CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

A number of underwater vehicles are developed, where it is divided into two types which are manned underwater vehicle and unmanned underwater vehicle. The manned underwater vehicle is usually used to service the military and also gather data about the ocean. Today, there are two types of unmanned underwater vehicle (UUV) which is the remote operated vehicle (ROV) and autonomous underwater vehicle (AUV).

Though ROV and AUV is both categorized as UUV, Blidberg (2001) however has proposed that the main difference between both is ROV is tethered in order to obtain power supply and transmit signals such as position while AUV has their own power and control itself to accomplish the task.

Hoang and Kreuzer (2007) recommended that ROV can be equipped with different sensors. It is launched into the water from the mothership and was controlled to reach to the structure that task is needed to be conducted. ROV is used in the oil industry for almost three decades where it is useful in constructing production facilities, inspection and intervention (Liu Hsu et al., 2000).

Azis et al. (2012) suggested that ROV can be utilize in inspection of cracks on the underwater section of the ship, oil and gas industry, telecommunication, geotechnical investigation and mineral exploration, which is mainly a hazardous environment for human to work. Bessa et al. (2008) suggested that the development of underwater vehicles enable tasks such as inspection and repair of offshore
structures, assembly and sub-sea phenomena to be completed without risking the human life by positioning and controlling the altitude of the vehicle automatically.

Propeller is a device that consists of several blades that rotates to accelerate the fluid along the propeller axis, which produce thrust force in the opposite direction (Palmer, 2009). The performance of the blade can be affected by its rotational speed and the flow into the propeller (Palmer, 2009). The propulsion system consists of several components, which are the propeller, gear, motor, controller and batteries.

![Propulsion System Diagram](image)

**Figure 1.1:** The propulsion system of an AUV where P is the propeller, G represents the gear, M for Motor, C for motor controller and B as the batteries.

Source: Palmer (2009)

The performance of the propulsion system is the ratio of power output (generated thrust and resultant speed of the vehicle) to the power input supplies by the batteries (Palmer, 2009). Others include the vibrations produced by the propeller to the hull, and noise generated by the system affect the performance of the propulsion system.

This paper describes the process of propeller design of a ROV developed by Professor Dr. Hj. Zahari Taha, which is shown in Figure 1.2. The goal is to design a set of propeller (two vertical propellers and three thruster propellers) for the ROV. The objective of this study is to design the ROVs’ propellers.
The design specifications are as follows:

- Speed, $v = 1.0\text{m/s}$
- Motor speed, $\omega = 85\text{rpm}$ (no load)
- Motor speed, $\omega = 80\text{rpm}$ (at cruise)
- Propeller hub diameter = 15% of the propeller diameter
- Torque, $Q = 9.3256\text{Nm}$
- Power, $P = 78.1256\text{W}$

The motor speed is set at 80rpm to ensure that the motor will be operating in the safe range to prolong the motor’s life cycle.

**Figure 1.2:** ROV developed that need a set of customize propeller.