programs; the proposed annual procurement rates for the programs; the industrial base implications of the programs; the personnel implications of the programs; and whether the Navy has accurately priced the work it is proposing to do in FY2020 on the programs.

Advanced Model Predictive Control for Autonomous Marine Vehicles Springer Nature
Nonlinear Control of Vehicles and Robots develops a unified approach to the dynamic modeling of robots in terrestrial, aerial and marine environments. The main classes of nonlinear systems and stability methods are summarized and basic nonlinear control methods, useful in manipulator and vehicle control, are presented. Formation control of ground robots and ships is discussed. The book also deals with the modeling and control of robotic systems in the presence of non-smooth nonlinearities. Robust adaptive tracking control of robotic systems with unknown payload and friction in the presence of uncertainties is treated. Theoretical and practical aspects of the control algorithms under discussion are detailed. Examples are included throughout the book allowing the reader to apply the control and modeling techniques in their own research and development work. Some of these examples demonstrate state estimation based on the use of advanced sensors as part of the control system.
Science at Sea Springer Science & Business Media
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.
Small Unmanned Aircraft Springer Nature
Unmanned Aircraft Systems (UAS) are an integral part of the US national critical infrastructure. They must be protected from hostile intent or use to the same level as any other military or commercial asset involved in US national security. However, from the Spratly Islands to Djibouti to heartland America, the expanding Chinese Unmanned Aircraft Systems (UAS / Drone) industry has outpaced the US technologically and numerically on all fronts: military, commercial, and recreational. Both countries found that there were large information security gaps in unmanned systems that could be exploited on the international cyber-security stage. Many of those gaps remain today and are direct threats to US advanced Air Assets if not mitigated upfront by UAS designers and manufacturers. The authors contend that US military / commercial developers of UAS hardware and software must perform cyber risk assessments and mitigations prior to delivery of UAS systems to stay internationally competitive and secure. The authors have endeavored to bring a breadth and quality of information to the reader that is unparalleled in the unclassified sphere. This book will fully immerse and engage the reader in the cyber-security considerations of this rapidly emerging technology that we know as unmanned aircraft systems (UAS). Topics covered include National Airspace (NAS) policy issues, information security, UAS vulnerabilities in key systems (Sense and Avoid / SCADA), collision avoidance systems, stealth design, intelligence, surveillance and reconnaissance (ISR) platforms; weapons systems security; electronic warfare considerations; data-links, jamming operational vulnerabilities and still-emerging political scenarios that affect US military / commercial decisions.
Advanced, Contemporary Control Independently Published
Dynamics and Control of Mechanical Systems in Offshore Engineering is a comprehensive treatment of marine mechanical systems (MMS) involved in processes of great importance such as oil drilling and mineral recovery. Ranging from nonlinear dynamic modeling and stability analysis of flexible riser systems, through advanced control design for an installation system with a single rigid payload attached by thrusters, to robust adaptive control for mooring systems, it is an authoritative reference on the dynamics and control of MMS. Readers will gain not only a complete picture of MMS at the system level, but also a better understanding of the technical considerations involved and solutions to problems that commonly arise from dealing with them. The text provides: · a complete framework of dynamical analysis and control design for marine mechanical systems; · new results on the dynamical analysis of riser, mooring and installation systems together with a general modeling method for a class of MMS; · a general method and strategy for realizing the control objectives of marine systems with guaranteed stability the effectiveness of which is illustrated by extensive numerical simulation; and · approximation-based control schemes using neural networks for installation of subsea structures with attached thrusters in the presence of time-varying environmental disturbances and parametric uncertainties. Most of the results presented are analytical with repeatable design algorithms with proven closed-loop stability and performance analysis of the proposed controllers is rigorous and detailed. Dynamics and Control of Mechanical Systems in Offshore Engineering is primarily intended for researchers and engineers in the system and control community, but graduate students studying control and marine engineering will also find it a useful resource as will practitioners working on the design, running or maintenance of offshore platforms.