Numerical Simulation of Overall Marine Transportation of Bay Bridges under Complex Hydrographic Environment

Yu Fang, Wen Xiong

Southeast University, NanJing, JiangSu, China

Jun Kan, Hailong Liu

China Road and Bridge Co., Ltd, BeiJing,China

Southeast University, NanJing, JiangSu, China

Contact: 220203426@seu.edu.cn

Abstract

Although more and more research achievements have been obtained in offshore engineering in recent years, there are few studies on transportation of bridge under marine condition. In order to explore the response characteristics of bridge transportation under the action of marine environment, this paper conducts numerical simulation of the transportation of a butterfly arch bridge by a semi-submersible barge. In this paper, the software based on potential theory has been used to analyze the swing motion of the transportation of bridge. The motion response of the combined float has been calculated under the action of wind, waves and currents with the varying of frequencies and directions. The results show that the swing motion amplitude of the combined float in the condition determined by the local code is relatively small, and the action of waves are the main factor of the swing motion compared to wind and currents.

Keywords: marine transportation; AQWA; semi-submersible barge; butterfly arch bridge.

1 Introduction

In recent years, the construction of offshore projects such as cross-sea bridges and sub-sea tunnels has been increasing in order to alleviate the problem of insufficient urban land resources in developed areas. Therefore the application of technology related to the marine transportation and installation of bridge sections is becoming more and more significant. Marine transportation of bridges is a fluid-structure coupling problem. There are usually two research methods to solve the problem of barge transportation, CFD method and potential flow theory method. Although the CFD theory method present high calculation accuracy, it requires huge computational power and running time, while the potential flow theory analysis method is fast and meets the accuracy requirement of most shipping project and occupies an important position in the ship transportation engineering. Therefore, the most used commercial software in the marine field such as AQWA, MOSES, WAMIT, etc. are based on the 3D potential flow theory. For the above reasons, this paper uses AQWA as the main analysis tool for bridge marine transportation.

https://doi.org/10.2749/nanjing.2022.0793
Distributed by structurae