

DESIGN BY ANALYSIS OF RUBBER FENDER PRODUCT

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Abstract— One indicator of the progress of a nation is to have a strong industry, resulting in a superior product that can compete in the global era. Countries that have advanced technology and industry will be more prosperous and respected by other countries because they have excellent products that sell well in the international market. Industrial progress requires human resources (HR) that are able to sustain the growth of the industry. Industrial growth requires cooperation with the education to develop new necessary technologies to improve the quality of its products. Automotive products by Small and Medium Industries (SMEs) do not meet automotive industry standards (ISO TS 16949) that marketing is limited to shop / outlets automotive components for limited purposes. Technical problems encountered by the industry partner is the low quality of the products produced by the Automotive Component SMEs, so the industry which makes excellent products do not meet the standards set by the industry. The purpose of this research is analysis the structure of rubber fenders based software Catia V5. Through design by Analysis (DBA) method, Industry can produce the appropriate components SNI (Standar nasional Indonesia). Design based on Analyzed the structure use CATIA V5 software can produce a quality product and meet product standards.

Keywords —CATIA V5, Design by Analysis, FEA, rubber fender , Small and Medium Industries

I. INTRODUCTION

One indicator of the progress of a nation is to have a strong industry, resulting in a superior product that can compete in the global era. Countries that have advanced technology and industry will be more prosperous and respected by other countries because they have excellent products that sell well in the international market. Industrial progress requires human resources (HR) that are able to sustain the growth of the industry. Industry human resource quality is determined by the education system prevailing in the country. Industrial growth requires cooperation with the education to develop new necessary technologies to improve the quality of its products. Automotive products by Small and Medium Industries (SMEs) do not meet automotive industry standards (ISO TS 16949) that marketing is limited to shop / outlets automotive components for limited purposes. Technical problems encountered by the industry partner is the low quality of the products produced by the Automotive Component SMEs, so the industry which makes excellent products do not meet the standards set by the industry.

One of the automotive products Small and Medium Industries (SMEs) in Semarang is CV. Densuko Jaya which produces automotive components based on fiber and rubber materials. The resulting product CV Densuko does not meet industry standards. The resulting product CV. Densuko does not meet industry standards, because in making the product does not go through of product design based on analysis. One of product CV densuko is Rubber Fender. The function of the rubber fender is absorbing the kinetic energy of the ship. If low quality rubber fenders are used to resist ship docked the part that touches the boat dock will be damaged. To produce automotive product according Indonesian national standard so in design need to analyze the structure. The design must meet acceptable criteria (factor of safety is greater than one).

Structural analysis is performed in order to ensure that a structure will fulfill its intended function in a given loads environment . The structural analysis method used is the finite element method. In the analysis of a structure using the finite element method as a basis for problem solving, has many emerging programming package that offers a wide range of applications are accurate and easy completion of the operation. The program could help solve the problem without having to deep understanding calculations in the finite element method. Finite element method software that is used in the structural analysis of rubber fender is CATIA V5.

II. METHODS OF DESIGN

1. Methode of Design

Method in designing a rubber fender is design by Analysis (DBA). Design by analysis is performed using the FEA (Finite Element Analysis). FEA to calculate maximum stress that occur because of load applied. FEA will be calculated using CATIA V5 software.

2. Modelling

Rubber fender was modeled using CATIA V5 software which is shown in Fig.1. Design parameter of rubber fender is 1000 mm on length, 300 mm on width, and 150 mm in height. The rubber fender design was made from part design menu of CATIA V5.



Figure 1. Rubber fender v- type design using Catia V5

3. Material properties

The material of rubber fender is styrene–butadiene rubber with main properties as specified in table 1

Table 1. Material Properties of Rubber Fender [1]

Material	styrene–butadiene rubber
Young's modulus (N/m ²)	2×10^6
Poisson's ratio	0.49
Density (kg/m ³)	910
Coefficient of thermal expansion °K	1.62e-004
Yield strength (N/m ²)	$6,0 \times 10^7$

4. Load Case

The load cases to be considered during the analyses are 5000N ship longitudinal load, and 300 N of the mass rubber fender.

5. Finite Element Analysis (FEA)

Finite Element Analysis (FEA) is a numerical technique for finding approximate solutions of partial differential equations (PDE) as well as of integral equations. The solution approach is based either on eliminating the differential equation completely, or rendering the PDE into an approximating system of ordinary differential equations, which are then numerically integrated using standard techniques such as Euler's method, Runge-Kutta, etc. Finite Element Modeling is one of the most robust and widely used phenomenon to virtually Investigating the faults occurring in real time problems which are in general difficult to witness [2]. FEA will be calculated using CATIA V5 software.

6. Acceptable Criteria

The factor of safety is a factor of ignorance. If the stress on a part at a critical location (the applied stress) is also known precisely, if the material's strength (the allowable strength) is also known with precision and the allowable strength is greater than the applied stress, then the part will not fail [3]. Design was acceptable if the FS (factor of safety) is more than 1.

III. RESULTS

1. FEA using CATIA

Applied load on rubber fender as shown in Fig. 2. The distributed force (5000N) applied to longitudinal direction of rubber fender, and 300 N of the mass rubber fender.

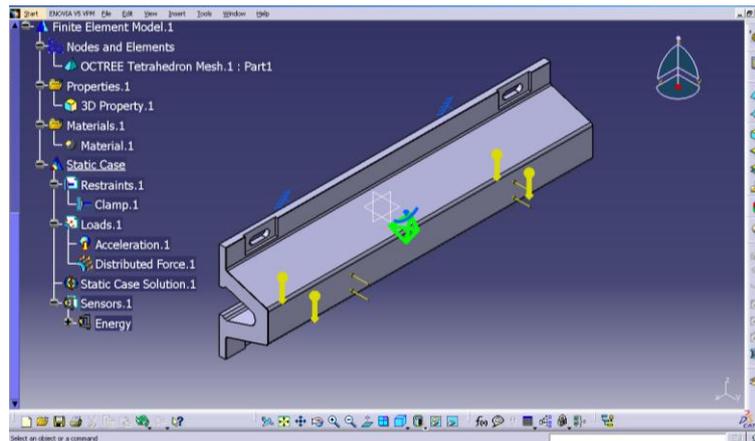


Figure 2. Distributed force (5000N) of rubber fender

Structural analysis of rubber fender has been calculate using finite element analysis (FEA) CATIA V5. The result (Fig. 3) shown the maximum value of von mises stress is $3.45 \times 10^4 \text{ N/m}^2$.

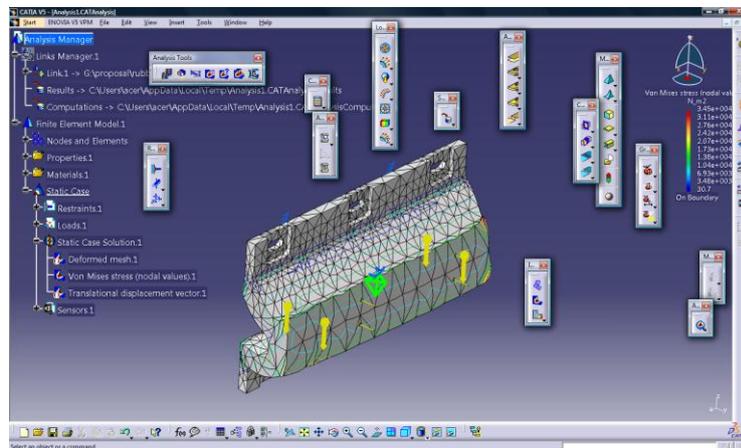


Figure 3. Von mises stress value of rubber fender using CATIA

The maximum of von mises stress was obtained from finite element analysis of the rubber fender using CATIA. The maximum value of von mises stress is $3.45 \times 10^4 \text{ N/m}^2$, and allowable strength (yield strength) of material rubber fender $6,0 \times 10^7 \text{ N/m}^2$, so the design of rubber fender is acceptable from acceptable criteria. FS (factor of safety) of rubber fender using styrene-butadiene rubber is greater than one, so the design is not fail. The structure analysis using FEA CATIA help design engineer of industry to known the design is safe or fail, before production. Design process using method design by Analysis (DBA) gave several advantages, the design process is more efficeince, efectiv, low cost production, the design product can be analyzed before mas production. Trought analyzed of product design, the product can according standart.

IV. CONCLUSION

The FEA result of rubber fender design shown if the design is safe, because the von mises stress is less than allowable strength. The rubber fender design was according standart. Through design by Analysis (DBA) method, industry can produce the appropriate components SNI (Standar nasional Indonesia). Design based on Analyzed the structure use CATIA V5 software can produce a quality product and meet product standards.

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