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The Effects of Current on Cnoidal Wave

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Abstract
Wave current interactions have been one of the most interesting topics in ocean engineering. When sea waves enter an inlet against an ebb current, changes of wave heights and wave length occur.
Understanding of wave characteristics in the coastal region is the most important challenge in coastal engineering. In near shore, with depth decreasing, there are parallel coastal currents from non-orthogonal wave radiation. However, these trends in the coast, with waves have influences on each other. Wave current interaction is one of the most interesting issues in marine engineering and oceanography. For example, when the wave reaches the sea coast, waves and currents between parallel the beach, a interaction occurs. Variable current rate and length and wave form change to the average velocity and wave current, makes a significant effect.
What this paper examines is, effect on the current on wave and a new form of dispersion relation will be obtained for wave current interaction that the opposite current, and decrease the speed and wave length and increases wave sharpness and vice versa.

Keywords: *wave current interaction, linear wave, cnoidal wave.*

1-Introduction

Wave and current interaction is important in many fields of coastal and marine, oil and gas industries, pipelines, shipping, ship routing, coastal protection, waste disposal, sediment transport, morphology, beach, wave and tidal, effective flood warning system. Mechanism of wave and current interaction with reviews on radiation stress by Longuet Higgins and Stewart (1961) were presented. They showed a change in wave length and amplitude to the current depends on wave propagation direction. Later, Jonsson et al. (1970) introduced the concept of average energy level and its derivatives, equations applied to wave and current interaction presented. Ohnaka et al. (1988) proposed mild slope equations (MSE) for wave and current interaction. Ren et al. (1997) presented equations called Boussinesq equations, in wave and current field. Madsen et al. (1991, 1992) expressed wave equations for wave and current interaction with amendments on dispersion relations.

2-Cnoidal Wave

The applicability of Stokes theory diminishes as a wave propagates across decreasing shallow water depths. Keulegan (1950) recommended a range for Stokes theory application extending from deep water to the point where the relative depth is approximately 0.1. However, the actual Stokes theory cutoff point in intermediate water depths depends on the wave steepness as well as the relative depth. For steeper waves, the higher order terms in the Stokes theory begin to unrealistically distort results at deeper relative depths. For shallower water, a finite-amplitude theory that is based on the relative depth is required. Cnoidal wave theory and in very shallow water, solitary wave theory, are the analytical theories most commonly used for shallower water.