Wave Trapping by Porous Breakwater near a Wall under the Influence of Ocean Current

Sanjay Kumar Mohanty

Department of Mathematics, School of Advanced Sciences, Vellore Institute of Technology, Vellore, 632014, Tamilnadu, India

Abstract

In this paper, oblique water wave interaction with a surface piercing box-type porous structure placed in front of a vertical rigid wall is investigated in the presence of current, which flows making a certain angle with the direction of wave propagation. The current speed is considered distinct in different subdomains. However, in a particular subdomain current speed is uniform throughout the water depth. In this analysis, Sollitt and Cross model is used for the study of wave motion inside the porous structure. Employing small amplitude linear water wave theory, the present model of our interest is developed into a boundary value problem and solved analytically using the eigenfunction expansion method. Using the developed solution, the reflection coefficient and hydrodynamic wave forces on porous structure are computed for different values of parameters: the dimension of porous structure, the friction coefficient of porous structure, the current speed of following current (angle between wave and current direction is acute) and opposing current(angle between wave and current direction is obtuse). In the presence of the following current, the study shows that the highest reflection occurs when the current flows parallel to the wall, with maxima of reflection occurring when the gap spacing between the porous structure and solid wall is almost an integer multiple of half of the wavelength. This research paper suggests that suitable arrangement of rigid walls and surface-piercing partially extended porous structures can be an effective and economical approach for guiding ocean currents and protecting marine facilities against wave attacks.

[1] Further author information:

S.K.M.: E-mail: sanjaykumar.mohanty@vit.ac.in, Telephone: +91 9938942839,

Address: Department of Mathematics, School of Advanced Sciences, Vellore Institute of Technology, Vellore, 632014, Tamilnadu, India