PERFORMANCE OF DOUBLE ACTING TANKER DURING ASTERN IN ICE CONDITION

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Dedicated to...

My beloved mother Zabidah binti Zainudin,

My beloved father Arifin bin Yatim,

My beloved wife Miftahul Jannah binti Mohamad,

My beloved son Muhamad Ar Rayyan bin Muhamad Ridzuan,

Universiti Teknologi Mara,

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ABSTRAK

Tujuan kajian ini adalah untuk menyiasat prestasi kapal tangki dual-tindakan (DAT) semasa bergerak mengundur dalam keadaan lautan diselaputi ais. Reka bentuk kapal adalah berdasarkan reka bentuk yang sedia ada dikenali sebagai Kapal-A yang merupakan kapal tangki yang sudah digunakan di pasaran. Prestasi kapal telah dinilai untuk bergerak mengundur dalam keadaan ketinggitan ais yang berbeza. Reka bentuk kapal baru yang dikenali sebagai Kapal-B telah dibangunkan dengan berpandukan reka bentuk pada Kapal-A dengan pengubahsuaian tertentu pada bahagian belakang kapal. Kesan geometri rekabentuk kapal telah dikaji dan rintangan kapal telah dianalisa. Hasil kajian diantara data Kapal-A dan Kapal-B telah dibandingkan dengan perbincangan mengenai hubungan rekabentuk geometri bahagian belakang kapal dengan rintangan terhadap kapal.

ABSTRACT

The purpose of this study is to investigate the performance double acting tanker (DAT) during astern in ice condition. The design of ship is based on the existing design known as Ship-A which is the tanker that already used in the market. The performance of ship has been evaluated for moving astern in different ice level condition. The design of ship is designed using SolidWorks and Maxsurf. The design from SolidWorks format is used in CFD simulations by ANSYS to evaluate the performance of ship. New ship design known as Ship-B has been developed based on design on Ship-A with certain modification at stern hull. The effect of ship geometry was studied and resistance of ship were highlighted. Results were compared between data of Ship-A and Ship-B come out with discussion about the relationship of stern hull geometry with resistance of ship.

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LIST OF SYMBOLS

d	-	Diameter
F	-	Force
g	-	Gravity = 9.81 m/s
T	-	Thrust
R	-	Resistance
v	-	Kinematic viscosity
σ	-	Ice flexural strength
h	-	Ice thickness
μ	-	Viscosity
A	-	Area
ρ	-	Density
L	-	Length
L_{OA}	-	Length overall
L_{PP}	-	Length between perpendiculars
L_{WL}	-	Wetted length
Ω	-	Angular velocity
P	-	Pressure
V	-	Velocity
T	-	Draught
B	-	Beam
D	-	Depth
ε	-	Dissipation

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CHAPTER 1

INTRODUCTION

1.1 Background of study

The increasing of shipping activities through the Northern Sea Route (NSR) and growth of oil and gas activities in Arctic and Sub-Artic regions required suitable design of ice-going ships and planning operations in ice. The characteristic of ice should be noted depends on locations of ice, form of ice level, ice ridges and icebergs. Figure 1.1 shows the typical geographical regions where the ice actions are of current concern[1].

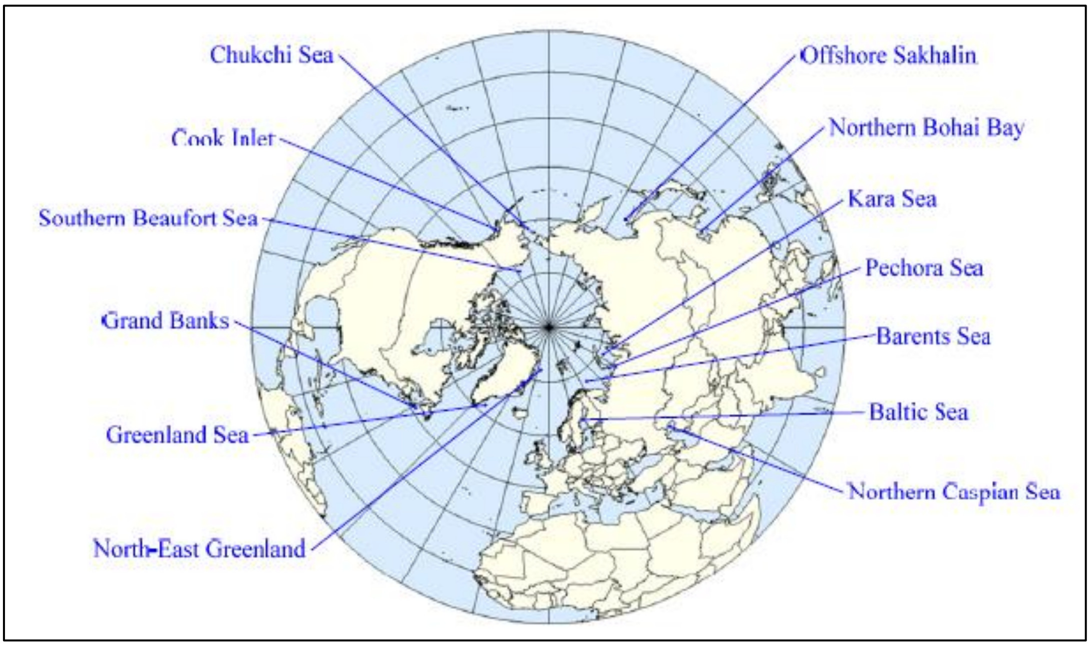

Figure 1.1: Location of ice actions[1]

Design of ice-going ships requires considering the performance, adequate hull and strength of machinery and good functioning of the ship in ice condition and open water condition. Nowadays, the ice-going ships has been develop that called as Double Acting Tanker (DAT) which is can run astern more efficiency than ahead in ice condition[2].

There is a lot of research finding the optimum design of hull for best performance of double acting tanker in ice condition during astern. In addition, the lacks of research about DAT in ice condition during astern also motivate us to do the case study for performance of DAT. The existing research has been doing the analysis of performance of DAT with different angle of stern design. Hence, to finding better design of stern hull and optimum performance of tanker, this thesis has been doing

1.2 Problem Statement

The running in astern mode of DAT in ice condition will give effect to thrust, wake and ice cutting performance. Beside that the design of stern hull will gives impact to the performance of DAT

1.3 Objective

The objectives of this research are:

i. To evaluate hull performance of double acting tanker during astern operation.
ii. To analyse the performance of double acting tanker during astern in ice condition using different ice level.

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