UNIVERSITI TEKNIKAL MALAYSIA MELAKA

REDUCING AIR PRESS TURBULENCE BY CFD ANALYSIS

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Degree of Mechanical Engineering Technology (Automotive Technology) with Honours.

by

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I hereby, declared this report entitled "Reducing Air Press Turbulence by CFD Analysis" is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Mechanical Engineering in Automotive Technology with Honours. The member of the supervisory is as follow:

……

(Project Supervisor)

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ABSTRAK

Dalam kajian saya, akan ada lebih banyak memberi tumpuan kepada model gelora kerana model ini akan digunakan sebagai rujukan untuk mereka bentuk Air Press baru. kajian ini adalah untuk mengkaji profil analisis akhbar udara pergolakan menggunakan CFD dan CATIA dan bandingkan uji kaji. Selain itu, juga memberi tumpuan kepada pengurangan pergolakan udara di akhbar udara merangsang bentuk perbezaan atau reka bentuk website saya dengan perisian Solidworks. Juga menumpukan perhatian kepada pengurangan bunyi oleh pergolakan udara di akhbar udara pada kelajuan tinggi. reka bentuk yang baik daripada Air Press bahawa mempunyai kurang pergolakan dan bunyi berlaku pada ia akan menjadi hasil daripada projek ini siasatan ini akan menjadi sebagai sastera berasaskan dan maklumat ini dengan ini siasatan akan menjadi sebagai rujukan kepada sesiapa yang tahu pergolakan udara peringkat selepas laporan akan dilakukan.

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ABSTRACT

In my study, there will be more focus on turbulence model because this model will be used to as a reference to design a new Air Press. This research is to study the profile of air press turbulence analysis using CFD and CATIA and compare experimentally. Besides that, also focus on reduction of air turbulence at air press the stimulate difference shape or design and check it with Solidwork software. Also concentrate on reduction of noise by air turbulence at air press on high speed. The improved design of Air Press that have less turbulence and noise occur at it will be the result of this project This investigation will be as a literature based and this information by this an investigation will be as a reference to anyone that to know the air turbulence level after report will be done.

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DEDICATION

Dedicated to my beloved mother Rohaya Binti Ali and my brother Hazwan Azfar bin Hashim. To my supervisor Mr. Muhammad Nur bin Othman, lecturers and friends for all their help and support especially my housemate Azad Abu Bakar, Azmir Zainal, Safwan Rahim, Faiz Razali, Shafiq Laili, Khairul Anuar, Hazim Mazlan, Adi Azri, Tarmizi Bahari, Faidhillah Omar and Syed Naguib.

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

Nowadays many people use air press as a accessories at their car, to make their car looks good with air press. But they don't really know the reality function of air press. There are also some people do not like wearing air press in their vehicles for some reason. There are also some people do not like wearing air press in their vehicles for some reason. Some automotive companies manufacture their cars with air press once and there are also companies that do not use air press during production of their cars.

An air press is mounted above the doors of some automobiles, to protect the inside of the car from rain or other precipitation in case of slightly opened windows. Additionally, it may help to prevent precipitation entering the interior in case of an opened door. Air press are also fitted to sunroofs to deviate wind. It is also known as a "window deflector" or a "rain visor" (in countries without monsoon).The primary purpose of air press is to prevent dust, snow, rain, other precipitation or excessive wind from entering to the cabin. Also, air press direct air flows over the vehicle, and thus, reduce the wind noise when driving on moderate speeds. Air press can be installed directly in the window channel or attached to the vehicle's body in the sunroof or side window area using 3M automotive-grade adhesive tape.

Those who never drive with their windows open may see wind deflectors as an unnecessary expense and extra hassle. In the rain, this greatly reduces the amount of water that travels across your side windows. As a result, water is prevented from "blobbing" into gelatinous-like pools that ripple across the windows at speed. And

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because that doesn't happen, salt spray, dirt, and other road contaminants aren't deposited across the entire surface of the windows. With these factors eliminated, side windows stay much cleaner and vision isn't obscured. Dirt and grit left on side windows create a lot of drag on power window motors, window regulator arms, and other components which move when the glass is raised and lowered.

This research is to study the profile of air press turbulence analysis using CFD and CATIA and compare experimentally. In a high speed, turbulence will occur in the air press which is above the window of the vehicle. When the flow detaches, the air flow becomes very turbulent and chaotic when compared to the smooth flow on the front of an object. Turbulence is created by the detachment of an air flow from the vehicle. The final unavoidable detachment at the very rear of the vehicle leaves a turbulent wake. Turbulence will generate noise where it will interfere with the driver. Because of that, this study also focus on reduction of air turbulence at air press the stimulate difference shape or design and check it with Solidworks software.

While driving there will be a lot of noise that would occur. One of which is the result of air turbulence which would occur when the vehicle sustained high speeds. In my research also concentrate on reduction of noise by air turbulence at air press on high speed. The display of Air Press is shown at **Figure 1.1**.

Figure 1.1 : Air Press

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1.2 Problems Statements

Each driver will be driving at different speeds. When in a state of high speeds will inevitably lead to higher levels of turbulence. Turbulence occurs in some places in the vehicle. When turbulence occurs in the air press will cause noise that can interfere with the driver. This noise can affect the concentration of the driver and may cause an uncomfortable to driver. To overcome this problem, an improvement on air press design that can reduce turbulence and noise need to be taken.

1.3 Objectives

The objective of the present research are :

i. To study air press turbulence profile
ii. Study how to reduce air press turbulence and noise cause by air press turbulence

1.4 Scope

The scope of the present research are :

i. Redesign air press using 3D Scanner
ii. To study the profile of Perodua Myvi air press turbulence using CFD and Catia and compare experimentally
iii. Focus on reduction of air turbulence at air press the stimulate difference shape or design and check it with Solidworks software
iv. Focus on reducing noise that make by turbulence

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will discuss and explain about the fundamentals, theories an concepts of this project. This chapter also explains about the perspective, components and method that will be used in this project. The concept of this project will be discussed an explained is more about design and comparison.

2.2 Air Press

The basic role of air press is to avoid clean, snow, rain, other precipitation or exorbitant twist from entering to the lodge. Additionally, air press coordinate wind streams over the vehicle, and hence, decrease the wind commotion when driving on direct speeds. Mostly there are two type of material that use to create air press. It is acryline and stainless steel.

2.2.1 Acrylic

Poly(methyl methacrylate) (PMMA), otherwise called acrylic or acrylic glass and additionally by the exchange names Plexiglas, Acrylite, Lucite, and Perspex among a few others (see underneath), is a straightforward thermoplastic regularly utilized as a part of sheet frame as a lightweight or break safe contrasting option to glass. A similar material can be used as a

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throwing gum, in inks and coatings, and has numerous different employments.

In spite of the fact that not a kind of commonplace silica-based glass, the substance, in the same way as other thermoplastics, is frequently actually named a sort of glass (in that it is a non-crystalline vitreous substance) henceforth its incidental noteworthy assignment as acrylic glass. Artificially, it is the engineered polymer of methyl methacrylate. The material was produced in 1928 in a few distinct research facilities by numerous scientific experts, for example, William Chalmers, Otto Röhm and Walter Bauer, and was first acquired to showcase 1933 by the Rohm and Haas Organization under the trademark Plexiglas.

PMMA is an efficient contrasting option to polycarbonate (PC) when extraordinary quality is a bit much. Furthermore, PMMA does not contain the possibly hurtful bisphenol-A subunits found in polycarbonate. It is frequently favored in view of its direct properties, simple dealing with and handling, and minimal effort. Non-altered PMMA carries on in a weak way when under load, particularly under an effect drive, and is more inclined to scratching than regular inorganic glass, however changed PMMA is once in a while ready to accomplish high scratch and effect resistance. That is a lot of test method used to test the acrylic as a **Table 2.1** below.

Table 2.1: Properties of Acrylic

Mechanical	**Nominal Value**	**Test Method**
Tensile Modulus		
73°F	184000 to 512000 psi	ASTM D638
73°F	342000 to 500000 psi	ISO 527-2
Tensile Strength		

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Yield, 73°F	5420 to 10700	psi	ASTM D638
Yield, 73°F	5370 to 12100	psi	ISO 527-2
Break, 73°F	2800 to 10900	psi	ASTM D638
Break, 73°F	7100 to 11200	psi	ISO 527-2
73°F	5340 to 11500	psi	ASTM D638
73°F	5190 to 11600	psi	ISO 527-2
Tensile Elongation			
Yield, 73°F	2,4 to 5,2	%	ASTM D638
Yield, 73°F	3,6 to 25	%	ISO 527-2
Break, 73°F	0,20 to 15	%	ASTM D638
Break, 73°F	1,8 to 7,2	%	ISO 527-2
Nominal Tensile Strain at Break (73°F)	9,9 to 27	%	ISO 527-2
Flexural Modulus			
73°F	188000 to 512000	psi	ASTM D790
73°F	174000 to 508000	psi	ISO 178
Flexural Strength			
73°F	5300 to 20000	psi	ASTM D790
73°F	7110 to 19100	psi	ISO 178
Yield, 73°F	9130 to 19900	psi	ASTM D790
Break, 73°F	4800 to 15900	psi	ASTM D790
Compressive Strength			

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73°F	14100 to 18000	psi	ASTM D695
73°F	5950 to 17000	psi	ISO 604
Taber Abrasion Resistance (73°F)	0,00100 to 3,81	mg	ASTM D1044

2.2.2 Stainless Steel

Propelled iron and steel advancements have seen impressive improvement over the previous decade and are regularly included into new plans and updates by all automakers. The steel business and segment providers are putting vigorously in advancement. The outcome of the theory is different instances of productive, insightful usage of stainless steel, new plans of iron, top notch steels, and a related combination of new framework, creation, and get together methodologies. Applications incorporate vehicle bodies, as well as motor, undercarriage, haggles different parts. The uses usually show weight lessening in addition to concurrent enhancements in quality, solidness, and other auxiliary execution attributes. In this way, an unmistakable potential exists to reasonably make vehicles lighter and more secure in the meantime (Ghassemieh, 2011).

While body, suspension, motor and other powertrain segments made of ferrous materials include the biggest piece of a vehicle by mass, lightweight steel and iron innovations rival potential substitutes in these applications. Mass decrease through advances in the utilization of iron and steel is critical (ferrous materials), since they are the prevailing material (64% of a regular family vehicle). Iron and steel shape the basic components of structure for by far most of vehicles, and are minimal effort materials with a broad affair base and recognition to the business. (Ghassemieh, 2011)

The previous quite a long while have seen unfaltering increments in the utilization of high-quality steels (HSS), numerous renditions of which are alluded to as high-quality, low-compound (HSLA) steels. These materials in addition to their related propelled outline and creation systems (and also

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enhanced plan and manufacture utilizing customary steels) framed the premise of the American Iron and Steel Establishment (AISI) Ultralight Steel Auto Body (ULSAB) arrangement of studies and exhibition ventures. The ULSAB auto body showed a 19% mass diminishment in a body structure that had predominant quality and basic execution (counting crashworthiness) alongside a decreased parts check and net assembling cost reserve funds contrasted with an ordinary steel body. (USAB, 1998) Equivalent mass diminishments and different advantages were accomplished for entryways, hoods, decklids, and hatchbacks. Enhanced steel materials and shaping procedures permit a noteworthy improvement of vehicle body structures and parts (Ghassemieh, 2011).

The prime purpose behind utilizing steel in the body structure of a car is its characteristic capacity to ingest affect vitality in a crash circumstance. This, in mix with the great formability and joining ability, makes these materials frequently a first decision for the planner of the body-in-white (BIW) structure (Ghassemieh, 2011). The properties of stainless steel is shown below at **Table 2.2.**

Table 2.2: Properties Types of Metals (Ghassemieh, 2011)

Property	Duplex Stainless Steel (1)	Austenitic Stainless Steel			6061 Aluminium Property Alloy		High Strength Steel HSLA
		Annealed	C850(2)	C1000(3)	T4(4)	T6(5)	
Density ρ (g/cm3)	7.8	7.9	7.9	7.9	2.7	2.7	7.83
Yield Stress : σ (N/mm2)	640	370	600	880	130	275	410
Specific Strength (N/mm2/g/cm3)	82	46.8	76	111.4	48.1	100	52.4

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2.3 Computational Fluid Dynamic (CFD)

The shortening CFD remains for computational fluid dynamic. It speaks to an immeasurable territory of numerical examination in the field of liquid's stream wonders. Progress in the field of CFD recreations is firmly reliant on the improvement of computer related advances and on the headway of our comprehension and fathoming common and halfway differential conditions (Tribute and PDE). However CFD is significantly more than "just" computer and numerical science. Since direct numerical tackling of complex streams in genuine like conditions requires a staggering measure of computational power accomplishment in taking care of such issues is particularly subject to the physical models connected. These must be determined by having a complete comprehension of physical wonders that are overwhelming in specific conditions (Sodja, 2007).

2.3.1 Historical Background

The advancement of present day computational fluid dynamics (CFD) started with the approach of the computerized PC in the mid 1950s. Finite difference methods (FDM) and finite element methods (FEM), which are the fundamental instruments utilized as a part of the arrangement of fractional differential conditions all in all and CFD specifically, have diverse birthplaces. In 1910, at the Imperial Society of London, Richardson displayed a paper on the principal FDM answers for the anxiety examination of a brick work dam. Conversely, the main FEM work was distributed in the Aeronautical Science Diary by Turner, Clough, Martin and Topp for applications to flying machine push investigation in 1956. From that point forward, both techniques have been grow widely in fluid dynamics, heat transfer and relate areas (T.J Chung, Computational Fluid Dynamics).

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