琉球大学学術リポジトリ

大型実験及び数値計算による新たに開発した人工リーフブロックの特性に関する研究

メタデータ	言語: 出版者: 琉球大学 公開日: 2018-10-09 キーワード (Ja): キーワード (En): 作成者: Schaab, Carolyn Virgin, シャーブ, キャロリン　バージニア メールアドレス: 所属:
URL	http://hdl.handle.net/20.500.12000/42565

Form 3

Abstract

Study on specially designed concrete block reef using large-scale hydraulic experiments and numerical simulation

A submerged reef is an artificial structure widely applied for measures to protect beaches and areas in front of seawalls from erosion and wave-overtopping phenomena. CADMAS-SURF may be a useful numerical simulation tool to study the complex interactions between waves and such structures. In this study, using large-scale hydraulic experimental data of a submerged reef composed of specially-designed concrete blocks, parameters such as porosity, coefficient of drag and coefficient of inertia are examined. This study also demonstrates CADMAS-SURF numerical simulation as an applicable tool to verify and extend the experimental results for a porous submerged reef.

Further utilizing CADMAS-SURF, key properties including wave set-up/down, wave reflection coefficient, and wave transmission coefficient of submerged reefs are investigated in detail. The key characteristics of the new permeable reef-block reef design are evaluated by examining the performance and effectiveness to mitigate waves. Key factors such as non-dimensional wave height distribution, velocity, wave reflection coefficient, wave transmission coefficient, and wave setup are studied. Permeable barriers, such as reefs, that are built to be open instead of completely solid can dissipate wave energy through friction and allow some of the energy to pass through, gradually reducing the wave energy.

The newly designed reef is then evaluated in comparison with a standard low-porosity rubble mound reef of similar dimensions and wave conditions. The advantages of this reef are demonstrated through comparisons of key properties, especially wave setup. It is essential to reduce the effects of wave setup which is a result of the placement of submerged breakwaters; wave setup can increase the mean sea level, increasing the risks of damage to coastal infrastructure. Wave setup contributes to the overtopping of coastal defense structures during storm conditions and may be a contributory factor in coastal flooding, as well as an important influence in currents in the coastal zone that influence factors like sediment transport and beach erosion. Next, an emerged reef composed of the same unit model blocks is examined. Key properties are evaluated to determine the performance of the emerged reef and compared with the submerged reef and the rubble mound structures. In the last section, an underwater channel site is analyzed in Okinawa to determine the effectiveness of solely a trapezoidal pit breakwater. The results show the need for a protective coastal reef to best mitigate against wave action at the site.

Name　Schaab, Carolyn Virginia