First Arctic Under-ice Ocean Walking Laboratory (FAU OWL)

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OBJECTIVE

This study is a step toward exhibiting the viability of a robot that can be used to explore the Arctic region by crawling along the sea floor or inverted underneath an ice sheet. By utilizing everyday items we demonstrated buoyant force could be utilized to aid a robot's ability to walk upside down along the submerged surface of an object.

BACKGROUND

- Land walking vehicle technology has increased significantly and proven viable in recent times. This has led to increased curiosity of applying the same technology to water/sea.
- The Arctic circle is one of the least studied areas. With global warming contributing to rising sea levels, the Arctic has become a focus of much needed research. New discoveries are found each year from biological to geographical findings.
- Studies of research in this region include obtaining water (and mineral) specimens to examine environmental changes, locating natural resources (such as oil deposits), and deciding if a location is suitable for deployment of air and sea operation systems.
- In this study, existing robots were modified to test and support the theory. The key component during testing was an electrical insulating/anticorrosion coating.

PROCEDURE

- To begin, multiple types of simple commercially available robots were used for testing. Their circuit boards, motors, and any additional electronic components were protected with a marine spray to safeguard against water and corrosion.
- A large container was filled with tap water. The robots were tested in this water-filled container and inspected for corrosion or damage. This was replicated for several weeks with no observable effects on the robots.
- Foam blocks were attached to a few robots to encourage buoyancy. The robots were then placed in a container of water to ensure the ability to float. Once buoyancy was confirmed, a wooden plank was placed in a tank in the Hydrodynamics Laboratory and each robot was inverted under the submerged wood surface. The ability to walk along the underside of the surface was confirmed.
- Currently, a larger and more intricate robot is being tested, by attempting to encase its control board and motors, as an added water resistant barrier in addition to using the marine spray.

Collection of the robots tested in this study

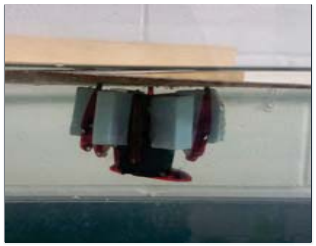
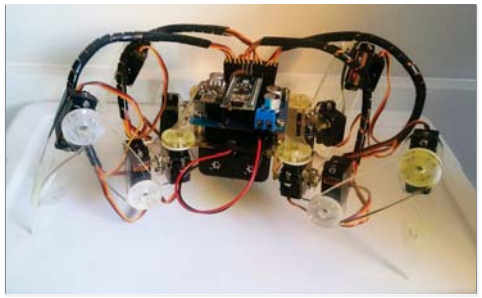


Illustration of inverted underwater walking capabilities



Robot currently undergoing testing

CONCLUSION

- Biological, inorganic, and organic substances in water can interact with electronic materials and degrade them. Therefore, electronics used in a marine setting need to be protected against water and its elements.
- Although the robots successfully worked underwater, the speed of each robot's motion was reduced in water as opposed to a dry environment. This may be due to the fact that water has a higher viscosity than air, thereby increasing resistance against the robots' movements.
- The versatility of the robots was improved with the added buoyancy foam blocks. From this, it can be noted that if the buoyancy was controllable by the use of adjustable air bags, or alike, the robots could go from walking along the floor to walking upside down at the surface. This would allow access to a greater range of terrains.
- Cold Arctic climates may potentially pose challenges in this field of robotic study such as failure of parts. Care must be taken to create new technology that can withstand these conditions.

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