PERFORMANCE OF SEMI-ACTIVE CONTROL OF RAILWAY VEHICLE SUSPENSION

MOHAMAD FAIZUL FADZLY BIN SALEHUDIN

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"I hereby declare that I have read this thesis and in my opinion this report is sufficient in terms of scope and quality for award of degree of Bachelor of Mechanical Engineering (Automotive)."

Signature : .....

Supervisor I : Mr. Mohd Hanif Bin Harun

Date : 23 May 2011

Signature : .....

Supervisor II : Mr. Fauzi Bin Ahmad

Date : 23 May 2011

"I hereby declare that the work in this report is my own work except for summaries and quotations that I have mentioned its sources."

Signature : .....

Name of Author : Mohamad Faizul Fadzly Bin Salehudin

Date : 23 May 2011

To my beloved dad, mom and family

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ABSTRACT

This PSM report describe the performance of semi-active control of railway vehicle suspension. The overall PSM work including development of 3 degree of freedom (DOF) of half railway vehicle ride model, equation of motion for passive suspension control and semi-active suspension control, PID controller for semi-active suspension control, half railway vehicle ride model with passive suspension control, half railway vehicle ride model with semi-active suspension control and simulate both half railway vehicle ride model with MATLAB-Simulink. The PSM work also study and analyze several graphs from simulation work for half railway vehicle ride model such as body acceleration, body velocity, body displacement, body rolling acceleration, body rolling velocity, body rolling angle, bogie acceleration, bogie velocity, bogie displacement, suspension travel response for damper (Cs), suspension travel response for spring (k1) and suspension travel response for spring (k3). The discussion is including evaluate the performance of semi-active suspension control with the passive suspension control of half railway vehicle ride model according to the graphs from simulation results. Based on analysis and discussion, the semi-active suspension control has provided the improved performance compared with the passive suspension control for half railway vehicle ride model.

ABSTRAK

Laporan PSM ini menerangkan prestasi kawalan semi aktif untuk suspensi kenderaan kereta api. Kerja-kerja untuk keseluruhan PSM adalah meliputi pembangunan 3 darjah kebebasan untuk model separuh kenderaan kereta api dalam keadaan bergerak, persamaan gerakan untuk kawalan suspensi pasif and kawalan suspensi semi aktif, pengawal PID untuk kawalan suspensi semi aktif, model separuh kenderaan kereta api dalam keadaan bergerak dengan kawalan suspensi pasif, model separuh kenderaan kerata api dalam keadaan bergerak dengan kawalan suspensi semi aktif dan menjalankan simulasi untuk kedua-dua model separuh kenderaan kereta api dengan menggunakan perisian komputer yang dikenali sebagai 'MATLAB-Simulink'. Kerja PSM ini akan mengkaji dan menganalisis beberapa graf iaitu pecutan jasad, halaju jasad, sesaran jasad, pecutan gulingan jasad, halaju gulingan jasad, sudut gulingan jasad pecutan bogi, halaju bogi, sesaran bogi, tindak balas perjalanan suspensi untuk penyerap hentakan (Cs), tindak balas perjalanan suspensi untuk spring (k1), tindak balas perjalanan dan tindak balas perjalanan suspensi untuk spring (k3). Hasil analisis dan perbincangan menunjukkan bahawa kawalan suspensi semi aktif memberikan peningkatan prestasi berbanding kawalan suspensi pasif untuk model separuh kenderaan kereta api.

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m_1	=	Bogie Mass, kg
m_2	=	Body Mass, kg
I_r	=	Moment Of Inertia Of Rolling, $kg.m^2$
k_1	=	Spring Stiffness, N/m
k_2	=	Spring Stiffness, N/m
k_3	=	Spring Stiffness, N/m
b	=	Half Of Track Width (Distance Between k_3 And Centre Of Gravity Of Body), m
h_1	=	Height Between k_1 And Centre Of Gravity Of Body, m
h_2	=	Height Between c_s And Centre Of Gravity Of Body, m
c_s	=	Damping Coefficient, Ns/m
Θ	=	Roll Angle At The Centre Of Gravity Of Body, °
$\ddot{\Theta}$	=	Roll Acceleration At The Centre Of Gravity Of Body, rad/s^2
F_{s1}	=	Spring Force, N
F_{s2}	=	Spring Force, N