UNDERWATER NOISE ANALYSIS – IMPACT TO COMMUNICATION LINK

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To my beloved Mother

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ABSTRAK

Thesis ini memaparkan dan membentangkan kaedah analysis dengan tajuk "***Analisa Hingar Dalam Air – Kesan Keatas Talian Perhubungan Data***". Talian perhubungan data harus di analisakan dan di nilai terhadap kadar data, kekebalan hingar, jarak kendalian perhubungan dan kegunaan kuasa. Thesis ini memberikan penumpuan kepada kesan hingar dalam air kepada prestasi perhubungan data. Penyelakuan dan permodelan penghantar dan penerima dibina, termasuk permodelan beberapa jenis hingar dalam saluran dengan penekanan kepada aras hingar dalam air.

ABSTRACT

This thesis presents and implements the “Underwater noise analysis-impact to communication data link”. The communication data link has to be asses in terms of data rate, noise immunity, operational communication range and power consumption. In this thesis has been focused on the impact of underwater noise to the performance of a data link. Simulation and modeling of the transmitter and receiver including modeling of several noises in channel with emphasis on the underwater noise level.

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LIST OF SYMBOLS

PPT	-	Part Per Thousand
PA	-	Pascal
BT	-	Bottom Type
TL	-	Transmission Loss
PSD	-	Power Spectral Density
1 knot	-	0.154444444 m/s

CHAPTER 1

INTRODUCTION

1.1 Introduction

Acoustic waves are the most important characteristic for convey data in underwater domain as a practical method. The mechanical vibration can propagate in sea easily, on the other hand electromagnetic (EM) and lightning signal have many limitation and losses, in counterpart waves that are in acoustic range has better in water environment [9], then newly acoustic signals has effected all data links and radars equipment in underwater communication field. Acoustic signals application divided by three part as shown in figure1.1 [9] first detect and locate obstacles and target second features measurement of marine situation (sea bed topography, analysis of living creatures) and the last transmit and receiving signal of data which can carry information and commands between submarines, vessels, scuba drivers and all robots that are doing a special mission in sea floor.

All communication systems and the media between them have faced noise. Then main noises in underwater environment are ambient noise, self noise, reverberation and acoustic interference [9], that can deform or damage message signal in communication systems cycle. The underwater noise analysis is essential for running every underwater

field project and data link implementation and also underwater noises are base on passive sonar radars for detecting every target [16].

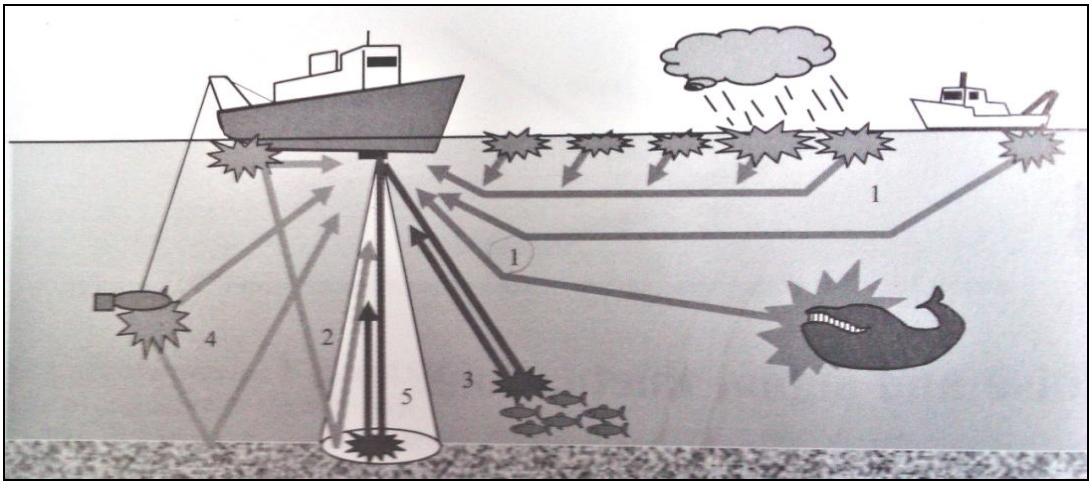

Figure (1.1) : types of acoustic noise (1) Ambient noise; (2) self noise ; (3) reverberation; (4) acoustic interference; (5) expected target echo

Current trend of research in underwater propagation channel modeling is developed by all types of noise field at dissimilar situation and diverse parameters such as depth, temperature, velocity, pressure. And by pattern noise modeling the researcher and engineers are able to optimum design of equipments and implement communication systems [12] .oil infrastructure and military systems and seabed topography are some context of noise modeling knowledge [16], can monitored by 2D or 3D graph by many simulator for instance Matlab and Python program.

1.2 Problem Statement

The thesis started with the stated limitations below which affect on the studying of the underwater noise impact to data communication link behavior:

- Study on all types of underwater noise and focus on ambient and self-noise

- Analysis of real man-made, ambient, and marine creature samples in time and frequency domain separately and receiving to time-frequency (STFT) graphs.
- Develop underwater noise modeling which consist of a QPSK transmitter, receiver with additive underwater noise disjointedly in channel between them.
- Performance evaluation of the model with different degree of noise level
- Study of underwater noise behavior on QPSK data link communication

1.3 Objectives

The objectives and goals of this paper can be briefly summarized in the following points:

- To Analyse of several underwater noise samples as a real noise sound wave.
- To investigate change time and frequency characteristics of noise graph by using Matlab software.
- To implement QPSK transmitter and receiver model by Matlab software.
- To investigate BER due to different types of underwater noise on QPSK data communication link.
- To recommend solutions to filter of each types underwater noise .

1.4 Research Question

- What are the underwater signal noises characteristics?
- What can be done to solve high BER in QPSK underwater data link communication?

1.5 Scope

This project will be divided into four phases, they are described as follows:

- Getting underwater sound signal from internet as a real samples.
- Using MATLAB software to get the time, frequency and (STFT) of each under – water noise component.
- Simulate QPSK communication data link by MATLAB software.
- Adding samples noise to QPSK channel and evaluation of the BER model with different kind of noise.

1.6 Limitation

- Collect underwater different noises separately
- The available time to gather information
- The cost in carrying out the research as a practical project

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