Development and Experiments on a Kind of Small Dolphin Robot

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Inspired by the high mobility and flexibility of dolphins, this project sought to learn from and mimic the dolphin's movements to create a bionic dolphin robot and to find out the impact of different factors on its swimming speed. Three mechanisms were designed and developed via Arduino software and mechanical hardware to control the robot's movements: propulsion, steering, and floating/sinking. Using the robot, several experiments were performed. The results of these experiments demonstrated that the swimming speed of the robot is positively correlated with tail size, tail swing frequency, and steering gear combinations. In contrast, there is a negative correlation between the robot's swimming speed and the tail's range of rotation. Correlation statistical analysis revealed that the tail's swing frequency was the most significant factor in determining swimming speed, followed by steering gear combinations, tail size, and the tail's range of rotation. In addition, simulation software was utilized to measure the robot's buoyancy, water pressure, and changes in water velocity, and showed that the greater the tail's range of rotation, the greater the buoyancy fluctuation, causing vertical instability and movement. These theoretical results provide an explanation of the physical findings, and elucidated areas in need of future improvements. In the future, the dolphin robot may be used to help control floods by inspecting dams and rivers and possibly also for sea exploration.

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