

Study on Resistance Performance of the Wave Piercing Catamaran

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ABSTRACT

The paper focuses on the experiment analysis and theory prediction of the resistance performance of large WPC (Wave-piercing Catamaran). The wave-making resistance is predicted by means of linear wave-making resistance theory, and the viscous resistance is predicted based on Boundary Layer Theory. High precision is accomplished in certain velocity range for the WPC. Through changing the distance between the hulls, the wave-making interference of the two hulls is studied both in theory and experiment. By test in ship model tank, the practicability and reliability of the theory method is verified. The theory prediction of the resistance of WPC agrees well with the test result.

KEY WORDS: wave-piercing catamaran; wave-making resistance; viscous resistance.

INTRODUCTION

The form of WPC experiences a few changes, and now goes to large and high speed. In 1983, the experiment boat built by INCAT is in fact a catamaran which takes out the upper part above waterline and installs two pillars to connect with the super structure. In 1986, INCAT modified the above solution. The fore and aft pillars on each side are changed to a single pillar. The hull and the pillar are smoothly connected with a piercing part on the fore hull. And the bottom of upper main body changed to V-type. Thus the WPC is easy to sail through waves with little resistance and better sea-keeping capacity. After 2000, the WPC installed self-controlling fin on fore, foil on the side and controllable plate on aft to reduce trim. The sea-keeping capacity improved greatly. As for other companies, the multi-hull company AMD of Australia carried out a series of experiments of WPC model in Australia and Holland, and NKK of Japan carried out research on connecting bridge with thin wall on WPC.

In our country, the research on WPC starts from the end of 80s in the last century. A few research institutes and universities carried out research on WPC key technologies. The speed and sea-keeping capacity is studied for WPC-30, 250t displacement WPC-40, 360t displacement and 900t displacement WPC-72 both in theory and

experiment. A few new WPCs are developed with better performance. The feasibility of WPC in military and civil use is studied with overall plan.

Absorbing the experience of the preceding work, the theory and experiment of resistance performance is studied for 1800 t displacement WPC-96. And, Tab.1 gives out the list of its principal dimensions and form coefficients.

Tab.1 Principal dimensions and form coefficients

Item	Value and units
Length of waterline, Lwl	96 m
Length between perpendiculars, Lbp	86 m
Molded breadth, B	26.5 m
Breadth of demihull, b	4.6 m
Designed draft, T	4.1 m
Displacement	1847 t
Demihull block coefficient, Cb	0.545
Longitudinal center of buoyancy, LCB	-9.302%Lbp

Theory Prediction of WPC's Resistance

The resistance of WPC is composed of wave-making and viscous resistance. Wave-making resistance includes wave pattern making resistance and wave-breaking resistance. The viscous resistance includes friction and viscous pressure resistance. The wave pattern making resistance of WPC can be predicted using linear wave-making resistance theory. The viscous resistance of WPC can be predicted using Boundary Layer Theory. The two hulls of WPC is very slim, so the wave-breaking resistance can be ignored. And the wave-making resistance only considers the resistance caused by ship wave. The transom stern and knuckle line's influence on the wave-making resistance should also be considered. When in high speed, the spray resistance occurs.