DESIGN AND IMPACT ANALYSIS OF AUTOMOTIVE B-PILLAR

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"I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of the Bachelor of Mechanical Engineering (Structure & Material)"

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A thesis report submitted to Faculty of Mechanical Engineering in partial fulfillment of the requirement award of Bachelor degree of Mechanical Engineering
(Structure & Material)

Faculty of Mechanical Engineering
Kolej Universiti Teknikal Kebangsaan Malaysia

Mei 2006

"I hereby the author, declare this report entitled "DESIGN AND IMPACT ANALISYS OF AUTOMOTIVE B-PILLAR" is my own except for quotations and summaries which have been duly acknowledged"

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ACKNOWLEDGEMENTS

Alhamdulillah with His Mercy and Blessings, this project was finally successful. I would like to express my deepest gratitude and appreciation to my supervisor, Mr. Tan Chee Fai from Faculty of Mechanical Engineering, Kolej University Teknikal Kebangsaan Malaysia (KUTKM), for his tremendous help, advice, inspiration and unending guidance to me until completing this thesis.

Besides that, I would like to express my sincere thanks to all my family and friends because understand, patience and co-operation. May Allah bless all them. Finally the author is expressing his sincere gratitude to Allah once again who made the study to complete.

ABSTRACT

This project (PSM) is carried out with the purpose of design and impact analysis of automotive B-pillar. The scope of this study is to know the basic system of beam and pillar loaded by the forces. The basic of the analysis is used Nastran/Patran and CosmosXpress software to aid the finite element method. The comparison among the 4 type of beam will be tested to choose the best one beam that can be used in this project like rectangular hollow bar beam and T beam. The designs of the test rig are used Solid Work 2005 software. The fabrication process of the product will be used manufacturing process in the Fakulti Kejuruteraan Mekanikal lab (FKM). The important of the system of the test rig here is to test the pillar strength before the product sell to the customers. The factory can use this product to test their pillar system with the simply usage.

ABSTRAK

Projek (PSM) ini dijalankan adalah untuk mereka cipta dan menganalisis impak yang dikenakan pada automotif B-pillar. Skop bagi projek ini adalah untuk mengetahui sistem asas dalam bendul dan penyokong yang telah dikenakan daya-daya. Sistem asas dalam penganalisaan adalah menggunakan Nastran/Patran dan Solid Work 2005 dalam mengetahui kelemahan sesuatu bahan. Proses merekabentuk adalah menggunakan perisian Solid Work 2005. Manakala proses mereka bentuk bahan menggunakan kaedah proses pembuatan yang dijalankan di makmal Fakulti Kejuruteraan Mekanikal (FKM). Kepentingan sistem penganilisa ini adalah untuk meguji kekuatan penyokong sebelum produk tersebut boleh dijual kepada pelanggan. Kilang-kilang perindustrian boleh menggunakan produk ini untuk menguji sistem penyokong dengan cara yang mudah.

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SYMBOL	DEFINITION
A	Area = mm^2 / m^2
b	width
G	gravity
F	force
y	y-axis
x	x-axis
ξ	Horizontal displacement
η	Vertical displacement
t	thickness
θ	angle
$V(x)$	shearing force per unit length
$q(x)$	downward force per unit area
P	Pressure
ν	Poisson ratio
I	geometrical moment of inertia
Nd	uncertainties
E	energy
T	torque

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CHAPTER 1

INTRODUCTION

1.1 Introduction

As a pillar is loaded, different regions of the pillar are subjected to varying internal shear forces and bending moment. Like a simple words the pillar will deflect. Determining the deflection of the pillar under a giving loaded condition is of particular interest. This is generally accomplished either by integration or by using area moment-method.

This project presents herein focus on integration. Most of this analysis will be use in the constructions side to check the failure of the pillar to support the beam. The material in use just a cheaper cost to analyze the pillar. So in this case we put the metal characteristic in the object measuring (pillar-tester) to the subject (B-pillar or other pillar) we use in producing or constructing method. As a good pillar-tester that we can sell to our customers may be in one day so we must know what the customer need such as their confident, easy using object, portable, low cost, flexible, and lightweight.

So the objectives not just to have our good report to our reader but we need to prove our project in good condition. The pillar that we need to test is an L-pillar, I-pillar, and E-pillar also. So to test the pillar in the lowest measuring like 1 kilo Newton for the one pulling by the wire cable connected with the motor system.

1.2 OBJECTIVES

The Objectives of the projects as follows:

- Using the knowledge about static load and dynamic force to calculate the beam reaction after load applied.

- This project is important to use in industry to check the pillar.

- Design the proportional models using SolidWork 2005 software and can be choose the best one to make an example product.

- So knowing the method for the test rig, the pillar test rig must be portable, lightly, flexible and useful.

- This project will be analyzed with Finite Element Method such as Nastran/Patran software to know their problem and fatigue.

- This project will be fabricated to make an example for the test rig system.

1.3 PROBLEM STATEMENT

To make sure this design is useful we must know the problem that we will occur. The major case in this pillar-checker is about the specification of the metal consumption.

a) During on pillar-tester inspection, the most problem is unable of inspector to move in a stable condition. So the failure of the tester may be created by the pulling force applied.

b) From the design given we know the place where the failure will happen if we use the larger force. So the lowest force such as 1 kilo Newton to check the failure part for the first analysis.

c) For the cable method we need to check the metal in use either it suitable or not to make a movement while pulling in progress.

d) How about the pillar for hold the pulley to pull the cable? This method was important to make sure our checker will work in good condition. So we need to select the good strength of the cable connecting with the power supply.

e) The good motion and the less friction for our cable we need to check our angular position upon the pulley in use. The angular is from the pulley to the motor side.

f) Other part that needs to make attention is from the pillar position on the tester surface. The good foundation to put the pillar must be analyzed. Use both of screw or wench to lock this part.

CHAPTER 2

LITERITURE REVIEW

2.1 Material

Alloy Steels 4130 related trades name is **Chrome moly-4130**

Principal Design Features: AISI 4130 is a low alloy steel containing molybdenum and chromium as strengthening agents. The carbon content is nominally 0.30% and with this relatively low carbon content the alloy is excellent from the fusion weld ability standpoint. The alloy can be hardened by heat treatment.

Applications: Typical applications for 4130 low alloy steel include. Structural use such as aircraft engine mounts and welded tubing applications.

Machinability: This alloy is readily machined by conventional methods. Machinability is best with the alloy in the normalized and tempered condition. Although the alloy may be machined in the fully heat treated condition, machinability becomes more difficult with increasing strength (hardness) of the alloy.

Forming: Formability is best in the annealed condition for which the ductility is very good. Bend radii of 1t on annealed sheet material may be made.

Welding: 4130 alloy is noted for its weldability by all of the commercial methods.

Heat Treatment: Heating at 1600 F followed by an oil quench will harden the 4130 alloy. For best results a normalizing pre-hardening heat treatment may be used at 1650 to 1700 F followed by the 1600 F soak and oil quench.

Forging: Forge at 2200 F maximum down to 1750 F.

Hot Working: 4130 in the annealed condition has excellent ductility. Thus it is usually not necessary to do hot working to form parts. If hot working is needed it can be done in the range of 2000 F to 1500 F.

Cold Working: Cold working by conventional methods is readily accomplished on this alloy.

Annealing: 4130 (and most of the other low alloy steels) may be annealed at 1550 F for a time long enough to allow thorough heating of the section size. It should then be cooled in the furnace at a rate of less than 50 F per hour down to 900 F, followed by air cooling from 900 F.

Aging: Not applicable to this alloy.

Tempering: Tempering is done to restore some of the ductility that may be lost after the hardening heat treatment and quench, Alloy 4130 is tempered at between 750 F and 1050 F depending upon the strength level desired. The lower of tempering temperature the greater of the strength.

Hardening: Hardening is accomplished by heat treatment or by cold working.

The 4130 alloy is a through hardening alloy and should not be case hardened.