A Study on the Effects of Wind Load on the DP Capability

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ABSTRACT

Environmental concerns and high oil prices made vessel owner consider how the fuel efficiency of vessels can be improved in order to reduce operation cost. In case of dynamic positioning vessels, the arrangement of superstructures has a great effect on the fuel efficiency. Because, in most cases, the required thrust of thrusters depends on the wind loads. If less wind loads are acting on the vessel, less capacity of thruster can be selected, which will give a great help to reduce fuel consumption. In this thesis, the effect of wind load on the DP capability was examined. These studies will help research of superstructure arrangement to reduce wind loads.

First, the wind tunnel model test results of various vessel types were reviewed. As a result, the wind load coefficients have been classified according to the shape of graph.

Second, the DP capability analysis was performed in the various wind load coefficients. The DP capability analysis in house program, C-Plot is used in calculation. The wind loads were taken into account, as well as the thrust force generated by thrusters. The maximum wind velocity is calculated, in which the vessel could station keeping.

Finally, the DP capability analysis results were analyzed. As a result, effects of wind loads on the DP capability can be seen. The results of this study will help the research of reduction of fuel oil consumption. The study on optimal arrangement of superstructure will be carried later on.

KEY WORDS: dynamic positioning; station keeping; DP; DP capability; wind load; wind coefficients; thruster capacity; thruster configuration

INTRODUCTION

As the demand of offshore energy market increase, the business market of dynamic positioning vessel, DP vessel, also has grown gradually. The competitions among builders are heightening. The each builder is trying to satisfy the needs of ship owner in order to take lead. The owners want not only high performance of DP, but they also want reduction of fuel consumptions.

Figure 1. Dynamic Positioning – Environmental Forces & Thruster Forces

Dynamic positioning (DP) is a computer-controlled system to automatically maintain a vessel's position and heading by using its own propellers and thrusters. Position reference sensors, combined with wind sensors, motion sensors and gyro compasses, provide information to the computer pertaining to the vessel's position and the magnitude and direction of environmental forces affecting its position.

DSME have developed the dynamic positioning system called MAPS (Maneuvering Aids Positioning System) and it has been applied to 8 LNG RVs. Recently the MAPS has also been applied to heavy lift carrier that can unload the cargoes by float-off method. In addition to DSME have developed the DP capability analysis program (C-Plot) and DP simulation program (DSME DPSIM). Our experiences and technologies will be instrumental in studying the DP capability.

This paper describes the effect of wind load on the DP capability. In case of dynamic positioning vessels, the arrangement of superstructures has a great effect on the fuel efficiency. Because, in most cases, the required thrust of thrusters depends on the wind loads. If less wind loads are acting on the vessel, less capacity of thruster can be selected,