NUMERICAL SIMULATION OF WAVE RESISTANCE OF TRIMARANS BY NONLINEAR WAVE MAKING THEORY WITH SINKING AND TRIM BEING TAKEN INTO ACCOUNT[*]

WANG Zhong, LU Xiao-ping
College of Naval Architecture and Power, Naval University of Engineering, Wuhan 430033, China,
E-mail: wangzhonghj@sohu.com

Abstract: Up to now, there are no satisfactory numerical methods for simulating wave resistance of trimarans, mainly due to the difficulty related with the strong nonlinear features of the piece hull wave making and their interference. This article proposes a numerical method for quick and effective calculation of wave resistance of trimarans to be used in engineering applications. Based on Wyatt's work, the nonlinear free surface boundary condition, the time domain concept, and the full nonlinear wave making theory, using the Rankine source Green function, the 3-D surface panel method is expanded to solve the trimaran wave making problems, with high order nonlinear factors being taken into account, such as the influence of the sinking and trim, transom, and ship wave immersed hull surface. And the software is successfully developed to implement the method, which is validated. Several trimaran models, including a practical trimaran with a sonar dome and the transom, are used as numerical calculation samples, their wave making resistance is calculated both by the present method and some other methods such as linear (Dawson) methods. Moreover, sample model resistance tests were carried out to provide data for comparison, validation and analysis. Through the validation by model experiments, it is concluded that present method can well predict the wave making resistance, sinking and trim, and the accuracy of wave making resistance calculation is significantly improved by taking the trim and sinking into account, especially at high speeds.

Key words: trimaran, nonlinear wave making resistance, surface panel method, sinking, trim, ship model test

Introduction

The trimaran discussed in the present article consists of a slender center hull (also called the main hull) and two slender outer hulls of much smaller size (also called the side hulls or outriggers), as shown in Fig.1. In recent years, a considerable research effort has been put on the trimaran due to its many advantages that come from its special hull construction, such as the excellent resistance performance, the high stability, the broad deck and satisfactory seakeeping performance, and the trimaran is widely accepted as a new ship form with a wide application prospect[1,2]. A good prediction method for the wave making resistance of trimaran is very important for its practical development and building.
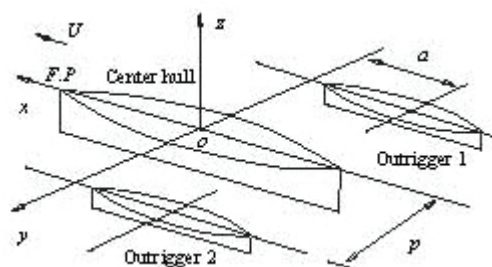

Fig.1 The coordinate on the trimaran

As was observed[3], the wave interference between the center hull and the outriggers is very complicated, with the waves repeatedly reflected and superimposed in a limited water area restrained by the main hull and the inner side wall of each outrigger. Moreover, the outrigger bow spray may be evident and mixed with the wave making flow at high speeds.

Biography: WANG Zhong (1981-), Male, Ph. D.