CHAPTER 2
EXTENSION OF NON-RESONANT INTERACTION THEORY

2.1 Introduction

Non-resonant interaction theories are extended to allow waves incident at oblique angles over a one-dimensional topography. Then a bottom with regularly spaced bumps is decomposed into individual Fourier components, the contribution to reflection is calculated and the reflection coefficient calculated as the sum of the contributions.

2.2 Governing Equation

The solution given by Davies and Heathershaw results from a perturbation expansion to second order of the components of the wave field propagating over a sinusoidal bottom of finite length. The major assumption made is that all reflection takes place at $O(c)$, or the wave is weakly reflected. Thus the leading order component incident on the ripple patch propagates over it unabated. As recognized previously, this assumption violates energy conservation in the domain if any reflection were to take place. To account for this, Davies and Heathershaw artificially impose a linear attenuation on the $+x$ propagating wave, then adjust the solution to match the requirements of energy conservation. Two additional drawbacks to this solution are its inability to adequately handle the Bragg resonant case of strong reflection in the area where $O(1)$ reflection occurs, and in its original form, the inability to solve the problem allowing waves incident at oblique angles.

Miles (1981) solved the same problem for an arbitrary bottom and oblique incidence. The solution method employed involved assuming a form of the incident, reflected and transmitted wave fields and applying them to the problem. The solution method is very similar to the one explained below. It should be noted here, however, that all three solutions,