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A Study of Drift Force on Submerged Body in X4-AUV Development

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Abstract–Autonomous Underwater Vehicles (AUVs) are robots able to perform tasks without human intervention (remote operators). Research and development of this class of vehicles are growing, due to the excellent characteristics of the AUVs to operate in different situations. Therefore, this study aims to analyze the drift force over different geometric configurations of an AUV hull, in order to reduce the drag force on the body. It is important to design an AUV with minimizing the drag forces acting on the hull to make AUV cruising smoothly. We also simulate the drift force for our X4-AUV ellipsoidal shape to compare the results with other hull shape.

Keywords-Ellipsoid, AUV, Drift force, Slenderness ratio

1. Introduction

An Autonomous Underwater Vehicle, or AUV, is defined as a robot which travels underwater without physical communication with the land and without the necessity of the human operator. The AUVs are included in the group of Unmanned Underwater Vehicles, better known as UUVs (see Figure 1). During the last years, several AUVs have been developed and researches in the area are becoming more frequent, due to the extremely favorable characteristics that these robots have, like the ability to operate autonomously in hostile environments, such as unexplored areas, enemy water territories (in wartime), contaminated or deep water areas, etc. All these features make the use of AUVs very interesting for military, scientific and industrial sectors.

Most existing AUVs use batteries as an energy source for the propulsion system. The high value of drag force generated during the displacement of the robot increases the energy consumption of the system and therefore the AUV autonomy will be lowered, which is undesirable for any engineer.

In order to design any AUV,the major design aspects that need to be considered are identifying hull design, propulsion, submerging and electric power. The most basic characteristic about an AUV is its size and shape. The basic shape of the AUV is the very first step in its design and everything else must work around it. The shape of the AUV determines its application, efficiency and range.

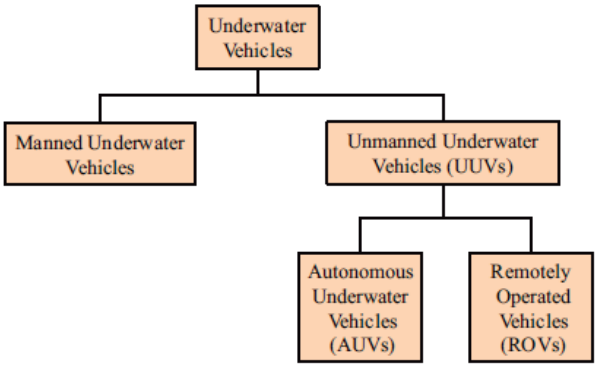

Fig. 1. Types of underwater vehicles

There have been a wide variety of AUVs in size and shape such as spherical hull shape, torpedo and non-torpedo shape, streamlined shape etc. as shown in Figure 2 – 8 [1][2][3]. It is important to design an AUV with minimizing the drag forces acting on the hull to make AUV cruising smoothly.

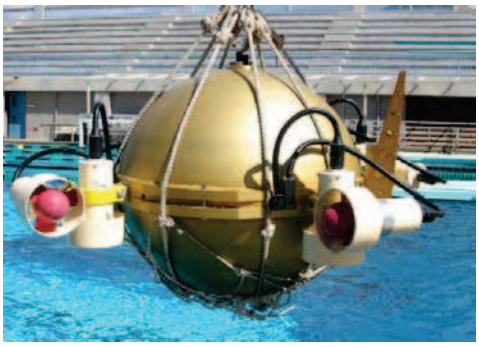

Fig. 2. ODIN spherical hull shape.

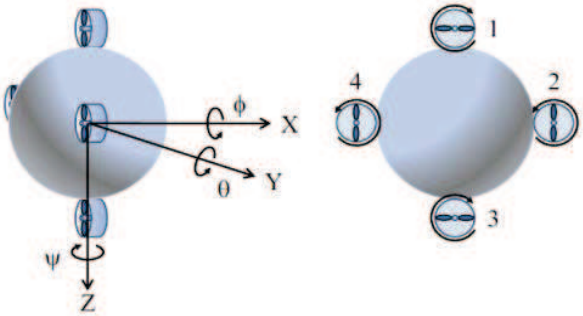

Fig. 3. X4-AUV with spherical hull shape.

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