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CHAPTER 22

MECHANICAL DESIGN OF UNMANNED UNDERWATER VEHICLE

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22.1 Introduction

The ocean is a major part of the earth and is one of the main reasons why man is able to exist on it. Statistics show that 1) the ocean covers two-thirds of the earth and 2) about 37% of the world population lives within 100 km of the ocean. Even though its importance is clear, the ocean is usually forgotten as attention is focused on only land and atmospheric issues. The full depths of the oceans and its abundant living and non-living creatures have not been fully explored.

To classify underwater robots, there are Autonomous Underwater Vehicles (AUV) and also Remotely Operated Vehicles (ROV) \cite{1}. The Unmanned Underwater Vehicle (UUV) comes under the AUV category. The applications of the UUV are in the fields of science such as seafloor mapping and investigating oceanographic events such as tsunami. The military has also been widely using the UUV for shallow water mine detecting and disposal besides spying \cite{2-3}. Other applications include inspections of underwater structures, underwater communication and fisheries.

The UUV can float because of the weight of the water that it displaces is equal to the weight of the UUV \cite{4-7}. This displacement of water creates an upward force called the buoyant force and acts opposite to gravity, which pulls the UUV down. To control the buoyancy, UUVs usually have ballast tanks that can be alternately filled with water or air. When it is on the surface, the tank is filled with air and the overall density of the UUV would less than its surrounding water \cite{8}. As the UUV dives in water, the tank is filled with water and the air in the tank is vented from the UUV until its overall density is greater than the surrounding water and the UUV begins to sink due to negative buoyancy \cite{9}. In addition, the UUV has movable sets of short wings called hydroplanes on its body that control the angle of the dive. The hydroplanes are angled so that the water moves over the stern which force the stern upward, causing the UUV to be angled downward.

22.2 Design of the Mechanical System of the UUV

The design of the Unmanned Underwater Vehicle is divided into three major components. Firstly, there’s the mechanical design which involves the theoretical calculation and the integration of sensors and actuators. Secondly, there the design of the decision algorithm which is based on the control system and navigation of the UUV. Lastly, there’s the design of the controller together with the electronic and electrical components. The