UNIVERSITI TEKNOLOGI MARA

Design and Development Of An Enhanced Metacentric Height Measurement Tool for Laboratory Experiment

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ABSTRACT

The researches of fluid dynamics and stability of floating objects is the most importance in many fields such as shipbuilding and naval architecture. One measurement tool that is used to analyze the stability of floating objects is the metacentric height. The metacentric height measures the distance between the center of gravity and the metacentre of a floating body. The current metacentric height measurement tools used in laboratory experiments suffers from many problem like inaccurate measurement, limited data acquisition, limited experimental flexibility and lack of user-friendliness. The methodologies used in this project is research and analyze the existing metacentric height measurement techniques and tools, concept development based on identified requirements and objectives , testing and validation for accuracy, reliability, usability and compatibility. After that, for the expected result, it is surely to improve the metacentric height's accuracy in measuring the value, also to enhance data acquisition capabilities and to increase the experimental flexibility during lab experiments.

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CHAPTER ONE
INTRODUCTION

1.1 Background of Study

The stability analysis of floating bodies, such as ships, offshore structures, and marine vessels, is crucial in naval architecture and ocean engineering. The metacentric height (GM) is a key parameter that determines stability of a floating object. The metacentric height (GM) is used to measure the initial static stability of a floating body. It is calculated as the distance between the centre of gravity of a ship and its metacentre. A larger metacentric height implies greater initial stability against overturning [1]. A parameter such as metacentric height of the ship, is determined based on the swinging time of the ship by utilizing a predetermined algorithm [2]. The system for definition of a metacentric height of a ship contains gauges to measure a displacement torque and a roll angle [3]

Metacentric height is not only being used in ocean engineering or any other industry, but also being used for education purposes. In the vast realm of naval architecture, the concept of metacentric height stands as a cornerstone. It's a term that, while perhaps unfamiliar to many, plays a pivotal role in ensuring the stability and safety of ships [4]. For example the mechanical engineering student in UiTM is also using this product to deepen their understanding toward metacentre and stability of floating body. The students will use this product to completed their laboratory experiments and require them to record all the data. However, the metacentric height measurement tools that is being used in the laboratory have a limitation in accuracy of measuring the value, data acquisition, usability and experimental flexibility. The determination of metacentric height is important while investigating the stability of the floating bodies such as ships, [5] Therefore this study aims to design and develop an enhanced metacentric height measurement tool. The enhanced tool will include advanced inclinometer , good data acquisition and user-friendly.