

ID50- CORRELATION PATTERNS OF MULTI-INFLUENCE MEASUREMENTS FROM CRUISE SHIPS IN THE MEDITERRANEAN SEA

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Abstract. - The increasing human interaction with the marine environment is bringing about a continuous growth in the ambient noise levels, which aggregates to the traditionally existing noises produced by natural sources and can affect, sometimes in a severe way, to the wellbeing of the marine fauna. To date studies have centered on the acoustic radiation, leaving in a second place the rest of radiations which also have a proven effect on marine life. In order to help to fill this gap, this study centers on analyzing the levels and correlations patterns of several types of energy radiations in the marine environment:

acoustic, electric, magnetic and seismic. The study is based on measurements with a multi-influence range system of a kind of vessels of increasing presence and importance worldwide as are the cruise ships. Results show not only a significant level of correlation between acoustic and seismic radiations by one side and electric and magnetic by other side, but additionally a correlation degree among the four analyzed radiations.

Keywords: Multi-influence measurements, underwater ambient noise, acoustic level, seismic level, electric field level, magnetic field level, correlation patterns

ID51- COMPREHENSIVE FRAMEWORK FOR THE DEVELOPMENT OF CONTROL AND NAVIGATION SYSTEMS OF AUTONOMOUS UNDERWATER VEHICLES: THE MISSION-SICUVA PROJECT

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Abstract- This paper presents an overview of coordinated project MISSION-SICUVA, and the results achieved at its recent completion. A prototype of UUV has been built with an orientation to oceanographic research and test of new control algorithms. It consist of an underwater vehicle towing a surface buoy, with applications such as monitoring water quality, high resolution bathymetry of the seabed and its map projection. New biological inspired navigation algorithms have been implemented using a comprehensive component based development framework.

Keywords- Unmanned Underwater Vehicles, Biological Inspired Controller, Oceanographic Monitoring, Component Based Software Development, Software Framework.

I. INTRODUCTION

The SICUVA project (Control and Navigation Systems for Autonomous Underwater Vehicles in missions of Oceanographic Monitoring), began in 2010 and ended in December 2014 aiming for the construction of a prototype of underwater vehicle towing a surface buoy with scalable and reusable software oriented oceanographic research, with applications such as monitoring water quality, high resolution bathymetry of the seabed and its map projection. To do this, the researchers signing this article have developed innovative sensing and control structures neurobiologically inspired to provide autonomy to underwater vehicles.

This project was funded in coordination with the MISSION Project (Comprehensive Framework for Software Development of Autonomous Underwater Vehicles based on Models, Components and Frameworks) in order to provide an enhanced development environment for software control of such vehicles so that (1) the integration and reuse of existing code is promoted, (2) the most advanced principles and techniques of Software Engineering in the domain of AUVs are systematically applied and (3) specific requirements of underwater robotics are taken into account: efficiency, reliability, lack of computational resources and energy constraints.

In the MISSION project a set of software tools have been built following the CBSE (Component Based Software Engineering) and MDS (Model Driven Software Development) paradigms that facilitate the reuse of proven designs and software components and permit to raise the level of abstraction in software

developments. To that end, the FraCC component-based framework has been defined to automatically interpret high-level design (graphical models and components) generating an executable. The model-driven toolchain C-Forge [1] provides support to define new components encapsulating algorithms and existing drivers. Thus, new applications are built simply selecting and assembling the right components in each case. The basis of design of these tools have been recently exposed in prestigious specialized international conferences [2] [3]. Because it is a coordinated project, both the software tools developed and new bio-inspired control algorithms have been validated through its application to real case studies.

II. THE BIOLOGICAL INSPIRED CONTROLLER. IMPLEMENTATION USING C-FORGE.

The UUV controller integrates a Self-Organization Direction Mapping Network (SODMN) and a Neural Network for the Avoidance Behaviour (NNAB) both biological inspired [4]. The SODMN is a kinematic adaptive neuro-controller and a real-time, unsupervised neural network that learns to control the underwater vehicle in a nonstationary environment. The NNAB is a neural network based on animal behaviour that learns avoidance behaviours based on a form of animal learning known as operant conditioning. This algorithms has been implemented as a module of the framework.

To implement the SODMN and NNAB algorithms, the designer simply fill a number of methods predefined methods in a software component. The interaction of this component with the other components conforming the application architecture is automatically managed by the FraCC framework. The designer is only concerned to build each component and link them graphically through their ports. The control software deployment on different hardware nodes and software processes and threads is performed also using a graphical tool which in turn validates the real-time behavior of the system. The deployment can be easily modified if it necessary depending on the schedulability tests. The application of the same approach to develop a different AUV in collaboration with OSL of HWU is presented in [5]

III. SEA-TRIALS

To carry out an evaluation of the UUV with this control software architecture, several tests in Mar Menor coastal Lagoon were carried out. One set of test to