DESIGN AND ANALYSIS OF CAR SIDE DOOR IMPACT BEAM

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This report is submitted in partial fulfillment of the requirements for the Bachelor of Mechanical Engineering (Design & Innovation)

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MAY 2008

I hereby declare that this project report is written by me and is my own effort and that no part has been plagiarized without citations.

Signature :……

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ACKNOWLEDGEMENT

Syukur Alhamdulillah and thanks to Allah, the Al-Mighty for giving me the patience and high confidence to complete this final year research project. I would like to take this opportunity to express my gratitude towards my supervisor, Mr. Fadzli Abdollah who was guiding me through completing the process. He was the one who not only motivated me but also gave me encouragement and some advises that helps me a lot during the research project.

The deepest appreciation to Mr. Shakir as a technician in Car Noise and Chasis Lab and Mr. Azhar Shah in Material Science Lab (FKP) in UTeM for letting me using the lab and providing me with all the equipments that I needed. And also special thanks to Mr. Tan Chi Seng as giving me permission to use his workshop in Malim Jaya for research purposes.

Not to forget, my appreciation to relatives friends and families for their supports and also to all others who directly or indirectly involved in this final year research project.

ABSTRACT

In serving the best in fuel efficiency, the improvement of passenger car in term of lightweight, shape and impact energy absorption of impact beam are considered in conjunction with problems and safety issues nowadays. This report presents the findings of a need on designing and making analysis on the types of aluminum alloy car side door impact beam that can be sustained the maximum load using Finite Element Analysis (FEA) software instead of studying the impact energy of aluminum alloy compared to high strength steel. By having fully understanding of the stress and deformation due to bending on the impact beam, FEA software and bending theoretical formula can be applied together with impact testing done on both aluminum alloy and high strength steel in order to analyze the energy absorption and temperature effect. From the results, aluminum alloy is lighter and have higher impact energy absorption compared to high strength steel with square hollow cross sectional as the most appropriate shape to be used due to highest maximum load that it can sustained. Besides, the impact energy absorption for both materials does not affected by temperature change. The particular strength of this study is in providing insight into the current use of aluminum alloy as impact beam and its future potential in car manufacture.

ABSTRAK

Bagi menyediakan kecekapan minyak yang maksimum, penambahbaikan kepada kenderaan penumpang daripada segi jisim, bentuk dan penyerapan tenaga hentaman oleh rasuk hentaman adalah dipertimbangkan selaras dengan masalah dan isu-isu keselamatan yang melanda. Laporan kajian ini menyediakan keperluan untuk merekabentuk dan membuat analisis terhadap rasuk hentaman pintu sisi kenderaan penumpang daripada jenis aluminium aloi yang boleh menampung beban maksimum menggunakan Perisian Analisis Unsur Terhingga selain mengkaji mengenai tenaga tekanan dan deformasi disebabkan oleh lenturan ke atas rasuk hentaman, Perisian Analisis Unsur Terhingga dan Formula Teori Lenturan boleh diaplikasikan bersama ujian hentaman yang dilakukan ke atas aluminium aloi dan keluli bertenaga tinggi untuk menganalisa penyerapan tenaga dan kesan suhu terhadap rasuk hentaman. Berdasarkan keputusan, aluminium aloi adalah lebih ringan dan mempunyai penyerapan tenaga hentaman yang tinggi berbanding keluli bertenaga tinggi disamping bentuk segi empat lohong yang paling sesuai digunakan hasil daripada pencapaian beban maksimum. Selain itu, perubahan suhu tidak memberi sebarang kesan terhadap penyerapan tenaga hentaman bagi kedua-dua jenis bahan. Teras kekuatan kajian ini ialah dalam menyediakan wawasan kepada penggunaan terkini aluminum aloi sebagai rasuk hentaman dan potensinya dalam industri pengeluaran kereta.

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A	=	Area
B	=	Depth of The Door
BCC	=	Body-Centered-Cubic
b	=	Width
c	=	Centroid
CFD	=	Computational Fluid Dynamic
d	=	Length
E	=	Modulus of Elasticity
F	=	Force
F_e	=	Equivalent Static Force
FCC	=	Face Centered Cubic
FEA	=	Finite Element Analysis
g	=	Gravity Acceleration
H	=	Height
h	=	Height
HT	=	Heat-Treatable
I	=	Moment Of Inertia
L	=	Length
M	=	Moment
N	=	Newton

NHT	=	Non-Heat-Treatable
r	=	Radius
t	=	Thickness
V	=	Shear
v	=	Velocity
W	=	Width
w_f	=	Final Lateral Dimension
w_i	=	Initial Lateral Dimension
Δw	=	Lateral Expansion
x	=	x-axis
y	=	y-axis
Π	=	pi
σ	=	Stress
δ	=	Deformation/Deflection
δ_{st}	=	Static Deflection

LIST OF EQUATIONS

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