EXPERIMENTAL DESIGN ANALYSIS AND COMPARISON OF FORM OF FORECASTLE DECK EDGE USING WAVE SPEED VARIATION USING COMPUTATIONAL FLUID DYNAMICS

by Sulaiman Sulaiman

International Journal of Civil Engineering and Technology (IJCIET)
Volume 10, Issue 1, January 2019, pp.451–454, Article ID: IJCIET_10_01_042
Available online at http://www.iaeme.com/IJCIET/issues.asp?JType=IJCIET&VType=10&IType=1
ISSN Print: 0976-6308 and ISSN Online: 0976-6316

EXPERIMENTAL DESIGN ANALYSIS AND COMPARISON OF FORM OF FORE-CASTLE DECK EDGE USING WAVE SPEED VARIATION USING COMPUTATIONAL FLUID DYNAMICS

Suharto, Hartono, Sulaiman
Department of Naval Architecture, Vocational Program,
Universitas Diponegoro, Semarang 50275, Indonesia

ABSTRACT

The purpose of this study is to design experiments to determine the impact of ship aerodynamics in Indonesia using the Computational Fluid Dynamic method and compare the impact of fuell consumption and load from experimental testing. Thus, it can be known in detail about the voltage that occurs up to the final speed of the ship during testing. In the preparation of this research the first step is to model the end of the ship using CAD software from the original model used in experimental testing. The next thing is to determine the value of the mechanical properties of the material and then put it in the CAE software. In CAE software, it is also determined about the boundary conditions of the material and then determines the speed. The next thing to do is the process of meshing the plate and ammunition and after the meshing process is proceeded to the running process. In contrast to experimental testing where there are various obstacles, the data produced by testing the Computational Fluid Dynamic method and experimental testing can sometimes be different. This is because in the testing process using Computational Fluid Dynamic, conditions are always in optimal conditions.

Keywords: ship design, Computational Fluid Dynamic,experimental design, fore-castle deck edge, wave speed variation.

Cite this Article: Suharto, Hartono and Sulaiman, Experimental Design Analysis and Comparison of Form of Fore-Castle Deck Edge Using Wave Speed Variation Using Computational Fluid Dynamics, International Journal of Civil Engineering and Technology (IJCIET), 10 (1), 2019, pp. 451–454.
http://www.iaeme.com/IJCIET/issues.asp?JType=IJCIET&VType=10&IType=1

INTRODUCTION

Most ship design tests are still carried out experimentally, where experimental testing has a high cost (Woelke, 2010; Gerard, 1957; Woisin, 1988). This is because the test specimen can only be used for several tests and if it cannot be used then the specimen must be replaced with a new specimen. The shape of the end of the ship (the height of the bow) began to be developed in the last few years, because this affected the loading capacity of the movement and the resistance on the ship. Besides that, the speed of the ship is also determined by the length (L), Width (B), depth, and coefficient of fineness, displacement, and selection of msein types which have an influence on the speed and strength of the ship (Rouf, 2004).

However, until now the testing of ship design has largely been carried out experimentally with a high cost (Woelke, 2010; Gerard, 1957; Woisin, 1988). This is because the test specimen can only be used for several tests and if it cannot be used then the specimen must be replaced with a new specimen. There is a more economical alternative test that is using the Computational Fluid Dynamic method. In testing using finite elements, designs can be modeled in 3 dimensions using a computer. The advantage of using the finite element method in this impact test is that in addition to lower costs, the results can vary. A researcher can get results regarding the shape of the deformation of the plate, the stress that occurs both on the plate, and the energy that occurs on the ship.

However, even though testing uses the finite element method has quite a lot of advantages compared to experimental, research on endurance testing uses a method of elements that is still very little. This is because ballistic simulation using the finite element method is one of the relatively new methods and is classified as a heavy simulation so that few people understand this. The purpose of this study is to design an experiment to perform collision resistance test models using the Computational Fluid Dynamic method, designing a study to validate the results of experimental testing with Computational Fluid Dynamic method to find optimal nodal numbers, and design test simulations with variations in arrangement and plate material using Computational Fluid Dynamic method.The benefits of this design are by obtaining deformation or other impacts on the height of the impacted vessel from drag at a certain speed in order to get the design of the ship with high fuel efficiency and maximum capacity.

Impact Test

Impact testing is testing using rapid loading. The impact test is carried out by giving rapid loading which is limited to a certain area of a material. The impact energy absorbed by the specimen until a fault occurs which is expressed in joule units is used to determine the level of material toughness (Kilduff, 1996). The amount of energy required by the pendulum to break composite material specimens is (Shackelford, 1992)

Impact Testing of the Charpy Method

The Charpy impact test (also known as the Charpy v-notch test) is a high strain rate testing standard that determines the amount of energy absorbed by the material during a fault. The absorbed energy is a measure of the toughness of a particular material and acts as a learning tool depending on the brittle ductile transition temperature. This method is widely used in industries with critical safety, because it is easy to prepare and do. Then the test results can be obtained quickly and cheaply. The equipment used in impact testing is Charpy type impact test equipment and specimens (Ismail, 2012).

Testing the Impact of the Izod Method

The Izod test method is commonly used in England and Europe. The Izod test object has a square or circular cross section with a V notch near the pinned end, then the impact test with this method is generally also carried out only at room temperature and is intended for materials designed for cantilever. The fundamental difference between Charpy and Izod is the placement of specimens. Testing using Izod is not as accurate as the Charpy test, because in Izod the specimen holder also absorbs energy, so that the measured energy is not the energy that is able to absorb material completely (Ismail, 2012).

The following are the advantages and disadvantages of the Izod method:

Strengths:

- a. The collision is right on the notch because the workpiece is gripped.
- b. Can use larger size specimens.
- c. The specimen is not easily shifted because it is gripped at one end.

Losses:

- More expensive testing fees.
- Loading is carried out only at one end, so the results obtained are not good.
- The time spent is quite a lot because of the many testing procedures, from clamping the workpiece to the testing stage.

TESTING METHOD

Composite Material Specifications

To test the strength of a structure, the most important thing to look for is the value of voltage and deflection. The value of the voltage and deflection can be known from one of the data materials used. The material of the plate is Un-heat treated steel (soft plate) and heat treated steel (hard plate).Following are some of the assumptions used in this simulation:

- Thickness of each plate tested is 6 mm.
- The experiment was carried out with the most critical firing angle of 90 °.

Modeling Process

One of the most basic stages in the simulation is drawing cad or object images that will be simulated using Solidworks 2016 software. Subsequently, geometry, simulation, mesh determination, mesh variation, data in the form of drag values are then converted to fuel efficiency.

The Effect of NotchShape On Impact Testing

The shape of the notch is very influential on the severity of a material, because of differences in distribution and concentration of stress on each of these notches which results in different impact energy. The following is the order of impact energy that is owned by a material based on the shape of the notch.

- Triangle notch (V)

It has the smallest impact energy, so it is most easily broken. This is because the voltage distribution is only concentrated at one point, namely at the tip of the notch.

- Rectangular notch

Rectangular notch has greater energy at the triangular notch because the voltage is distributed at 2 points at its angle.

- Half circlenotch

This notch type has the greatest impact energy because the stress distribution is spread on each side, so it is not easily broken (Khaeran, 2011). Figure 1. Triangle (V), Half-circle, Quadrangle Notchs

Source: Faishal, 2015

Computational Fluid Dynamic

Computational Fluid Dynamic (CFD) is a computer-based tool for simulating the behavior of a system of fluid flow, heat transfer, other physical processes. The mechanism of action by solving fluid flow equations includes a desired area, with conditions at the boundaries of the area being specific and known. There are a number of solution methods used for CFD codes. The most widely used solution method is the volume technique. In this technique the analysis area is divided into several sub-regions called the regulating volume. The set equation is then discreted and resolved interactively for each set volume. The result is an approximation of the value of each variable at a certain point in the domain. In this way we get a full picture of the desired flow behavior.

CFDs are achieved by engineers and scientists in the fields of aviation, automotive, energy generation, shipping, petroleum, and electronics. The code on the CFD is arranged in a numerical algorithm that can handle fluid problems. There are 3 main stages in conducting CFD, namely pre processor (input fluid problem), solver (main technique for finding numerical solutions), and post processor (final result).All flows that occur in the engineering world that count with reynold numbers will be seen in the Computational Fluid Dynamic simulation.

REFERENCE

[1] AASHTO.1991. *Guide Specification and Commentary for Vessel Collision Design of Highway Bridge, GVCB-1*. Washington, DC: American Association of State Highway and Transportation Officials,.

[2] Amdahl, J. 1983. Energy Absorption in Ship-Platform Impacts. Dr. Ing. Thesis, Report No. UR-83-84. The Norwegian Institute of Technology, Trondheim.

[3] Callister, W.D. 2007. Materials Science and Engineering. Department of Metallurgical Engineering. The University of Utah: John Wiley & Sons, Inc.

[4] Dieter, G. E., & Djaprie, Sriati. 1993. Metalurgi Mekanik I. Erlangga. Jakarta

[5] Faishal, Ahmad. 2015. Material Teknik Pengujian Impak. http://materialteknikafcoo19.blogspot.co.id/

[6] Gerard, G.1957. Compressive Strength of Flat Stiffened Panels. National Advisory Committee for Aeronautics, NACA TN3785.

[7] Ismail, Fajar. 2012. Rancang Bangun Alat Uji Impak Charpy. Universitas Diponegoro. Semarang

[8] Johnson, E.A., Flores. M. Saleh. L. Edwardsm. 2011. Ballistic Performance of Multi-Layered Metallic Plates Impacted by a 7.62-mm APM2 Projectile. International Journal of Impact Engineering. Australia

[9] Saul, R., and Svensson,H. 1983.Meansof reducing consequences of ship collisions with bridges and offshore structures. IABSE Colloquium on Ship Collision with Bridges and Offshore Structures, Copenhagen

[10] Wierzbicki, T. 1983.Crushing behaviour of plate intersections. Structural Crashworthiness (edited by N. Jones and T. Wierzbicki); Chapter 3.London: Butterworth and Co.

[11] Woisin, G. 1979. Design against collision. Proc. Int. Symposium on Advances in Marine Technology. Vol. 2. Trondheim

EXPERIMENTAL DESIGN ANALYSIS AND COMPARISON OF FORM OF FORECASTLE DECK EDGE USING WAVE SPEED VARIATION USING COMPUTATIONAL FLUID DYNAMICS

ORIGINALITY REPORT

2%	0%	0%	2%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

MATCH ALL SOURCES (ONLY SELECTED SOURCE PRINTED)

2%

★ Submitted to University of Glamorgan

Student Paper

Exclude quotes	On	Exclude matches	Off
Exclude bibliography	On		