1. **Pomorska robotika u očuvanju kulturne baštine (Marine robotics in preservation of cultural heritage)**Petra Završki

Traditional underwater archaeology is performed via scuba diving but is constrained by the depth that a diver can work to (normally < 50 meters) and the time that can be spent underwater. New technologies, like remotely operated vehicles (ROVs) and autonomous underwater vehicles (AUVs) may potentially allow archaeologists to survey at depths up to 6000m which corresponds to 98% of the world’s ocean seafloor. This dramatically increases the number of sites available for archaeological study. While technology plays a significant part in this work, it must be combined with archaeologists’ research methodology so that archaeology in deep water conforms to the required standards.

 Keywords and hints:

* heterogeneous systems like ASCs (Autonomous Surface Craft), AUVs (Autonomous Underwater Vehicles), ROVs (Remotely Operated Vehicles) and HROVs (Hybrid AUV/ROV systems).
* Image processing technologies including 2D/3D optical mapping, and 2D/acoustic mapping
* new sensing techniques with application to archaeology, or innovative uses of preexisting sensing techniques, as well as to new tools for underwater intervention.

1. **Pomorska robotika u pomorskoj sigurnosti (Marine robotics in maritime security)**Marin Širić

Keywords and hints:

* Underwater acoustic sensing to detect approaching vessels
* Sea bottom survey to automatically detect and classify dangerous features or navigational hazards
* Water column survey to detect and localize plumes of dangerous materials
* small team of autonomous vehicles and/or unattended platforms that can be ASVs (Autonomous Surface Vehicles), AUVs (Autonomous Underwater Vehicles), Gliders, UAVs (Unmanned Aerial Vehicles) or “static” platforms (moored or drifting) that must cooperate to deliver an enhanced measurable outcome
* the LOON site

1. **Pomorska robotika u istraživanju mora ispod arktičkog leda (Marine robotics in Arctic underice exploration)**Antonio Karneluti

The Arctic Ocean is undergoing rapid and significant warming, leading to reduced sea ice cover and predictions of an ice free summer environment within two decades; consequently the region is an increasing target for exploitation of animate and inanimate resources (e.g. minerals, hydrocarbons, fish), new shipping routes, security activity, and geopolitical negotiation. Marine robots provide a unique capability for data gathering in Arctic unde rice and ice margin environments to inform these activities, in areas that are both technically challenging and dangerous to access using manned vessels.

Keywords and hints:

* mixed fleet of marine robots including long range AUVs, submarine gliders and unmanned surface vessels,
* support vessels, e.g. RRS Sir David Attenborough, NRV Alliance,
* Characterisation of Arctic under-ice and ice-margin environments, including basic ocean parameters (e.g. temperature, salinity, dissolved oxygen) and anthropogenic impacts (e.g. macroplastics, acoustic noise) to demonstrate the utility of marine robots for baseline data collection and future long-term environmental monitoring in this rapidly changing region.
* ecosystem monitoring across multiple trophic levels (plankton to fish to marine mammals) in under-ice environments, using a combination of active and passive acoustic systems deployed on marine robots.
* integrated marine observation in Arctic seas, utilising satellite remote sensing, model and archive data to both guide deployment of the marine robot fleet and to provide wider spatiotemporal context for the collected insitu data.

1. **Pomorska robotika u oceanografiji (Marine robotics in oceangraphy)**Nikola Lovrić

Keywords and hints:

* continuous monitoring of the main physical and biogeochemical water column variables, as a commondata information source
* submarine gliders and ASVs, moored buoys
* ESTOC deepocean observatory)
* autonomous ocean observing platforms suited with oceanographic (and meteorological) sensors, in order to improve monitoring capabilities in terms of quality and quantity

1. **Hibridne akustičko-optičke podvodne komunikacijske mreže (Hybrid acousticoptical underwater communication networks)**Fran Borčić

General purpose underwater communication systems designed to operate over ranges on the order of kilometers are overwhelmingly based on acoustics, as other alternatives such as RF or optics usually undergo strong absorption in seawater and are therefore practically limited to ranges of tens of meters, at most. Acoustic signals, however, are severely distorted — by extensive multipath, broadband Doppler, long propagation delays — thus limiting the effective data rates attainable (usually, on the order of 32kb/s) and the efficiency with which the transmission medium can be shared, even with advanced signal processing techniques.

Over the past years, wireless optical communications have been steadily emerging as a viable solution for Highspeed data transmission over short ranges in the ocean. Most of the underwater optical modems are however prototypes developed at research institutes, with very few systems commercially available on the market. According to the at sea testing conducted so far and to the information reported in the literature, current underwater optical modems are able to communicate Megabits per second over tens of meters. Therefore, these systems can be effectively used to complement mainstream acoustic communications operating over much longer ranges, but at lower data rates.  Hybrid underwater communication systems are the next logical step towards maximizing performance in underwater data transfers.

1. **Kooperativni robotski sustavi za interakciju s čovjekom pod vodom (Cooperative humanmarine robot systems)**Ena Lucija Kovač

While human-robot interaction in industrial environments is quite well developed, little progress has been made with respect to robotic systems that can assist diver(s) during hazardous underwater operations where human presence is still required. These applications are related to commercial and technical diving that often occur in stressful conditions. This task is devoted to enhancing research results obtained within the FP7 project "CADDY Cognitive Autonomous Diving Buddy" where a set of autonomous underwater and surface robotic vehicles were developed for interacting with the diver.

Keywords and hints:

* AUVs and USVs specifically designed for the purpose of diver-robot interaction (i.e. BUDDY AUV)
* sonar image processing in order to determine diver position and orientation
* development of interfaces between divers and robots