Numerical Simulation of Wave Transformation in Surf Zone

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Abstract

A two-dimensional numerical model has been developed to study wave transformation in surf zone. A free surface VOF (Volume Of Fluid) model in conjunction with a $k-\varepsilon$ *turbulence closure model have been employed in a RANS solver to study shoaling, breaking and overturning of waves inside surf zone. Approximations to the governing equations are acquired by use of Finite Difference Method. Two different types of breakers, namely plunging and surging breakers, are studied. Breaking types and characteristics of waves at the breaking points are well compared to the results of an experimentally validated wave model based on potential flow equations. Discussions are made on the velocity field during breaking process. At the breaking point, where the wave front face becomes nearly vertical, the crest velocity is found to be equal to the breaking wave speed. The maximum particle velocity at the breaking instant is observed to occur near the free surface in the vicinity of wave front with a value around 27% above the crest velocity. All mentioned conclusions are well supported by experimental and other numerical studies.*

Keywords: *wave transformation, wave breaking, breaking criterion, breaking index, velocity field, Volume Of Fluid (VOF) method*

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1. Introduction

The study of wave transformation in shallow water is of prime importance in the field of coastal engineering. Recent advances in experimental techniques have helped the understanding of wave transformation processes, i.e., wave shoaling, breaking and overturning, to become greatly improved. The techniques of hot-film anemometer, Particle Image Velocimetry (PIV), and Laser Doppler Velocimeter (LDV) have been used to measure the velocity distribution after wave