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Wave Period Mike21-BW Numerical Sea Wave Diffraction

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Abstract

The diffraction phenomenon is described as the apparent bending of waves around small obstacles and the spreading out of waves past small openings, while the diffracted wave crests in the lee of the border will form approximately concentric circular arcs with the wave height decreasing exponentially along the crests. By using an appropriate CFD Software like "DHI Mike21-BW Model" (based on Boussinesq Wave theory) wave diffraction would easily be described and by describing and considering it in designing of project so many critical events such as earthquake and tsunami can be avoided.

Wave period (T) is a one of basic characteristics of any wave, generated randomly or regularly, which measures the size of the wave in time. To assess the impacts that different wave periods cause on coastal regions, studies that evaluate the hydrodynamic behaviour and wave diffraction in sea water are necessary. A calibrated Model is a suitable background for examination of different wave periods.

In this paper by using the computer model, the affection of the wave period change on the diffraction will be discussed. Meanwhile, for calibrating the model reputed "Wave Diffraction Diagrams" has been used, which will be discussed in appropriate section.

It is concluded in these specific models and with its characteristics by increasing the wave period the wave height and the diffraction coefficient will be decreased. But depend on different data line nodes (distance from the opening), the behaviour of the curves may change.

Keywords: Diffraction, Sensitive Analysis, Wave Period (T), MIKE 21, Boussinesq Wave Theory, Numerical Model.

1. INTRODUCTION

Diffraction refers to various phenomena which occur when a wave encounters an obstacle. It is described as the apparent bending of waves around small obstacles and the spreading out of waves past small openings: [1].

While diffraction occurs propagating waves encounter obstacle, its effects are generally seen like changes on wavelength, wave height and Wave propagating direction. Based on obstructing object size, type, porosity and other characteristics, provides multiple variety of diffraction intensity: [1].

Parameters that may influence the diffraction phenomenon vary. Reflection Coefficient describes, amount of wave height that a substance reflect. Meanwhile, Porosity Coefficient has same meaning in reverse order. Porosity Coefficient is the substance characteristics which describes its porous mood. Usually, by increasing the reflection ability of a substance its Porosity Coefficient will decreases and vice versa.

Diffraction occurs because of the way in which waves propagate; this is described by the Huygens – Fresnel lemma. The propagation of a wave can become tangible by considering every point on a wave front as a node in computer modeling: [3]. The subsequent propagation and addition of all these waves form the new wave. When waves added together, the result is determined by the relative phases as well as the amplitudes of the individual waves. The summed amplitude of the waves can have any value between zero and the sum of the individual waves. Thus, diffraction patterns usually have a series of maxima and minima.

The form of a diffraction pattern can be resulted from the summation of the phases and amplitudes of the Huygens wavelets at each point in space. There are various analytical models which has the ability of doing this, including the Fraunhofer Diffraction Equation for the far zone and the Fresnel Diffraction Equation for the near shore. Most formatons including what mentioned in this paper could not be solved analytically easily, but can yield numerical solutions through FEM (Finite Element) and Boundry Elements Methods.

Boussinesq approximation for water waves is a valid one for nonlinear and long waves. The approximation name "Boussinesq", who first derived this (1872) in response to the observation by John Scott