Preface

Every 2 years, MOQESM is organized in Brest during the Sea Tech Week with the aim to focus on emergent techniques for quantitative monitoring of the underwater environment; MOQESM standing for MOnitoring Quantitatif de l'Environnement Sous-Marin. The 2014 edition of the conference, MOQESM'14, is the opportunity for people of the research and industry communities to meet, attend, and discuss with specialists of two research domains: marine robotics and coastal hydrography, with application to the coastal environment mapping and the survey of underwater infrastructures. The objective of the MOQESM'14 conference is to demonstrate that, though being very distinct, the two domains of marine robotics and coastal hydrography can take benefit from research progress in each other, in the future, in order to design new products and mapping methods combining them. The recent research and industrial achievements in these two domains are developed in the 11 papers gathered into the proceedings of MOQESM'14. The conference is organized in two plenary sessions headed with invited talks.

The first chapter of this book is dedicated to the improvements in hydrography. It begins with an invited talk given by Carole Nahum, from the Délégation Générale pour L'Armement (DGA), about defense needs and strategies in terms of environment monitoring. Techniques to acquire the underwater environment can be improved in many ways: from the positioning accuracy to the fusion of multiple sensors. Five scientific contributions constitute this first chapter. Precise mapping of the underwater environment requires accurate positioning of the acquired data. New approaches to obtain an accuracy of a few centimeters rely on Global Navigation Satellite Systems (GNSS). To reach such accurate positioning, Kees de Jong et al. propose an approach based on merging PPP techniques (use of precise satellite orbits and clocks) with Integer Ambiguity Resolution (IAR), known from GNSS Real-Time Kinematic (RTK) positioning techniques. As the accuracy of the acquired bathymetric data also depends on the motion of the sensors, Nicolas Seube, Sebastien Levilly, and Kees de Jong present an automatic method to estimate the angular alignment between the Inertial Measurement Unit (IMU) and the multibeam echo sounder. Acquiring the bathymetry can become a very difficult task

when the environment is challenging and not cooperative: high-flowing rivers, confined zones and ultra-shallow waters. In such environment, unreachable with conventional survey launches, Mathieu Rondeau et al. proposed an autonomous drifting buoy equipped with a GNSS receiver, an IMU, and a single-beam echo sounder. The acquisition and the monitoring of the underwater environment can be improved by combining different sensors. Claire Noel et al. present new tools to produce operational seabed maps by fusing the information collected by several acoustic systems operating simultaneously or not. This session concludes with the higher level issue on how to efficiently make available the data from the marine environment to end-users like marine industries, decision-making bodies, or scientific research. As in Europe the marine data are stored in a wide range of national, regional, and international databases and repositories using different formats and standards, J.-B. Calewaert et al. present the European Marine Observation and Data Network (EMODnet). EMODnet is a network of organizations set up in 2007 by the European Commission in the framework of EU's Integrated Maritime policy to address the fragmented marine data collection, storage and access in Europe.

The second chapter addresses new developments in marine robotics. The first invited speaker, Edson Prestes from Universidade Federal do Rio Grande do Sul, Porto Alegre, Brasil, proposes a new approach to the global positioning of underwater robots based on probability and interval analysis. The second invited speaker, Vincent Rigaud, IFREMER, France, introduces a new kind of underwater robots resulting from the hybridization of a Remotely Operated Vehicle (ROV) with an Autonomous Underwater Vehicle (AUV). Marine robotics has to operate in the very challenging oceanic environment. To design and build effective robots, a wide range of research topics must be addressed, e.g., underwater communication, obstacle avoidance, software design for embedded systems, control/command, sensor design and integration, algorithms for autonomous navigation, localization, and positioning. Below the sea surface high-frequency electromagnetic communication shows poor performance and acoustic waves are preferred. However, acoustic modems generally remains costly for small robots and Christian Renner et al. have studied a new acoustic modem design aimed at low power consumption, small form factor, and low unit cost. Before addressing the robot itself, it is important to improve the sensing devices. As for communications, the preferred technique for imaging the seabed is based on ultrasonic acoustic waves. New techniques based on synthetic aperture, multiple aspects and interferometry allow for both accurate measurement of the bathymetry and optics-like imaging of the sea floor. Myriam Chabah et al. present the design and discuss the first experimental results of the SAMDIS sonar system which first implements simultaneously these new techniques. Another scientific challenge is to efficiently design the code executing autonomous mission. Such code has several levels of abstraction from low-level control loops to high-level path planning. Goulven Guillou and Jean-Philippe Babau have developed IMOCA; a generic multi-platform model-based approach to code generation for embedded systems. At low level, the efficient control of a robot can be achieved by taking into account the hydrodynamics of the robot. Yang Rui et al. present this approach and apply it to the

Ciscrea AUV. At intermediate level, the AUV can be controlled using its vision sensor. Eduardo Tosa et al. show how visual servoing implemented in Coralbot AUV solve the problem of detecting coral reef. At higher level, when navigating on the surface or underwater, autonomous robots have to find a safe path. For example, autonomous navigation of a surface vessel must take care of the shore line and the other vessels. To solve this problem Silke Schmitt et al. proposed a vector field approach.

The main conclusion of MOQESM'14 is that, although different and often separate, the domains of marine robotics and hydrographic measurements share some research topics like global positioning, acoustic sensing, data processing, or mission planning. The content of this book also demonstrates that marine robotics will play an increasing role in acquiring the marine environment.

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