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Structure and Applications of Small Fishing Vessels

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Abstract

Small fishing vessels are involved in a significant number of maritime accidents in coastal waters. Performing dynamic simulations to estimate the trajectories and motions of vessels is frequently required in the investigation of maritime accident causes. For accurate simulations, vessels' initial conditions, including main dimensions, loading conditions, and hydrostatic properties, are necessary. During their fishing operations, small fishing vessels typically have few records of hydrostatic properties. As a result, methods for estimating the hydrostatic properties of small fishing vessels are suggested in this research. The initial focus is on the hull form characteristics of Korean small fishing vessels. The majority of vessels share similar hull shapes and have hard-chines and centreline skegs. The vessel widths and depths are used to normalize the Bonjean curves of several small fishing vessels whose gross tonnages are below 10 tons. Normalized bonjean curves are used to derive representative bonjean curves, and a representative hull plan is also produced. The representative bonjean curves can be used to calculate fore and aft drafts under the condition that weights and buoyancies are in equilibrium if the vessel loading conditions, such as total weights and centers of gravity, are provided. The representative hull plan is also used to estimate metacentric heights. When the proposed iterative estimation procedures for estimating drafts and metacentric heights are compared to actual vessel data, the estimated values are in good agreement with the actual values. Metacentric heights of vessels, as well as normalized fore and aft drafts, can be expressed as linear functions of normalized total weights and centers of gravity. Drafts and metacentric heights empirical formulas are proposed and shown to yield reasonable results that are comparable to those obtained by iterative estimation procedures employing representative bonjean curves and hull plan.

Keywords: Fishing vessels; Coastal waters; Hydrostatic properties; Buoyancies

Introduction

Coastline seas are frequently the scene of maritime accidents involving small fishing vessels. As indicated by the past examination by Park and Yeo, as of late 70% of Korea beach front oceanic mishaps are connected with fishing vessels, and 65 percent of those fishing vessels have gross weights under 10 tons. The investigation of the causes of accidents involving fishing vessels and the prevention of related accidents are essential [1].

To examine the reason for oceanic mishaps, playing out the unique reproductions by utilizing numerical models of vessels and environments is vital. Directions and movements of vessels are assessed through unique recreations, vessel ways of behaving are delicately impacted by starting circumstances like primary aspects, loads and hydrostatic qualities. In order to carry out dynamic simulations as accurately as possible, it is necessary to have specific information regarding the vessels' initial conditions. During operation, the majority of small fishing vessels do not keep many records of their weights or hydrostatic properties. For the purpose of accident simulations and analyses, it is therefore necessary to develop estimation techniques for the initial conditions of small fishing vessels [2, 3]. Based on the similar hull form characteristics of small fishing vessels, estimation methods for hydrostatic properties like drafts and metacentric heights of vessels are proposed in this study.

The hydrostatic properties of small fishing vessels have been the subject of a few previous studies. Through the regression analysis of several Korean fishing vessels, Park proposed empirical formulas for metacentric heights, centers of buoyancy, and centers of gravity. Using a variety of trawler hull series, Yilmaz and Kkner conducted regression analysis and proposed formulas for the functions of vessel dimensions for the centers of buoyancy and metacentric heights. Kim and Park researched strong qualities of 10 little fishing vessels at zero speed and at rapid turns, proposed new strength measures [4, 5]. Using statistical analysis, Kwon and Lee investigated the stability criteria for small fishing vessels. Mantari concentrated on flawless strength of some Portuguese fishing vessels under the activity of fishing gear, pillar waves and winds. It was affirmed that the steadiness disappointment can happen with behaving minutes by fishing gear activities and ecological burdens. Gonzalez's most recent research resulted in the development of a program for assessing the stability of fishing vessels in the event of an accident. This program examines the stability of fishing vessels in the event of an accident in order to determine the factors that led to the incident.

Yeo's research has recently produced a maritime accident reconstruction, investigation, and analysis system. The three types of sub-functions that make up that system are data visualization, data storage, and estimation of unknown data. Additionally, Kim and Yeo proposed methods for estimating weight parameters of small fishing vessels involved in accidents using unknown data [6]. The current study is also one component of Yeo's work to develop the "unknown data estimation" function. This study suggests methods for estimating unknown hydrostatic values of small fishing vessels. The initial focus is on the hull form characteristics of Korean small fishing vessels. One type of representative normalized bonjean curve and hull plan can be

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derived from multiple bonjean curves normalized with vessel breadth and depth because small fishing vessels generally have similar hull forms and appendages. The representative bonjean curves can be used to estimate a vessel's fore and aft drafts with the restriction that weight and buoyancy are in equilibrium if the vessel's main dimensions and weight parameters are known [7, 8]. Metacentric height can also be calculated using the water plane shapes that correspond to fore and aft drafts and the representative hull plan. With intact stability data from actual fishing vessels, the current iterative estimation procedures are confirmed. Normalized drafts, KB, and BM can be represented as the linear functions of normalized weights and LCG by means of the additional parametric calculations. Additionally, empirical formulas for the draft and GM are proposed and tested.

Ecosystem approaches to resource planning, which take into account species vulnerability and intricate social and economic factors, rely heavily on monitoring fishery activity. This data is used by systems for integrated environmental assessment to simulate casual connections between driving forces, pressures, chemical-physical and biological states, and the effects and responses of ecosystems. In this context, fishery activity classification is an essential part of systems that help policymakers comprehend patterns in fishery activity and the effects of regulations and management strategies on the quality of ecosystems [9, 10]. Due to the heterogeneity of nomenclatures, accessibility of data resources, interoperability of methodologies, and scalability and reusability of models across ecosystems, vessel-data processing systems and DPSIR frameworks currently have limitations. In addition, very few of these systems guarantee the open repetition and reproduction of the results to decision-making authorities.

Information sent by vessels during navigation via an Automatic Identification System or other radio and satellite-based systems is frequently the foundation for fisheries data processing. Coordinates, speed, route, vessel identity, and day/time are typically transmitted by vessels. Due to the terrestrial receiver and vessel type, AISs may have limited range coverage despite having a high reporting frequency. Furthermore, data quality can be compromised by technical and meteorological issues [11].

By integrating gear-specific data, logbook data, and shared data between ports, a number of vessel data processing systems improve information coverage and quality. In addition, present day scientific structures coordinate and connect vessel information with other information wellsprings of fisheries, biodiversity, and cultural data to separate new information. These frameworks can be used in maritime spatial planning for the following reasons: i) determining the locations of the highest density and intensity of fishing activity in particular monitored regions; ii) estimating the spatial overlap between large-scale and small-scale fisheries; iii) monitoring activities that are not regulated; iv) studying the interaction between species and vessels; and v) monitoring maritime traffic [12-14]. These methodologies frequently use fishing movement arrangement calculations in light of AIS information, which are either rule-based cycles or AI models.

Conclusion

The study's conclusions propose an iterative calculation method for estimating small fishing vessels' metacentric heights (GM) and fore and aft drafts. Additionally, intact stability data from actual vessels are used to validate the proposed procedure.

Conflict of Interest

None

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