سامية محمد مصطفى

شبكة المعلومات الجامعية

بسم الله الرحمن الرحيم

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شبكة المعلومات الجامعية

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التوثيق الالكتروني والميكروفيلم

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التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

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بالرسالة صفحات لم ترد بالأصل

AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
IRRIGATION AND HYDRAULICS DEPARTMENT

HYDRAULIC ROUGHNESS IN ALLUVIAL CHANNELS EXPOSED TO WAVES AND CURRENTS

BY

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ABSTRACT

Hydraulic roughness is an important part for sediment transport phenomena. Understanding the physical process of the hydraulic roughness in alluvial channels exposed to waves and currents is rather difficult. This difficulty comes from the non-linear interaction of waves and currents.

The aim of this study is to have a better understanding of the wave- current interaction and its effect on sediment transport phenomena and to verify some of the existing models.

In order to achieve the aim of the study experiments were carried out in the Large Oscillating Water Tunnel of Delft Hydraulics in the Netherlands. The tunnel is designed to simulate the near-bed orbital velocity at full-scale (1:1). It is also provided by a recirculating flow system which enables the study of wave-current interaction.

Three series of experiments were carried out (experiments series A, B and C).

Experiments series A were focussed on the hydrodynamic studies in a fixed bed condition. Waves were sinusoidal. Net current profiles with and without waves were studied.

Experiments series B were focussed on bed form studies using a sand bed with D_{50} = 0.21 mm. Waves were sinusoidal and different net currents were imposed (0 - 0.4 m/s). The behavior of bed forms were studied in case of only waves and waves superimposed on net currents.

Experiment series C were focussed on the study of time-averaged suspended concentration and net time-averaged sediment transport rate under regular asymmetric waves superimposed on net currents.

Laser Doppler and Electro Magnetic Velocity Meter were used for velocity measurements. Time-averaged concentration profiles were obtained using the Transverse Suction System. Net time-averaged transport rates were determined using mass conservation techniques.

It was observed that the waves reduce the velocity of the net current close to the bed over that expected for a net current without waves. The physical bed roughness has been replaced by an increased apparent roughness as a result of adding waves.

The experimental results showed that adding waves on the net currents helps in flatting the bed and transition to plan bed sheet flow conditions occurs at lower wave velocity amplitude. A steeper slope of the time-averaged concentration profile is obtained by adding following net currents superimposed on waves as a result of increased the vertical mixing induced by the net current. It was found that adding net currents on waves in direction of wave propagation increases the sediment transport rates even for a weak net current superimposed on waves.

It was found that the increased turbulent mixing induced by waves inside the wave boundary layer reduces the velocity of the net current close to the bed over that expected for a net current without waves. Outside the wave boundary layer the net current profile follows the usual logarithmic distribution with the change that the physical bed roughness has been replaced by an increased apparent roughness.

The experimental results showed that for increasing wave amplitude, first ripple growth takes place and then transition to plane-bed sheet flow. Moreover, for increasing superimposed net current, ripple dimensions generally reduce (except for small waves) and the transition to plane bed takes place at a lower wave velocity amplitude.
Eventually, the data obtained from the experiments were used to verify some of the existing models for the sediment transport phenomena in a coastal zone.

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STATEMENT

This dissertation is submitted to Ain Shams University for the degree of Master of Science in Civil Engineering.

The work included in this thesis was carried out by the author, at Ain Shams University, Faculty of Engineering, Irrigation and Hydraulics Department from November 1991 to October 1994.

No part of this thesis has been submitted for a degree or a qualification at any other University or Institution.

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