SUT: North of England Evening Meeting in conjunction with IEE

Subsea Robotics

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Subsea robotics is a constantly advancing field of engineering that allows Remotely Operated Vehicles (ROVs) and Autonomous Underwater Vehicles (AUVs) to perform a range of tasks at depths unsafe for humans. This fascinating subject was the topic for the SUT North of England's October evening meeting, with an attendance of over 50 people. The chair of the night's meeting, Michael van Zwanenberg of SMD Curvetech, introduced two guests who each delivered a presentation on their recent efforts in the industry.

Professor Nick Wright was first introduced as the former Pro-Vice-Chancellor for Research and Innovation at Newcastle University with a background in Electrical Engineering and Physics. He began with an overview of Team Tao, who are the group of innovative engineers and physicists that Nick has been a part of for over two years. The team are a collaboration of Newcastle University and Soil Machine Dynamics (SMD) and are representing the UK in the finals of a global competition known as the Shell Ocean Discovery XPRIZE. The competition challenges teams to develop subsea technologies to map the deep-sea fully autonomously and in higher resolution than ever before. Having secured funding for the final of the competition by passing the first round, the team are almost ready to travel to Greece to test their design 4km deep in the Mediterranean Sea.

Nick introduced Team Tao's design by first describing a popular seafloor surveying technique, which sees a surface vessel launch a high-value AUV to the seabed and swim in a pattern compared to that of a lawnmower. Team Tao saw this serial process as time-consuming and therefore developed an approach which allows multiple drones to measure the seabed surface at once, thus mapping in parallel. Their compact autonomous design consists of a surface vessel which launches several Bathypelagic Excursion Modules (BEMs) in a carousel-like manner. The BEMs utilise SONAR imaging technology and a range of sensors, allowing the modules to be localised, navigated and controlled. The cost of manufacturing the modules was greatly reduced by intelligent design techniques which allowed Team Tao to assemble the modules themselves, with the majority of materials purchased from standard hardware websites. The structural integrity of the module relies on 3D printed plastic parts reinforced with composite materials offering a lightweight yet stiff and resistant structure. Nick continued by describing the testing process, where the components survived pressure testing in a hyperbaric chamber under extreme pressures similar to those the modules will be subject to at 4km deep.

The talk was concluded by outlining some of the major challenges faced during the project followed by a summary of the competition, which will take place in just eight weeks' time. Team Tao's innovative and exciting engineering clearly inspired the audience and was presented in a thoroughly engaging way, resulting in an abundance of technical questions from the audience at the end.

Next up was Elizabeth Paull, who is the Business Development Manager at Sonardyne; an exciting international company which specialises in subsea technologies. Elizabeth's topic was Advances in Robotics with a focus on Hybrid Navigation. She began by giving a brief overview of Sonardyne, followed by outlining some of the challenges currently being faced by ROVs. Amongst these challenges, Elizabeth emphasised the importance of being able to navigate ROVs. These underwater vehicles are not only required to venture to very precise depths, but also to navigate around complex structures.

Previous navigation systems make use of several sensors such as Doppler Velocity Logs (DVLs), pressure sensors and Attitude Heading Reference Systems (AHRS'). Elizabeth highlighted the errors associated with each of these sensors and the alarming overall accumulation of errors as a result of combining them, leading to an overall positional inaccuracy when retrofitting them to an ROV. In order to reduce this error accumulation, Sonardyne have produced an acoustically aided hybrid all-in-one subsea navigation system. This remarkable design is a complete and integrated system, which combines some of the previously mentioned sensors, all in one module. These claims were supported with statistics which indicated a significant decrease in positional error as a result of implementing this system versus implementing previous systems.

Elizabeth described that the benefits of this hybrid navigator are not limited to just improving navigation accuracy, but also include the removal of human intervention when having to bring an ROV back to the surface. The presentation then gave an overview of the underwater missions the navigator has been challenged with when tested in Plymouth, such as a pre-lay survey and navigating around infrastructure. The error graphs produced as a result of these tests made the capabilities of the hybrid navigator clear to the audience.

Elizabeth concluded the presentation by discussing future possibilities as a result of implementing this new navigator, such as laser metrology, a surveying technique that could see a significant reduction in the time taken to map underwater structures. The benefits that this remarkable design could bring to subsea engineering were made very clear through a summary of its impressive capabilities. A brief Q&A session followed the presentation once again, where the audience were allowed to voice their queries.

The two informative presentations demonstrated the astonishing capabilities of modern-day subsea technology and the exciting direction in which the industry is heading. Thanks again to the guest speakers, to our sponsors and to Newcastle University for ensuring an enjoyable and educational evening.