Available online at www.sciencedirect.com
ScienceDirect
Journal of Hydrodynamics
2011,23(2):145-153
DOI: 10.1016/S1001-6058(10)60098-4
www.sciencedirect.com/science/journal/10016058

THE EFFECT OF WAVE GROUPINESS ON A MOORED SHIP STUDIED BY NUMERICAL SIMULATIONS*

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(Received October 23, 2010, Revised January 17, 2011)

Abstract: Waves with the same wave parameters, such as significant wave height and period, but with different wave groupiness factors are simulated, to study the motion behavior of a moored ship under the action of waves with different Groupiness Factors of Height (GFH) and Group Length Factors (GLF). The numerical results show that both the sway and heave motions increase with an increase in GFH. In contrast, the influence of GLF on the motions of a moored ship is weak.

Key words: wave groupiness, moored ship, Groupiness Factors of Height (GFH), Group Length Factors (GLF)

Introduction

In the consideration of the stability of wharf structure, vessel and cargo handling, it is important to determine accurately the motion of a moored ship exposed to the action of waves. Previous studies show that the responses of a moored ship are greatly influenced by the wave heights higher than the design waves in quick succession. Groupiness is an important feature of ocean waves, and waves in quick succession are regarded as wave groups, which directly affects the behavior of a moored ship system. Damage that wave groups would cause on breakwaters was studied[1]. Buldakov et al.[2] studied the diffraction of a directional wave group by a bottom-seated circular cylinder. Hossain et al.[3] revealed that the wave group is related with resonance oscillations in the harbor. Balaji et al.[4] studied experimentally the buoy motion under the action of wave groups and revealed that the effect of wave groups on motion of a buoy can not be ignored. Xu et al.[5] considered the envelope approach and simulated wave groups with the wave envelope spectrum and wave spectrum as targets.

The floating systems in the marine environment are designed based only on a design wave height according to Chinese Port Design Code. Though great progress has been made in this field[5-10], the motion of a moored ship in the open pier exposed to the action of wave groups is an issue to be further investigated.

To understand the interaction between the groupiness of waves and the motion behavior of a moored ship, a mathematical model of a moored ship under the action of wave groups is presented in this article. Waves with the same wave parameters, such as significant wave height and period, but with different wave groupiness factors are simulated, to study the motion behavior of a moored ship under the action of wave groups with different Groupiness Factors of Height (GFH) and Group Length Factors (GLF). Many recent studies focused on the effects of random waves (without groups).

In the light of this, the article is organized as follows. In Section 1, a numerical model is built to investigate the motion behavior of a moored ship under the action of wave groups. The numerical results of motion of a moored ship under the action of wave groups and common random waves (without

* Project supported by the National Natural Science Foundation of China (Grant No. 50921001), the Ministry of Communications of China (Grant No. 200632800003-01).
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