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JUDUL: DESIGN IMPROVEMENT FOR POWER WINDOW
MECHANISM - SCISSOR TYPE

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**DESIGN IMPROVEMENT FOR POWER
WINDOW MECHANISM - SCISSOR TYPE**

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**BACHELOR OF ENGINEERING
UNIVERSITI MALAYSIA PAHANG**

DESIGN IMPROVEMENT FOR POWER WINDOW
MECHANISM - SCISSOR TYPE

BADRUL HISYAM BIN AHMAD

Thesis submitted in fulfilment of the requirements
for the award of the degree of
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Faculty of Mechanical Engineering
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NOVEMBER 2009

UNIVERSITI MALAYSIA PAHANG
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I certify that the project entitled “Design Improvement of Power Window Mechanism – Scissor Type” is written by Badrul Hisyam Bin Ahmad. I have examined the final copy of this project and in our opinion; it is fully adequate in terms of scope and quality for the award of the degree of Bachelor of Engineering. I herewith recommend that it be accepted in partial fulfillment of the requirements for the degree of Bachelor of Mechanical Engineering with Automotive Engineering.

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LIST OF SYMBOLS

F	Force
j_p	The total number of primary joints
j_h	The total number of higher-order joints
τ	Torque
r	Radius
M	Moment
W	Weight
σ	Tensile strength

LIST OF ABBREVIATIONS

CAD	Computer Aided Design
FMEA	Finite Model and Effect Analysis
DC	Direct Current
AISI	America Iron and Steel Institute
FEA	Finite Element Analysis
FYP	Final Year Project
DOF	Degrees of freedom
CG	Centre of Gravity
UMP	Universiti Malaysia Pahang
UTS	Ultimate Tensile Strength
SEV	Ranting for Severity of failure
OCCUR	Ranting for Occurrence of failure
DETEC	Ranting for Detection of failure
RPM	Risk priority number

ABSTRACT

Power window regulator is a mechanism for raising and lowering door glass. It consists of a set of gear, electric motor and door sash channels. For this project, power window design of the Proton Gen-2 was selected, where the improvement had been made at main arm and slider. The main arm and slider was designed using CAD software. Then, the design was analyzed using FMEA method and FEA (ALGOR) software. These analyses were done to find the best design that can optimize the operation for the stress analysis. There is one design for main arm and two designs for slider had been done. The analysis showed that both of the new designs are better compared to current design. For the both designs, the result showed that when force are applied, the displacement of improvement design that occur is lowest than current design. In conclusion, this improvement can reduce the cost of repairing because the improvement made can hopefully reduce the failure occurrence for that specific power window mechanism.

ABSTRAK

Tingkat kuasa pengatur adalah satu mekanisma untuk menaikkan dan merendahkan kaca tingkat pintu. Ianya terdiri daripada set roda yang bergigi, motor elektrik dan saluran pintu jendela. Untuk projek ini, rekabentuk tingkat kuasa Proton Gen-2 telah terpilih dimana peningkatan itu telah dibuat pada lengan utama dan gelangсар. Lengan utama dan gelangсар telah direkabentuk menggunakan perisian CAD. Kemudian, rekabentuk dianalisis menggunakan kaedah FMEA dan perisian FEA (ALGOR). Tujuan analisis dilakukan adalah bagi mencari rekabentuk terbaik yang boleh menoptimumkan operasi untuk analisis tegasan. Terdapat satu corak untuk lengan utama dan dua rekaan untuk gelangсар telah dilakukan. Analisis itu menunjukkan yang kedua-dua rekabentuk baru itu adalah lebih baik berbanding untuk rekabentuk semasa. Untuk kedua-dua rekaan, hasilnya menunjukkan yang apabila daya dikenakan, sesaran peningkatan rekabentuk yang berlaku lebih rendah daripada rekabentuk semasa. Kesimpulannya, peningkatan ini boleh mengurangkan kos pembaikan kerana peningkatan mekanisma dibuat boleh mengurangkan kegagalan berlaku untuk mekanisma tingkat kuasa tertentu.

CHAPTER 1

INTRODUCTION

1.1 POWER WINDOW

Power assisted door glass is defined as automobile window which can be raised and lowered by depressing a button or switch as opposed to using a hand-turned crank handle. This system is also coined as power window in automotive industry. The power window of a vehicle door window is a device installed between the vehicle door panels and has a simple top level functional requirement. The glass guidance system will raise and drop the window glass with a reasonable speed from the electrical power window motor. There have a two different power assisted door glass system which are available in market. There are cable-drive system and cross arm system (scissor type system). The scissor type system is not widely use because of the high cost and heavy. However these functional systems are simple compare with cable drive system. In the scissor type system, there are four main parts, which are main arm, sub arm, sector gear, and electric motor. A typical scissor type system is show in Figure 1.1.

The entire system consists of four major subsystems, which are metal panels, seal, glass, and regulator. The glass movement is driven by the regulator (scissor type

system), which is powered by an electric motor. The small electric motor is connecting with pinion gear that is attached to sector gear at the main arm. The glass movement which is powered by an electric motor will require a torque to overcome friction within regulator mechanism (scissor type system), friction between glass and seal.

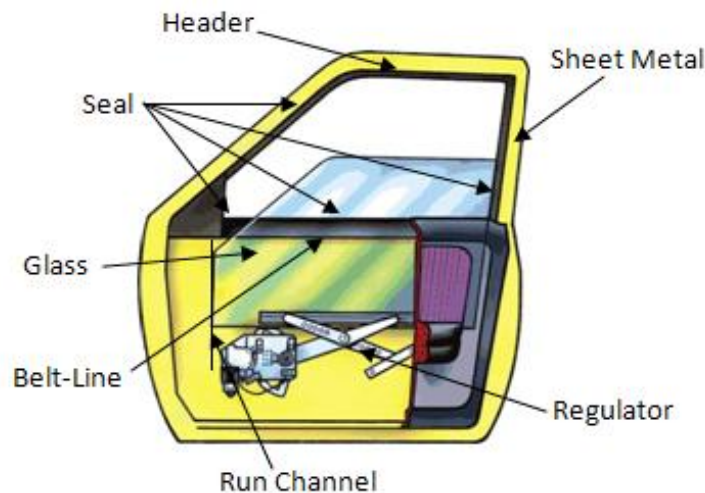


Figure 1.1: Typical Integrated Scissor Type System

An integrate scissor type regulator is shown in Figure 1.2. Glass movement is driven by a regulator subsystem through main arm and sub arm, which are driven by a sector gear to move. Ana electric motor powers movement of the sector gear. Carriers (glass holder) are attached to the main channel guide and able to slide by controlling from the slider for main arm and slider for sub arm along the main channel guide. Two major performance requirement of glass guide system should be satisfied for a power window. First, the time for the glass to move from its fully down position to its fully up position should not cause component failures or create unreasonable risk of injuring the occupants of vehicle.



Figure 1.2: Integrated Scissor Type Regulator

1.2 PROJECT BACKGROUND

Power window mechanism is the system that raised and lowered the window glass with a reasonable speed. This mechanism is controlled by electric motor which works as the main function in the mechanism. There had a two different glass guidance system that available in market. That is cable-drive system and scissor type system. The main focus in this project is to analyze and improve the current design of scissor type power window mechanism. However, this power window design varies according to manufacturer. To make a new design of power window, there are several stage and procedure base on the standard in manufacturing.

The new design power window is draw base on the current design for the guide of the parameter or dimension. Base on the new design, it will analyse first. To analyze it, the center of gravity of the glass is proposed to be determined so as the force that acting on the main arm and sub arm. The method and calculation for the power window force acting can be determined by the change of angle position for the power window. These things can be very important to reduce the failure that occurs in that system. The new design of slider can increase the efficient of the smooth system to operate. That

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