CHAPTER 4
ANALYSIS TECHNIQUE FOR LABORATORY STUDY

4.1 Introduction

A formulation for the calculation of two wave field spectra travelling in opposite directions to be used in analyzing the laboratory data from the experiments described in Chapter 5 is developed. The method used is a three point method using a least squares analysis for decomposing the measured spectra into incident and reflected spectra (Funke and Mansard, 1980). This method requires a simultaneous measurement of the wave field at three positions which are in reasonable proximity to each other and in a line parallel to the direction of wave propagation.

4.2 Theoretical Background

Although these calculations may be made by measuring the wave field with two gages of known distance apart and solving two linear equations directly, Funke and Mansard (1980) put forth a method for resolving the wave train spectra using multiple gages to measure the wave field and a least squares fit to resolve the incident and reflected wave spectra, in an effort to improve accuracy and reduce sensitivity to signal noise and non-linearities of the waves. The theory makes use of the axiom that an irregular sea state may be described as the superposition of an infinite number of discrete components

\[ \eta = \sum_{n=0}^{\infty} \eta_n \]  

(4.1)

where

\[ \eta_n = A_n e^{i(k_n z - \omega_n t)} \]  

(4.2)

and the assumption that each component will travel at a unique speed in a given water depth. The superposition will result in a time series \( \eta_1(t), \eta_2(t), \) and \( \eta_3(t) \) of the water