



## Enrico Simetti

Fixed-term assistant professor

✉ enrico.simetti@unige.it

☎ +39 0103532206

### *Education and training*

2012

#### **PhD in Mathematical Engineering and Simulation**

Planning and Control of Autonomous Marine Systems

University of Genova - Genova - IT

### *Academic experience*

2019 - ONGOING

#### **Assistant Professor (RTD-B)**

University of Genova - Genova - IT

Research activities on Marine Robotics and Manipulation

2014 - 2019

#### **Assistant Professor (RTD-A)**

University of Genova - Genova - IT

Research activities on Marine Robotics and Manipulation

2012 - 2014

#### **Post doctoral fellow (Assegnista di ricerca)**

University of Genova - Genova - IT

Control of autonomous underwater vehicle manipulator systems

2008 - 2009

#### **Research fellow (Assegnista di ricerca)**

University of Genova - Genova - IT

Development of obstacle avoidance algorithms for autonomous surface vehicles

### *Language skills*

#### **Italian**

Mother tongue

#### **English**

Proficient

FCE

### *Teaching activity*

Since 2020, I'm serving as vice-coordinator of the M.Sc. in Robotics Engineering.

I'm currently (A.A 21/22) teaching the following subjects:

- (48 hours - Computer and Robotics Engineering) **Cooperative robotics**, which covers a task priority approach to a multi-arm mobile system and its extension to cooperative robots;
- (48 hours - Computer and Robotics Engineering) **Embedded systems**, which covers programming microcontrollers for control oriented applications
- (20 hours - Mechanical Engineering) **Embedded control systems**, which covers programming microcontrollers for control oriented applications

## *Postgraduate research and teaching activity*

### **Supervision of PhD students, residents and post-doctoral fellows**

I'm supervising two PhD students.

I've supervised one research fellow on the H2020 project ROBUST.

I've supervised one research fellow on the BIPE-CableROV project

### **PhD committees membership**

I'm currently member of the PhD Council of the curriculum ROBOTICS AND AUTONOMOUS SYSTEM of the Phd School Bioengineering and Robotics

## *Research interests*

- Marine robotics
  - Autonomous underwater vehicles
  - Autonomous surface vehicles
  - Autonomous underwater-manipulator systems
- Industrial robotics
  - Cooperation between mobile manipulators
  - Bimanual manipulation
  - Human robot interaction

## *Grants*

2010 - 2013

### **FP7 TRIDENT**

European Commission - IT

403515 - Participant

TRIDENT proposes a new methodology to provide multipurpose dexterous manipulation capabilities for intervention operations in unknown, unstructured and underwater environments. The TRIDENT project is built on the top of two main concepts: 1) the use of a team of heterogeneous marine robot with complementary skills, an USV and an I-AUV, to achieve light intervention capabilities without the need for expensive support ships and

2) the use of a dexterous hand mounted on a redundant robot arm to achieve multipurpose manipulation capabilities.

2013 - 2016

## **MARIS**

MIUR (PRIN) - IT

283736 - Participant

In order to achieve the ambitious general objective of the project, it is necessary to achieve some important advances within the integrated development of different enabling technologies and methodologies. In particular, the MARIS project aims at fulfilling the following goals:

- Reliable guidance and control of the floating bases (during long-range motions) on a multi-sensory basis. This is done via the integration of inertial sensors, Doppler velocity measuring devices, external acoustic supports to localization (USBL or SSBL), as well as real-time SLAM techniques based on the sea-floor observations, and more generally of the submerged environment.
- Construction of multi-modal maps via real-time SLAM, as also referred at the previous point.
- Stereo-vision techniques for object recognitions and/or specific features recognition, including object position and pose estimation.
- Advanced techniques for grasping and manipulation from a floating base, by part of each operating agent. Automatic reasoning for the reliable grasping and manipulation of objects, and related reactive control, based on visual, force/torque and possibly tactile sensing of the entire system. This must be done guaranteeing the safety of its operative conditions, with particular care for the grasp keeping on a force-torque-tactile sensing basis.
- Automatic methods for the execution of coordinated intervention operations by part of cooperative teams of floating manipulator systems, based on their mutual exchange of information, their mutual visualization and localization.
- High level mission planning techniques, including the automatic decomposition and cooperative distribution of tasks among the agents, based on the mutual exchange of information.
- Advanced underwater communication techniques among the agents to the aims expressed by both the previous points.

The MARIS project aims to coordinately develop all the research activities above, allowing the achievement of the following specific objectives:

- Dexterity and agility for floating manipulator systems, individually or team operating.
- Experimental autonomous system 'single floating manipulator'.
- Experimental autonomous system 'team of floating manipulators'.

2014 - 2015

### **Autonomous Marine Drones for Scientific Applications**

DESA Engineering srl - IT

Participant

Design and realization of two autonomous catamarans for scientific applications in a 6 months time period.

2015 - 2018

### **H2020 WiMUST**

European Commission - IT

288375 - Participant

WiMUST aims at conceiving, designing, and engineering an intelligent, manageable, distributed and reconfigurable underwater acoustic array that could drastically improve the efficacy of the methodologies used to perform geophysical and geotechnical acoustic surveys at sea.

The novel key feature of the WiMUST system consists in the use of a team of cooperative autonomous marine robots, acting as intelligent sensing and communicating nodes of a reconfigurable moving acoustic network.

Recent developments have shown that there is vast potential for groups of marine robots acting in cooperation to drastically improve the methods available for ocean exploration and exploitation. Traditionally, seismic reflection surveying is performed by vessel towed streamers of hydrophones acquiring reflected acoustic signals generated by acoustic sources (either towed or on-board a vessel). In this context, geotechnical surveying for civil and commercial applications (e.g., underwater construction, infrastructure monitoring, mapping for natural hazard assessment, environmental mapping, etc.) aims at seafloor and sub-bottom characterization using towed streamers of fixed length that are extremely cumbersome to operate. The vision underlying the WiMUST proposal is that of developing advanced cooperative and networked control / navigation systems to enable a large number (tens) of marine robots (both on the surface and submerged) to interact by sharing information as a coordinated team (not only in pairs).

The project brings together a group of research institutions, geophysical surveying companies and SMEs with a proven track record in autonomous adaptive and robust systems, communications, networked cooperative control and navigation, and marine robot design and fabrication.

2015 - 2018

### **H2020 DexROV**

European Commission - IT

184375 - Participant

DexROV brings together seven different organisations from all over Europe to challenge the possibilities for undersea operations. DexROV will use and evaluate new technologies to allow safer and more cost-effective undersea operations with Remotely Operated Vehicles (ROVs).

The goals of the project are:

- Move control of ROVs to shore, from a safe distance.

- Overcome latency involved between onshore control centres and ROVs, through autonomous operations
- Develop advanced dexterous tools with the capacity to grip and manipulate in ways similar to a human hand

DexROV is part of the long-term Blue Growth strategy to support sustainable growth in the European marine and maritime sectors.

2015 - 2020

### **H2020 ROBUST**

European Commission - IT

447410 - Principal investigator

There is a need to develop an autonomous, reliable, cost effective technology to map vast terrains, in terms of mineral and raw material contents which will aid in reducing the cost of mineral exploration, currently performed by ROVs and dedicated SSVs and crew. Furthermore there is a need to identify, in an efficient and non-intrusive manner (minimum impact to the environment), the most rich mineral sites. This technology will aid the seabed mining industry, reduce the cost of exploration and especially the detailed identification of the raw materials contained in a mining sites and enable targeted mining only of the richest resources existing.

The ROBUST proposal aims to tackle the aforementioned issue by developing sea bed in situ material identification through the fusion of two technologies, namely laser-based in-situ element-analyzing capability merged with underwater AUV (Autonomous Underwater Vehicle) technologies for sea bed 3D mapping. This will enable resource identification done by robotic control enabled by the synergy between AUV hovering and manipulator capabilities. The underwater robotic laser process is the Laser Induced Breakdown Spectroscopy (LIBS), used for identification of materials on the sea bed. The AUV Robotic vehicle will dive, identify the resources that are targeted for LIBS scanning through 3D real time mapping of the terrain (hydro-acoustically, laser scanners, photogrammetry) and position the LIBS in the required locations of mineral deposits on the ocean floor to autonomously perform qualitative and quantitative analyses.

2018 - 2021

### **TARMEM**

Carnegie Mellon University - US

47118 USD - Participant

The general goal of the TARMEM project is to develop planning, coordination and communication tools for the distributed control of a team of aerial and aquatic robots for time-extended monitoring of marine environments. Ultimately, the aim is to exploit autonomous robot teams to allow frequent and pervasive data gathering in Gulf waters.

In particular, UNIGE's contribution lies in the Automatic takeoff/landing of an UAV (Unmanned Aerial Vehicle) on an USV (Unmanned Surface Vehicle). Since commercially available UAVs usually have much reduced power

autonomy with respect to USVs, the idea here is to let UAVs to be carried by USVs to recharge or save energy, and so as to stay in the air mainly in the area of interest. This will make long-term missions possible, overcoming current battery limitations for drones.

#### 2020 - ONGOING

##### **BIPE-CableROV**

University of Genova - IT

30666 - Principal investigator

The BIPE-CableROV project explores the use of an innovative hybrid cable-thruster driven robot, for the execution of underwater tasks requiring a larger payload capability.

The project has been funded by the University of Genova as an incentive to European project participation, after a corresponding project proposal met the funding threshold at the EU level, but was not funded due to limited money available. The research is carried out with a group of colleagues working on these topics at LIRMM in Montpellier, France.

#### 2021 - ONGOING

##### **Undroid**

Graal Tech S.r.l. - IT

70000 - Principal investigator

The UNDRROID project is a POR-FESR project funded by Regione Liguria, on the development of an innovative ROV system. The two main project's developments will be the creation of a compact robotic arm, with high dexterity in movements and easily installed on a small ROV and a wearable, ergonomic console with an advanced command and control software capable of supporting the operator in end of robotic manipulation operations on the seabed.

The UNIGE contribution will be on a technological transfer of the task-priority control architecture for the control of the compact robotic arm to simplify the teleoperation of the system itself.

### ***Editorial activity***

I've been Associated Editor for ICRA (2015, 2016, 2017, 2018).

I've served as Guest Editor for IEEE Robotics and Automation Magazine for a Special Issue on Autonomous (Aerial and Underwater) Floating Intervention, published in December 2018.