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UNFOLD-SUB: UNFOLDABLE ROBOT FOR SUB-SURFACE OCEAN WATER CHARACTERIZATION ON SOLAR SYSTEM BODIES

Abstract

Exploration of solar system bodies has always been a matter of interest for astrobiology research. Some of these solar system bodies harbor subsurface oceans, which could potentially support extraterrestrial life. To explore these oceans, a bio-inspired unfoldable robot has been proposed in this research paper.

The robot is designed to be deployable from a lander on the surface of the body, and then unfold itself to a larger size to navigate, and characterize the subsurface ocean. The biomimetic design of the robot consists of a central hub with deployable arms, which can be extended to their full length once deployed. The folding pattern of the arms is optimized to minimize the space required for storage during launch and to ensure that they can be unfolded smoothly underwater.

To evaluate the design of the robot, hydrodynamic simulations have been conducted. The simulations show that the robot's body shape and arm design are effective for underwater locomotion and can achieve a speed of up to 1.5 body lengths per second. The simulations also show that the deployment mechanism provides a smooth transition from the lander to the water, minimizing any disturbances to the robot's movement.

The proposed robot's mission profile includes characterizing the sub-surface ocean by measuring various parameters such as temperature, salinity, and pressure. The robot is also equipped with a sampling device that can collect water samples for further analysis. The robot's data collection and sampling capabilities make it a valuable tool for astrobiology research, as it can provide insights into the potential habitability of the subsurface ocean.

In conclusion, the bio-inspired unfoldable robot proposed in this research paper has the potential to revolutionize the exploration of sub-surface oceans in solar system bodies. The robot's design, deployment mechanism, and mission profile have been optimized to achieve maximum efficiency, and effectiveness in exploring, and characterizing subsurface oceans. The hydrodynamic simulations conducted in this research provide valuable insights into the robot's performance, and future work will focus on testing and optimizing the robot's capabilities in a real-world scenario.

Keywords: Bio-inspired robot, deployable robots, subsurface ocean characterization, design optimization