



Faculty of Engineering

**DREDGING AND RECLAMATION OF SARAWAK RIVER  
ESTUARY WITH THE APPLICATION OF SWAN**

**Ahmadi Bin Hashim**

**Bachelor of Engineering with Honours**

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**UNIVERSITI MALAYSIA SARAWAK**  
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**JUDUL: DREDGING AND RECLAMATION OF SARAWAK RIVER ESTUARY WITH THE  
APPLICATION OF SWAN**

**SESI PENGAJIAN: 2008 / 2009**

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**DREDGING AND RECLAMATION OF SARAWAK RIVER ESTUARY  
WITH THE APPLICATION OF SWAN**

**AHMADI BIN HASHIM**

This Thesis Is Propose To  
Faculty of Engineering, Universiti Malaysia Sarawak  
For Fulfilment of the Requirements for Bestowal  
The Degree of Bachelor of Engineering with Honours  
(Civil Engineering)

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*This project report is dedicated to my beloved mother and father, Patimah Bt Saad and Hashim Bin Long, and also to all my family members*



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# ABSTRACT

Sarawak River estuary faced critical erosion by ocean surface wave nowadays. Not only exposed to high energy wave condition from South China Sea, but also due to navigation channel. Hence, wave models are needed to control and then overcome this problem. Using the SWAN (Simulating WAve Nearshore) wave modeling, the physical wave parameters were investigated to determine the wave condition nearshore. This investigation is carried out to predict the wave generation, refraction and energy dissipation at Sarawak River estuary with dredging and reclamation bathymetry, and using the previous data of local wind and wave. The bathymetry map is digitized in SURFER where dredging and reclamation is visualized to view the bottom data. The wave model was developed for Annual, Northeast Monsoon and Southwest Monsoon wave condition. Design waves are analyzed using statistical method of short term and long term analysis. Short term analysis is presented by significant wave height of average height of the one third highest waves ( $H_{1/3}$ ), while, long term analysis comprises of extreme value from Gumbel and Weibull statistical distribution analysis. The outputs from this model are significant wave height ( $H_s$ ), mean wave period ( $T_{m01}$ ) and wave direction ( $Dir$ ) for each chose location. The  $H_s$ ,  $T_{m01}$  and  $Dir$  are different for each location.

# ABSTRAK

Hakisan muara sungai pada asasnya adalah proses semulajadi yang disebabkan oleh tenaga ombak dari lautan. Masalah hakisan ini menjadi semakin kritikal di muara Sungai Sarawak sejak akhir-akhir ini. Bukan sahaja terdedah kepada tenaga ombak yang tinggi dari Laut China Selatan malah muara Sungai Sarawak mengalami hakisan disebabkan oleh laluan kapal dagang untuk berlabuh. Untuk mengawal dan mengatasi masalah ini, kajian tentang model ombak adalah sangat diperlukan. Melalui model ombak SWAN (Simulating WAve Nearshore), fizikal parameter ombak bagi muara Sungai Sarawak dikaji. SWAN adalah model ombak generasi ketiga yang dimajukan untuk meramal keadaan ombak bagi kawasan cetek persisiran pantai. Dengan menggunakan data ombak dan angin yang sedia ada, kajian ini dijalankan untuk meramal pembentukan ombak, penyebaran ombak dan penyebaran tenaga ombak di muara Sungai Sarawak yang merangkumi faktor pendalaman dan penambakan laut. Kajian juga menganalisis ramalan ombak untuk jangka pendek dan jangka panjang. Ramalan jangka pendek dikaji menggunakan purata 1/3 ketinggian daripada ketinggian paling tinggi manakala ramalan jangka panjang menggunakan nilai ekstrim statistik Gumbel dan Weibull. Keputusan daripada model ini adalah ketinggian ombak ( $H_s$ ), purata tempoh masa ( $T_{m01}$ ) dan arah ombak ( $Dir$ ) bagi setiap kedudukan yang dililih.  $H_s$ ,  $T_{m01}$  dan  $Dir$  adalah berbeza bagi setiap kedudukan.

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Monsoon wave scenario for  $H_{\text{Weibull}}$ .

# LIST OF ABBREVIATIONS

|      |   |   |
|------|---|---|
| ANN  | - | Annual Monsoon                                  |
| DID  | - | Department of Irrigation and Drainage           |
| GUI  | - | Graphical User Interface                        |
| HAT  | - | Highest Astronomical Tide                       |
| EIA  | - | Environmental Impact Assessment                 |
| MMS  | - | Malaysian Meteorological Services               |
| NEM  | - | Northeast Monsoon                               |
| SSMO | - | Summary of Synoptic Meteorological Observations |
| SWAN | - | Simulating Wave Nearshore                       |
| SWM  | - | Southwest Monsoon                               |
| VOSP | - | Voluntary Observer Ship Programme               |

## LIST OF SYMBOLS

|                   |   |   |
|-------------------|---|---|
| $\sigma$          | - | Wave radian frequencies                                     |
| $\Gamma$          | - | Coefficient of overall wave steepness                       |
| $A$               | - | Amplitude   |
| $C_{bottom}$      | - | Bottom coefficient  |
| $d$               | - | Water depth   |
| $E_{tot}$         | - | Total wave energy   |
| $f$               | - | Wave frequency  |
| $H$               | - | Wave height   |
| $H_i$             | - | Individual wave height                                      |
| $H_s$             | - | Significant wave height                                     |
| $k$               | - | Wave number   |
| $L$               | - | Wave length   |
| $S_{ds\ br\ tot}$ | - | Mean rate of energy dissipation per unit<br>horizontal area |
| $T$               | - | Wave period   |
| $x$               | - | Mean  |

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# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

The coastal zones are some of the most dynamic environments on earth. The majority of the population in Malaysia lives in coastal areas. In Sarawak more than 80% of the population live along the 800 km coastline, the size and shape of which is constantly changing. Such things as daily tides, mangrove forest, storm waves and tidal flats are found only on the coast. The strip of land that straddles the coastline contains some of the most productive and valuable habitats of the world. Coastal zones are unique but also very sensitive ecological systems with great value in economic, aesthetic, social, environmental conservation sense.