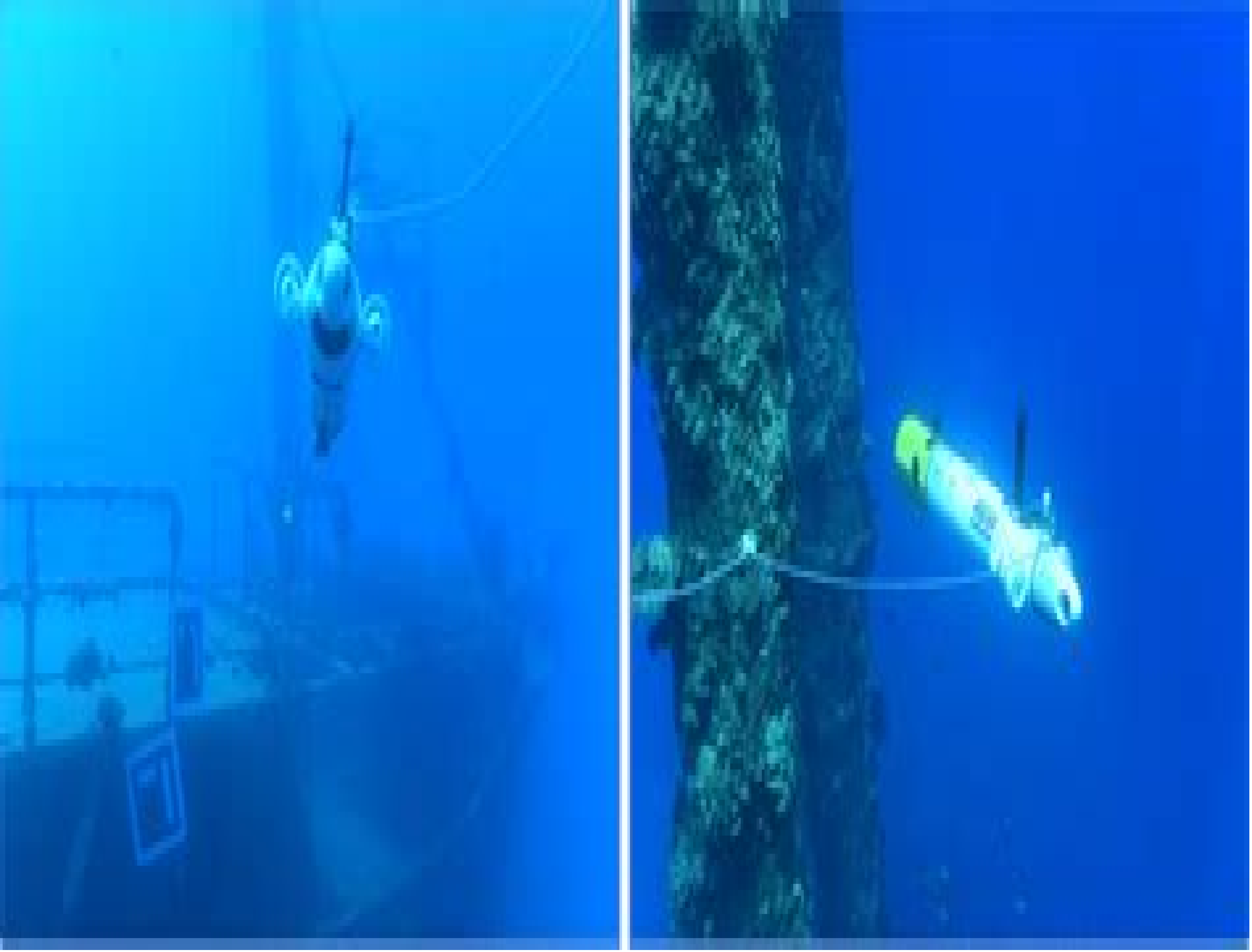

Obstacle Avoidance Control For The Remus Autonomous Underwater Vehicle

K Payea

Obstacle Avoidance Control For The Remus Autonomous Underwater Vehicle:

Obstacle Avoidance Control for the REMUS Autonomous Underwater Vehicle Lynn R. Fodrea,2002-12 Future Naval operations necessitate the incorporation of autonomous underwater vehicles into a collaborative network In future complex missions a forward look capability will be required to map and avoid obstacles such as sunken ships This thesis examines obstacle avoidance behaviors using a forward looking sonar for the autonomous underwater vehicle REMUS Hydrodynamic coefficients are used to develop steering equations that model REMUS through a track of specified points similar to a real world mission track Control of REMUS is accomplished using line of sight and state feedback controllers A two dimensional forward looking sonar model with a 1200 horizontal scan and a 110 meter radial range is modeled for obstacle detection Sonar mappings from geographic range bearing coordinates are developed for implementation in MATLAE simulations The product of bearing and range weighting functions form the gain factor for a dynamic obstacle avoidance behavior The overall vehicle heading error incorporates this obstacle avoidance term to develop a path around detected objects REMUS is a highly responsive vehicle in the model and is capable of avoiding multiple objects in proximity along its track path *Obstacle Avoidance Control for the REMUS Autonomous Underwater Vehicle* Christopher D. Chuhran,2003-09 As the Navy continues its development of unmanned underwater vehicles the need for total autonomous missions grows Autonomous Underwater Vehicles AUV allow for advances in mine warfare harbor reconnaissance undersea warfare and more Information can be collected from AUVs and downloaded into a ship or battle group s network As AUVs are developed it is clear forward look sonar will be required to be able to detect obstacles in front of its search path Common obstacles in the littoral environment include reefs and seawalls which an AUV will need to rise above to pass This thesis examines the behavior and control system required for an AUV to maneuver over an obstacle in the vertical plane Hydrodynamic modeling of a REMUS vehicle enables a series of equations of motion to be developed to be used in conjunction with a sliding mode controller to control the elevation of the AUV A two dimensional 24 deg vertical scan forward look sonar with a range of 100 m is modeled for obstacle detection Sonar mappings from geographic range bearing coordinates are developed for use in MATLAB simulations The sonar image of the vertical obstacle allows for an increasing altitude command that forces the AUV to pass safely over the obstacles at a reasonable rate of ascent and pitch angle Once the AUV has passed over the obstacle the vehicle returns to its regular search altitude This controller is simulated over different types of obstacles **Obstacle Avoidance Control for the REMUS Autonomous Underwater Vehicle** ,2002 Future Naval operations necessitate the incorporation of autonomous underwater vehicles into a collaborative network In future complex missions a forward look capability will be required to map and avoid obstacles such as sunken ships This thesis examines obstacle avoidance behaviors using a forward looking sonar for the autonomous underwater vehicle REMUS Hydrodynamic coefficients are used to develop steering equations that model REMUS through a track of specified points similar to a real world mission track

Control of REMUS is accomplished using line of sight and state feedback controllers A two dimensional forward looking sonar model with a 1200 horizontal scan and a 110 meter radial range is modeled for obstacle detection Sonar mappings from geographic range bearing coordinates are developed for implementation in MATLAE simulations The product of bearing and range weighting functions form the gain factor for a dynamic obstacle avoidance behavior The overall vehicle heading error incorporates this obstacle avoidance term to develop a path around detected objects REMUS is a highly responsive vehicle in the model and is capable of avoiding multiple objects in proximity along its track path Obstacle Avoidance Control for the REMUS Autonomous Underwater Vehicle Lynn Fodrea,2002 Future Naval operations necessitate the incorporation of autonomous underwater vehicles into a collaborative network In future complex missions a forward look capability will be required to map and avoid obstacles such as sunken ships This thesis examines obstacle avoidance behaviors using a forward looking sonar for the autonomous underwater vehicle REMUS Hydrodynamic coefficients are used to develop steering equations that model REMUS through a track of specified points similar to a real world mission track Control of REMUS is accomplished using line of sight and state feedback controllers A two dimensional forward looking sonar model with a 1200 horizontal scan and a 110 meter radial range is modeled for obstacle detection Sonar mappings from geographic range bearing coordinates are developed for implementation in MATLAE simulations The product of bearing and range weighting functions form the gain factor for a dynamic obstacle avoidance behavior The overall vehicle heading error incorporates this obstacle avoidance term to develop a path around detected objects REMUS is a highly responsive vehicle in the model and is capable of avoiding multiple objects in proximity along its track path *Obstacle Avoidance While Bottom Following for the REMUS Autonomous Underwater Vehicle* ,2004 Future Naval operations necessitate the incorporation of autonomous underwater vehicles into a collaborative network In future complex missions a forward look capability will also be required to map and avoid obstacles such as sunken ships and reefs Following previous work on steering control this work examines collision avoidance behaviors in bottom following using a hypothetical forward looking sonar for the autonomous underwater vehicle REMUS Hydrodynamic coefficients are used to develop diving equations that model REMUS behaviors A two dimensional forward looking sonar model with a 20 vertical scan and a 40 meter radial range is modeled for obstacle detection Sonar mappings from geographic range bearing coordinates are developed for implementation in MATLAB simulations REMUS is a highly responsive vehicle and care has taken to balance pitch and heave response to keep the obstacle to be avoided in sight during the response behavior Vertical Plane Obstacle Avoidance and Control of the REMUS Autonomous Underwater Vehicle Using Forward Look Sonar ,2005 Current rates of technological advancement continue to translate into changes on our battlefields Aerial robots capable of gathering reconnaissance along with unmanned underwater vehicles capable of defusing enemy minefields provide evidence that machines are playing key roles once played by humans within our military This thesis explores one of the major problems facing both commercial and military UUVs to date Successfully navigating in unfamiliar environments and maneuvering autonomously to avoid obstacles is a problem that has yet to be fully solved Using a simulated 2 D ocean environment the work of this thesis provides results of numerous REMUS simulations that model the vehicle s flight path over selected sea bottoms Relying on a combination of sliding mode control and feedforward preview control REMUS is able to locate obstacles such as seawalls using processed forward look sonar images Once recognized REMUS maneuvers to avoid the obstacle according to a Gaussian potential function In summary the integration of feedforward preview control and sliding mode control results in an obstacle avoidance controller that is not only robust but also autonomous *Reactive Obstacle Avoidance for the REMUS Autonomous Underwater Vehicle Utilizing a Forward Looking Sonar* ,2006 One day fully autonomous AUV s will no longer require human interactions to complete its missions To make this a reality the AUV must be able to safely navigate in unfamiliar environments with unknown obstacles This thesis builds on previous work conducted at NPS s Center for AUV Research to improve the autonomy of the REMUS class of AUVs with an implemented FLS The first part of this thesis deals with accurate path following with the use of look ahead pitch calculations With the use of a SIMULINK model constraints surrounding obstacle avoidance path planning are then explored focusing on optimal sensor orientation issues Two path planning methods are developed to address the issues of a limited sonar field of view and uncertainties brought on by an occlusion area The first approach utilizes a pop up maneuver to increase the field of view and minimize the occlusion area while the second approach creates a path with the addition of a spline Comparing the two methods it was concluded that spline addition planner provided a robust optimal obstacle avoidance path and along with the look ahead pitch controller completes the design of a back seat driver to improve REMUS s survivability in an unknown environment REMUS AUV UUV Autonomous Underwater Vehicle Reactive Obstacle Avoidance Forward Looking Sonar Vertical Plane Pitch Controller Spline Gaussian Occlusion Optimal Sensor Orientation Advances in Unmanned Marine Vehicles G.N. Roberts,R. Sutton,2006-01-31 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

Autonomous Underwater Vehicles Nuno Cruz,2011-10-21 Autonomous Underwater Vehicles AUVs are remarkable machines that revolutionized the process of gathering ocean data Their major breakthroughs resulted from successful developments of complementary technologies to overcome the challenges associated with autonomous operation in harsh environments Most of these advances aimed at reaching new application scenarios and decreasing the cost of ocean data collection by reducing ship time and automating the process of data gathering with accurate geo location With the present capabilities some novel paradigms are already being employed to further exploit the on board intelligence by making decisions on line based on real time interpretation of sensor data This book collects a set of self contained chapters covering different aspects of AUV technology and applications in more detail than is commonly found in journal and conference papers They are divided into three main sections addressing innovative vehicle design navigation and control techniques and mission preparation and analysis The progress conveyed in these chapters is inspiring providing glimpses into what might be the future for vehicle technology and applications Guidance and Control of Underwater Vehicles 2003 (GCUV 2003) G. N. Roberts,Robert Sutton,Robert Allen,2003 This volume contains forty papers from the 1st IFAC Workshop on Guidance and Control of Underwater Vehicles The aim of the Workshop was to bring together academic practitioners and industrialists involved in this important and expanding area of interest in order to exchange experiences on recent advances in this field Topics covered by the papers in this proceeding include UUV Control Applications System Identification UUV Architectures Navigation Modelling Fault Detection and Reconfiguration Contributors from Italy Ireland Japan Portugal Spain Turkey USA and the United Kingdom were represented at the workshop The Workshop was voted a resounding success by all delegates and in the light of this vote of confidence the Technical Committee on Marine Systems is planning to run this event again in 2005 with the slightly amended title of Navigation Guidance and Control of Underwater Vehicles Intelligent Autonomous Vehicles 2004 (IAV 2004) J. Santos-Victor,M. I. Ribeiro,2005 **Autonomous Vehicles** George Dekoulis,2020-09-09 This edited volume Autonomous Vehicles is a collection of reviewed and relevant research chapters offering a comprehensive overview of recent developments in the field of vehicle autonomy The book comprises nine chapters authored by various researchers and edited by an expert active in the field of study All chapters are complete in itself but united under a common research study topic This publication aims to provide a thorough overview of the latest research efforts by international authors open new possible research paths for further novel developments and to inspire the younger generations into pursuing relevant academic studies and professional careers within the autonomous vehicle field **Proceedings of 3rd 2023 International Conference on Autonomous Unmanned Systems (3rd ICAUS 2023)** Yi Qu,Mancang Gu,Yifeng Niu,Wenxing Fu,2024-04-20 This book includes original peer reviewed research papers from the 3rd ICAUS 2023 which provides a unique and engaging platform for scientists engineers and practitioners from all over the world to present and share their most recent research results and innovative ideas The 3rd ICAUS 2023 aims to stimulate researchers working in areas relevant to intelligent unmanned systems Topics covered include but are not limited to Unmanned Aerial Ground Surface Underwater Systems Robotic Autonomous Control Navigation and Positioning Architecture Energy and Task Planning and Effectiveness Evaluation Technologies Artificial Intelligence Algorithm Bionic Technology and their Application in Unmanned Systems The papers presented here share the latest findings in unmanned systems robotics automation intelligent systems control systems integrated networks modelling and simulation This makes the book a valuable resource for researchers engineers and students alike Manufacturing Technology, Electronics, Computer and Information

Technology Applications Zhang Lin,Hong Ying Hu,Ya Jun Zhang,Jian Guo Qiao,Jia Min Xu,2014-11-27 Selected peer reviewed papers from the 2014 International Conference on Manufacturing Technology and Electronics Applications ICMTEA 2014 November 8 9 2014 Taiyuan Shanxi China **Cognitive Informatics, Computer Modelling, and Cognitive Science** G. R. Sinha,Jasjit Suri,2020-04-08 Cognitive Informatics Computer Modelling and Cognitive Science Theory Case Studies and Applications presents the theoretical background and history of cognitive science to help readers understand its foundations philosophical and psychological aspects and applications in a wide range of engineering and computer science case studies Cognitive science a cognitive model of the brain knowledge representation and information processing in the human brain are discussed as is the theory of consciousness neuroscience intelligence decision making mind and behavior analysis and the various ways cognitive computing is used for information manipulation processing and decision making Mathematical and computational models structures and processes of the human brain are also covered along with advances in machine learning artificial intelligence cognitive knowledge base deep learning cognitive image processing and suitable data analytics

Underwater Vehicles Alexander Inzartsev,2009-01-01 For the latest twenty to thirty years a significant number of AUVs has been created for the solving of wide spectrum of scientific and applied tasks of ocean development and research For the short time period the AUVs have shown the efficiency at performance of complex search and inspection works and opened a number of new important applications Initially the information about AUVs had mainly review advertising character but now more attention is paid to practical achievements problems and systems technologies AUVs are losing their prototype status and have become a fully operational reliable and effective tool and modern multi purpose AUVs represent the new class of underwater robotic objects with inherent tasks and practical applications particular features of technology systems structure and functional properties *Innovations in Bio-Inspired Computing and Applications* Ajith Abraham,Anu Bajaj,Niketa Gandhi,Ana Maria Madureira,Cengiz Kahraman,2023-03-27 This book highlights recent research on bio inspired computing and its various innovative applications in information and communication technologies It presents 85 high quality papers from the 13th International Conference on Innovations in Bio Inspired Computing and Applications IBICA 2022 and 12th World Congress on Information and Communication Technologies WICT 2022 which was held online during 15 17 December 2022 As a premier conference IBICA WICT brings together researchers engineers and practitioners whose work involves bio inspired computing computational intelligence and their applications in information security real world contexts etc Including contributions by authors from 25 countries the book offers a valuable reference guide for all researchers students and practitioners in the fields of Computer Science and Engineering **Underwater Technology** Oceanic Engineering Society (U.S.),1998 A primary goal of IEEE OES is to take its symposiums around the world where emerging technology and applications can be synthesized into solutions for the future Key Issues for the Global Underwater Environment provides a thematic umbrella under which the problems and potential long term solutions which concern not only the Pacific Rim countries but the world in general are discussed **Proceedings of the ... International Symposium on Underwater Technology** ,1998 **Jane's International Defense Review** ,2005

Whispering the Techniques of Language: An Emotional Journey through **Obstacle Avoidance Control For The Remus Autonomous Underwater Vehicle**

In a digitally-driven world where monitors reign great and immediate transmission drowns out the subtleties of language, the profound strategies and emotional nuances concealed within words often go unheard. Yet, situated within the pages of **Obstacle Avoidance Control For The Remus Autonomous Underwater Vehicle** a fascinating fictional prize pulsing with raw feelings, lies an extraordinary journey waiting to be undertaken. Published by a skilled wordsmith, this enchanting opus invites readers on an introspective journey, lightly unraveling the veiled truths and profound influence resonating within ab muscles cloth of every word. Within the mental depths of the emotional evaluation, we shall embark upon a genuine exploration of the book is key subjects, dissect their interesting publishing design, and fail to the powerful resonance it evokes heavy within the recesses of readers hearts.

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