



Shallow Water Turbulent Surface Wave Striking an Adverse Slope

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Abstract

The problem of a sinusoidal wave crest striking an adverse slope due to gradual elevation of the bed is relevant for coastal sea waves. Turbulence based RANS equations are used here under turbulence closure assumptions. Depth-averaging the equations of continuity and momentum, yield two differential equations for the surface elevation and the average forward velocity. After nondimensionalization, the two equations are converted in terms of elevation over the inclined bed and the discharge, where the latter is a function of the former satisfying a first order differential equation, while the elevation is given by a first order evolution equation which is treated by Lax-Wendroff discretization. Starting initially with a single sinusoidal crest, it is shown that as time progresses, the crest leans forwards, causing a jump in the crest upfront resulting in its roll over as a jet. Three cases show that jump becomes more prominent with increasing bed inclination.

Key words: surface waves, shallow water waves, inclined bed, turbulence, unsteady flow, breaking waves.