DYNAMIC PERFORMANCE OF LONG COMMERCIAL VEHICLE

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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This report is submitted
in fulfillment of the requirement for the degree of
Bachelor of Mechanical Engineering

Faculty of Mechanical Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2019

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DECLARATION

I declare that this project report entitled “Dynamic Performance Of Long Commercial Vehicle” is the result of my own work except as cited in the references

Signature : .....

Name : .....

Date : .....

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APPROVAL

I hereby declare that I have read this project report and in my opinion this report is sufficient in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering.

Signature :. .....

Name of Supervisor : .....

Date : .....

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DEDICATION

To my beloved mother, Maimun Binti Abdullah and my supportive father, Khairul Azman Bin Hosnan.

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ABSTRACT

Dynamic performance of a vehicle is the important aspect in designing a vehicle. As for commercial vehicle which is related in delivering passengers and goods, comfort and safety are the crucial characteristics that must be taken into consideration. Three type of test simulation which cover ride, handling and stability criteria were carried out to determine the behavior of the vehicle in real world driving condition. Every test was carried out with different test parameters at different vehicle's speeds and masses. In the ride criteria, the bounce sine sweep test was carried out to represent the motion of vehicle when travelling on uneven road surface. Then, the handling criteria used double lane change test to represent the motion of vehicle during overtaking on the highway. For the stability criteria, J-turn type test was carried out to represent motion of vehicle when a sharp steering input was applied to the vehicle in an event of avoiding obstacle during emergency situation. All of the results from the tests are analyzed based on different test parameters to determine the difference in dynamic behavior of the vehicle. Higher values of vehicle's speed and produce higher value of test output results.

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ABSTRAK

Prestasi dinamik sesebuah kenderann ialah suatu aspek yang amat penting dalam fasa rekaan kenderaan. Bagi kenderaan komersial yang amat berkait dalam kerja penghantaran penumpang dan barang-barangan, keselesaan dan keselamatan adalah ciri penting yang perlu diambil kira dalam fasa rekaan kenderaan. Oleh itu, tiga jenis ujian simulasi yang merangkumi ciri penunggangan, pengendalian dan kestabilan telah dijalankan untuk menilai kelakuan kenderaan dalam situasi pemanduan sebenar. Setiap ujian dijalankan dengan menggunakan parameter ujian yang berbeza iaitu kelajuan berbeza dan berat berbeza. Dalam ciri penunggangan, ujian "Bounce sine sweep" telah dijalankan untuk mewakili pergerakan kenderaan ketika melalui permukaan jalan yang tidak rata. Selepas itu, ciri pengendalian menggunakan ujian "Double lane change" untuk mewakili pergerakan kenderaan kereta ketika memotong di jalan raya. Untuk ciri kestabilan, ujian "J-turn type" telah dijalankan untuk menunjukkan pergerakan kenderaan ketika stereng diputarkan dengan keadaan yang tergesa-gesa untuk mengelak daripada halangan ketika situasi kecemasan. Semua keputusan ujian yang telah dijalankan akan dianalisa berdasarkan perbezaan parameter ujian untuk menentukan keadaan kenderaan. Kelajuan dan berat kenderaan yang tinggi akan menghasilkan keputusan ujian yang tinggi.

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ACKNOWLEDGEMENT

I would like to thank my supportive supervisor, PM. Dr. Mohd Azman Bin Abdullah, for guiding me throughout this project. He already gave me many ideas regarding this project and helped me to understand this research better. I could not have imagined having a better supervisor for my final year project.

I also want to express my sincere thanks to my seminar panels, Mr. Amrik Singh A/L Phuman Singh and Mr. Adzni Bin Md. Saad for giving me a lot of comments and inputs during the seminar. I acknowledged all the comments and inputs for improving my research.

Last but not least, I would to thank my family for giving me support to finish this project.

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LIST OF ABBREVIATIONS

MIROS	Malaysian Institute of Road Safety Research
3D	3 Dimensional
ISO	International Organization for Standardization
CG	Center of Gravity
SAE	Society of Automotive Engineers
ESC	Electronic Stability Control
WSS	Wheel Speed Sensor
SAS	Steering Angle Sensor
RWD	Rear Wheel Drive
R1	Front right tire
RMS	Root Mean Square
NHTSA	National Highway Traffic Safety Administration

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LIST OF SYMBOLS

a_v	=	RMS acceleration
a_x	=	Longitudinal acceleration
a_y	=	Lateral acceleration
a_z	=	Vertical acceleration
p	=	Roll
q	=	Pitch
r	=	Yaw
F_x	=	Tractive force/Longitudinal force
F_{xmax}	=	Maximum longitudinal force
F_y	=	Lateral force
F_{ymax}	=	Maximum lateral force
F_z	=	Vertical force
F_s	=	Side force
α	=	Side slip angle
δ	=	Steering angle
Ψ	=	Drift angle
K_s	=	Understeer coefficient
α_f	=	Front tire slip angle
α_r	=	Rear tire slip angle
θ	=	Pitch angle

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ϕ	=	Roll angle
γ	=	Yaw angle
M_y	=	Pitch moment
M_{ymax}	=	Maximum pitch moment
m_b	=	Sprung mas of the bus
h	=	Height of CG to the ground
F_{zr}	=	Vertical tire force for right side of vehicle
F_{zl}	=	Vertical tire force for left side of vehicle
R	=	Rollover index

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