THE EFFECT OF ROAD PROFILE ON ONE QUARTER CAR SUSPENSION MODEL

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A dissertation submitted in partial fulfillment of the
requirements for the award of the degree of
Master of Science (Engineering Mathematics)

Faculty of Science
Universiti Teknologi Malaysia

JUNE, 2014

Specially..

To my beloved parents

To my beloved wife

And not forgetting to all friends

For their

Encouragements, Love, Sacrifice and Best Wishes

ACKNOWLEDGEMENT

Praise be to Allah S.W.T to Whom we seek help and guidance and under His benevolence we exist and without His help this project could not have been accomplished.

I would like to express my sincere thanks and appreciation to Associated Professor Dr. Shamsuddin Bin Ahmad, my project supervisor, for all the help, generous and guidance time given throughout the course of completing this dissertation.

In addition, I would also thanks to all my friends and course mates for their assistance, guidance, cooperation and friendship throughout the completion of dissertation.

Last but not least, my gratitude also goes to all my family members for their continuous encouragement and support. Thanks you all.

ABSTRACT

A vehicle suspension system consists a system of springs, shock absorbers and linkages that connects a vehicle to its wheels. The above system serves as comfort and security for the driver and passengers in the vehicle. The main objective of this study is to one quarter car suspension systems subject to a Yellow Transverse Bar road profile. In this study, the suspension of travel limit and magnitude of car's vertical acceleration are validated using the standard of Ford Scorpio car. The vibration of the car is compared with the effect of vibration the car driving on the sinusoidal road profile. The results of the study is obtained and analyzed by using mathematical model in term of Ordinary Differential Equation via Maple 12.

ABSTRAK

Sistem gantungan kenderaan terdiri daripada sistem spring, penyerap hentak dan sambungan mekanikal yang menghubungkan kenderan dengan rodanya. Sistem tersebut memberi keselesaan dan keselamatan kepada pemandu dan penumpang akibat daripada hentakan roda kereta dengan permukaan jalan. Objektif utama kajian ini adalah mengkaji satu per empat sistem gantungan kereta yang melalui permukaan jalan berbentuk Garisan Rentas Kuning. Had gantungan perjalanan dan magnitud cepatan mencangcang kereta disahkan dengan menggunakan piawaian kereta Ford Scorpio. Getaran kenderaan bagi sistem gantungan kereta di atas dibandingkan dengan kesan getaran kereta yang melalui profil jalan berbentuk sinus. Keputusan kajian diperolehi dan dianalisis menggunakan model matematik dalam sebutan Persamaan Pembezaan Biasa dengan pengaturcaraan Maple 12.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENT	iv
	ABSTRACT	v
	ABSTRAK	vi
	TABLE OF CONTENTS	vii
	LIST OF TABLES	x
	LIST OF FIGURES	xi
	LIST OF APPENDICES	xiv
1	**INTRODUCTION**	**1**
	1.1 Introduction	1
	1.2 Background of the Problem	2
	1.3 Statement of Problem	2
	1.4 Objectives of the Research	3
	1.5 Scope of the Research	3
	1.6 Significance of the Research	4
2	**LITERATURE REVIEW**	**5**
	2.1 Introduction on Car Suspension	5
	2.2 The Definition of Suspension	6
	2.3 The Suspension Systems	6
	2.3.1 The Active Suspension System	7
	2.3.2 The Semi-Active Suspension System	8

	2.3.3 The Passive Suspension System	9
	2.4 Comparison of Active Suspension and Passive Suspension	10
	2.5 Modeling of Quarter Car Suspension	12
	2.6 Road Profile	13
	2.6.1 Sinusoid Road Profile	14
	2.6.2 Yellow Transverse Bar Road Profile	15
	2.7 The Newton's Law of Motion	19
	2.8 The Hooke's Law of Motoin	20
	2.9 Second Order Differential Equation	21
	2.9.1 Solution of Homogeneous Equations	21
	2.9.2 Solution of Non-homogeneous equation	22
	2.9.2.1 Method of Undetermined Coefficients	23
	2.9.3 Fourier Series	24
3	**METHODOLOGY**	**28**
	3.1 Square-wave Function	28
	3.2 Sinusoidal Car Suspension System Model	31
	3.2.1 Method of Undetermined Coefficients	33
	3.2.2 Fourier Series	36
	3.3 Maple 12 Software	43
4	**FORMULATION OF A QUARTER OF CAR SUSPENSION MODEL**	**44**
	4.1 Factors to Set Up A Quarter of Car Suspension Model	44
	4.2 Assumptions	45
	4.3 Formulate a Quarter Car Suspension Model	46
	4.4 Solution of a Quarter Car Suspension Model	52

4.4.1 Analytical Solution of a Quarter Car Suspension Model 52
4.4.2 Interpretation and Validation of Graphs 56

5 YELLOW TRANSVERSE BAR ROAD PROFILE 62
5.1 Yellow Transverse Bar (YTB) Road Profile 62
5.2 Formulate a Model on YTB Road Profile 64
5.2.1 Interpretation and Validation of Graph 73

6 DISCUSSION 92
6.1 Discussion on Car Suspension System 92
6.2 Discussion of quarter car suspension system model's via sinusoidal and YTB road profile 93

7 CONCLUSION AND FUTURE RESEARCH 97
7.1 Conclusion 97
7.2 Recommendation for Future Research 98

REFERENCES 100

APPENDIX A - C 103 - 107

LIST OF TABLE

TABLE NO.	TITLE	PAGE
2.1	Yellow Transverse Bar Specification	17
2.2	Roots of the Characteristic Equation	22
2.3	General Solution	22
2.4	Expected trial functions $y_p(x)$	24
6.1	Effect of thickness and width of alert bar on quarter car suspension via YTB road profile	94

LIST OF FIGURES

FIGURES NO.	TITLE	PAGE
2.1	A Soft Active Suspension System	7
2.2	A Stiff Active Suspension System	8
2.3	A Semi-Active Car Suspension System	9
2.4	A Passive Suspension System	10
2.5	Front Vertical Wheel Displacement	11
2.6	Rear Vertical Wheel Displacement	12
2.7	Quarter Car Suspension Model	12
2.8	Sinusoid Road Profile	15
2.9	Yellow Transverse Bar (YTB)	16
2.10	(a) Curve (b) Junction (c) Pedestrian Crossing	16
2.11	Standard Measurement of Alert Bar	18

2.12	YTB Construction	18
2.13	Alert Bar	18
2.14	Square waveform road profile	19
2.15	Sine, Square, Triangle and Sawtooth Waveforms	25
3.1	Square waveform	28
3.2	Partial sums of the Fourier series for the square-wave function	31
3.3	Road Profile	32
3.4	Model of a Car	32
4.1	Sinusoid Road Surface Profile	46
4.2	Simple Car Body Model	47
4.3	Car Body Force Diagram	49
4.4	Displacement x against time t	57
4.5	Displacement x against time t	58
4.6	Displacement x against time t	59
4.7	Displacement x against time t	60
4.8	Displacement x against time t	61

5.1	Alert Bar Measurement	62
5.2	YTB Road Profile	63
5.3	YTB Road Profile with $h = 0.1\text{m}$, $d = 2\text{m}$	74
5.4	Graph of x Various Time t within $0 < t < 15$	75
5.5	Graph of x Various Time t within $0 < t < 15$	77
5.6	YTB Road Profile with $h = 1\text{m}$ and $d = 2\text{m}$	78
5.7	Graph of x Various Time t within $0 < t < 15$	79
5.8	YTB Road Profile with $h = 0.01\text{m}$ and $d = 2\text{m}$	80
5.9	Graph of x Various Time t within $0 < t < 15$	81
5.10	YTB Road Profile with $h = 0.001\text{m}$ and $d = 2\text{m}$	82
5.11	Graph of x Various Time t within $0 < t < 15$	83
5.12	YTB Road Profile with $h = 0.0001\text{m}$ and $d = 2\text{m}$	84

5.13	Graph of x Various Time t within $0 < t < 15$	85
5.14	YTB Road Profile with $h = 0.003$ m and $d = 0.3$m	86
5.15	Graph of x Various Time t within $0 < t < 15$	90
7.1	"Heaviside Waveform" road profile	99
7.2	"Sawtooth Waveform" road profile	99

LIST OF APPENDIX

APPENDIX NO.	TITLE	PAGE
A	Maple Code of Figure 4.4, Figure 4.5, Figure 4.6, Figure 4.7 and Figure 4.8	103
B	Maple Code of Figure 5.4	104
C	Maple Code of Figure 5.5, Figure 5.7, Figure 5.9, Figure 5.11, Figure 5.13 and Figure 5.15	106

CHAPTER 1

INTRODUCTION

1.1 Introduction

A suspension system connects the wheel of the car to the body. In such a way that the body is cautioned from jolts resulting from driving on uneven road surfaces. The suspension affects a car's comfort and performance. The suspension system must also keep tyres firmly in contact with the ground and to provide a comfortable ride for the passengers. The suspension also prevents the car form shaking itself and without the suspension the ride will be so harsh and inconvenient.

The shock absorber is modeled as a simple spring-dashpot system with spring stiffness and dashpot constant. Most car suspension system use springs in the form of a coil or a series of leaves made of steel. The dashpot which is commonly known as damper is usually a hydraulic device which is effectively a position moving inside a housing containing fluid.

1.2 Background of the Problem

The suspension system has two basic functions to keep the car's wheel in firm contact with the road and provides a comfortable ride for the passengers.

As the plunger in the shock absorber causes the fluid to move, a certain resistance to this motion is exhibited; a sort of internal molecular friction. This drag is caused by short-range molecular cohesive forces and it opposed the upward or downward motion of the wheel. Without coil and leaf springs to absorb the vertical energy would jump off uneven road. The suspension system suspends the car's body a short distance above the ground and maintains the body at relatively constant height to prevent it from pitching and swaying. The car suspension system also keeps all four tyres firmly in contact with the ground.

The car's suspension system is also needs to be designed to compromise between the comforts as the road handling can be improved by further investigation and research.

1.3 Statement Problem

A one quarter car suspension system consists a shock absorber and spring. The different of road profiles will give to different vibration on a car suspension system. The suspension system must also keep tyres firmly in contact with the road and to provide a comfortable ride for the passengers.

To study the effect of road profiles on the car suspension system, a specific model of the car suspension system need to be formulated.

1.4 Objectives of the Research

The objectives of this research are:

a) to formulate a quarter car suspension models.
b) to find the solution of the car suspension models.
c) to study the effect of sinusoidal and Yellow Transverse Bar on the car suspension models.

1.5 Scope of the research

There are many models to study the effect of road profile on car suspension systems. In this study we use an ordinary differential equation model.

1.6 Significance of the Research

In recent years, the automobile industry has tried to fulfill customer demand. In order to make it happen is with, put a great efforts in producing highly develop vehicle's suspension system in determining the quality of ride. This research will give benefits to Mathematicians, Physicists, Engineers and others field indirectly to improve the vehicle's suspension system and also improve vehicle's performance.

The advantage that we gain is we will able to investigate into the relationship between alert bar at the road surface and the tyre that rides through the alert bar with a view to identify some peculiar characteristics of this interaction. In particular, the model evaluates the effective distance that should be installed between two road bars. This would help in controlling the speed of vehicles, reduce noise pollution due to vehicle movement and sudden break application, and maintain minimum impact on the vehicles. Otherwise, the application of mathematics is specific to a car suspension system by different road profile.

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