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A Study on the Possibility of Hull Form Design using Numerical Towing Tank (SHIPFLOW)

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KEYWORDS: SHIPFLOW, CFD, Navier-Stocks, Potential Flow, Boundary Layer, Experimental and Calculation Analysis Method, Wave Profile, Wave making Resistance, Wave Hight.
ABSTRACT: *This paper discusses some practical problems of the determination of ship wave resistance from flow calculation and the model test. there are so many kind of CFD program as FLUENT, WAVIS, SHIPFLOW, COMET etc. for finding optimized hull. we should know how much percent we trust the program. so if we gather computed values of the wave resistance we'll able to get more accurated values of presumptive.*

1. INSTRUCTION

An accurate prediction of ship wave resistance is extremely important for the analysis of ships hydrodynamic performances and for the improvement of hull form. When we improve hydrodynamic's ability on the ship we should get a grip on flow around ships for design ships. there are two different ways for computing the wave resistance and checking flows around ship one of them is Experimental method is able to the only measure Resistances and check the wake but also check items for getting a grip on the waves. CFD(calculational Fluid Dynamics) is one of method It's can be reduce the expense for gathering values and time also It can be check values which can't get from the Model test but one of demerits is not enough correctness and confidence compare with model test. so we need to secure lots of data for getting a high quality of numerical calculated modelling and verifying results of numerical calculation of ship.

SHIPFLOW is using Finite Volume Method as common CFD. Our University is using it for calculation of resistance and Waves etc. SHIPFLOW is improving points which is purpose of · getting a grip on the flow analysis different from other program. other program can calculate so many case but this program aim at calculation around ship. normally the flow around ship be characteristic of thick boundary Layer on part of after body so that they divide 3 division for calculation using a low computer capacity as Fig 1.

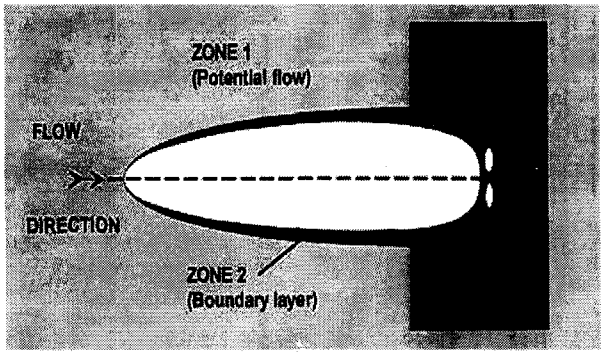

Fig. 1 Division of computational domain in SHIPFLOW

2. ANALYSIS METHOD

2.1 Analysis Method

There are three method for computation of factors around ships Free surface is calculated by Panel method assuming Potential Flow then the viscous flow and the flow direction on Fore perpendicular and the middle of ship be presumed by appling Boundary Panal method. after presuming that Numerical analysis doing the thick zone of stern of ships. those equation on thick boundary layer is RAN(Reynolds Averaged Navier-Strokes) appling SKE.

so CHOSUN UNIV. is solving problems of wake and flow around ships using CFD program (SHIPFLOW) we trying to find a agreeable way of comparison between model test using Experimental towing tank and Numerical Towing tank (SHIPFLOW). we need to gather lots of information calculated values as concerned then we'll be able to know method how much should we apply the computed values when we need to select an optimized

vessel.

2.1 Analysis Model

We were trying to compute Series 60 and 8600CBM LPG vessel which building in Dockyard. Series 60 has a lots of information for computation using CFD code and measured using Model test. It's easy to compare the values with them. we did model test with 8600CBM LPG vessel at Mitsubishi Experimental Tank before that we computed the vessel using SHIPFLOW.

3. The Series 60, CB=0.6 hull

The first test case is the series 60, CB=0.6 hull which has been extensively investigated experimentally by research organizations. The experiment results from Kim are here for comparison. the body plan is shown in fig.2 and dimensions in full scale of the series 60 are Lpp=121.9m, B+16.256 m and T=6.502m. the Free surface is covered by panels. The flow around the series 60 hull in fixed mode was computed by liner version of XPAN for the speed range Fn=0.22 to 0.35. The linear wave resistance was obtained from either integration of pressure forces over the body surface over the free surface and We computed 2times for series 60 with different methods. we using command of Xpan at the first computation and XPAN, XBOUND, XMESH, XVISC, XGRID at second.

The experimental values of the residual resistance were computed from factor 0.077. The comparison is shown at Fig.2

and the wave resistance graph figure is quit similar as graph figure of the wave hight near FP. that means most of wave resistance concern in the wave hight on near FP. (Fig.3)

4. The 8600CBM LPG Vessel

The second test case is the 8600CBM LPG Vessel which is building in Shipyard and has been investigated exparimentally by Chosun UNIV. The experiment results from Chosun UNIV. and Mitsubishi are here used for comparison. The main dimension in full scale of LPG vessel(Fig.4

Fig.5)are LPP=113.10m, B=19.80m and T=6.9m. The method of test is same as the series 60 test. We just use the method of Potential Flow command name is XPAN. We found so many problems of Offset file and Solver. so we need to research more for that. Fig.5 Fig.6

5. Calculation Results and Discussion

For the series 60 hull which is very slender the wave resistance was well predicted also we found similarity between a graph of wave hight on FP (Fig.7) and Cw graph (Fig.6)

we can predict that most of resistance in Series 60 concer ned on the wave of FP.

but as you see the graph of LPG vessel we can find lots of differences between Fig.6 and 7. we can predict that LPG vessel speed is so slow so most of resistance concerned on t he viscous resistance.

we tried to analysis these hull using SHIPFLOW and Exp ermental Model test. SHIPFLOW can show us the Wave pro files especially middle of ship. but the wave cut of FP and AP has errors

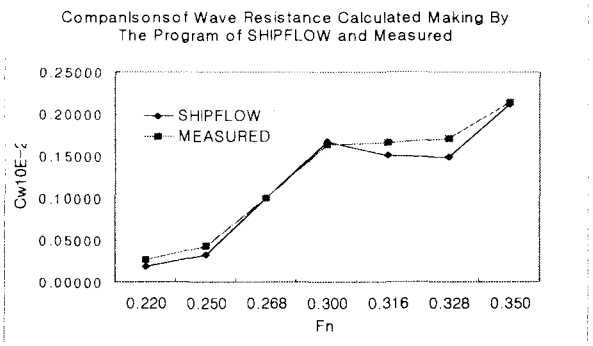

Fig.2 S60 Wave Resistance

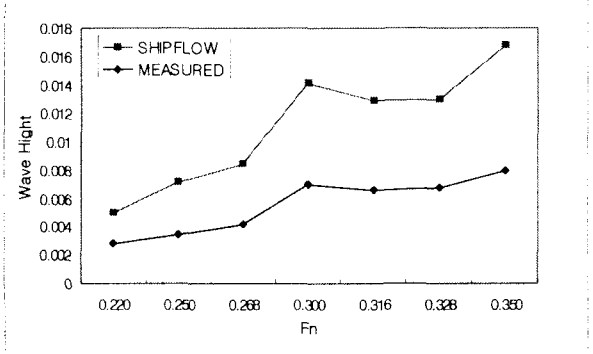

Fig.3 S60 Wave hight on FP

Fig.4 Penal Distribution of Series 60

Fig.5 Panel Distribution

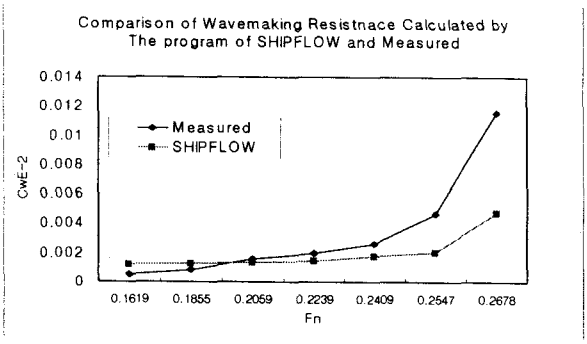

Fig.6 LPG Wave Resistance

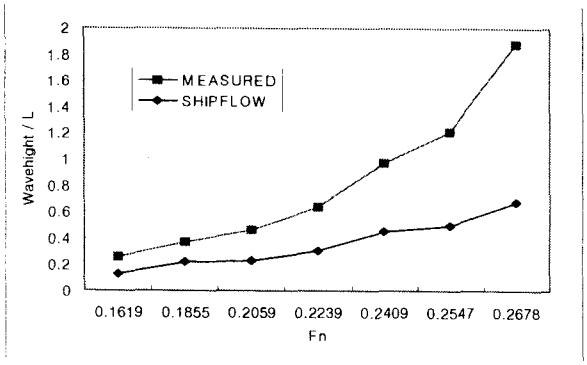

Fig.7 Wave hight on FP of LPG SHIP

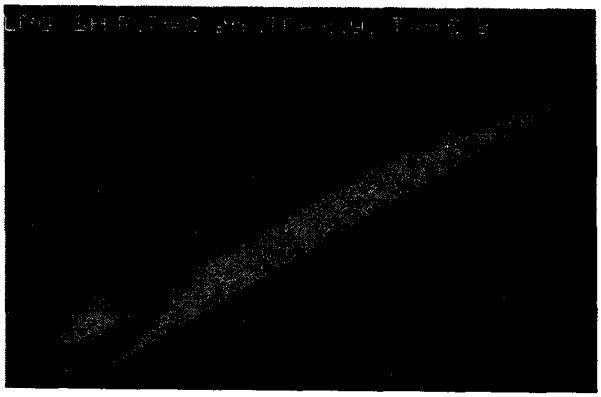

Fig.8 Panel distribution on LPG ship

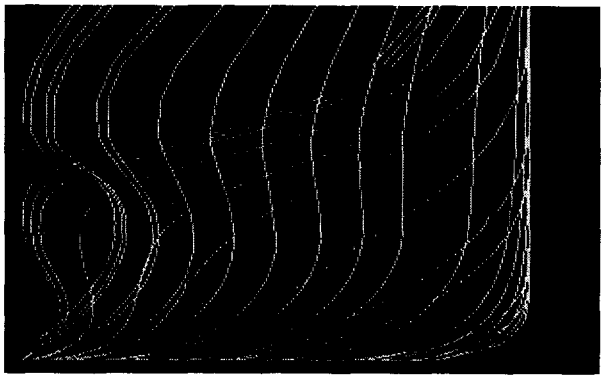

Fig.9 Offset data of LPG vessel

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