FINAL PROJECT

DESIGN OF PROPORTIONAL INTEGRAL DERIVATIVE (PID) CONTROLLER FOR BUS SUSPENSION SYSTEM USING MATLAB SOFTWARE

RESEARCH PAPER

Submitted as a Partial Fulfillment of the Requirements for Getting Bachelor Degree of Engineering in Automotive Department

by

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DECLARATION

I hereby declare that this final project report entitled

DESIGN OF PROPORTIONAL INTEGRAL DERIVATIVE (PID)
CONTROLER FOR BUS SUSPENSION SYSTEM
USING MATLAB SOFTWARE

is written by me and is my own effort and that no part has been plagiarized
without citations. If there is mistake in the writer's statements I will be wholly
responsible.

Surakarta, July 2011
The Writer

Muhammad Iqbal
APPROVAL

The final project entitled “Design of Proportional Integral Derivative (PID) Controller for Bus Suspension System using Matlab Software”, has been approved by supervisor and authorized by Director of International Program as partial fulfillment of the requirements for getting the Bachelor Degree of Engineering in Automotive Department of Muhammadiyah University of Surakarta.

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The Final Project entitled “Design of Proportional Integral Derivative Controller for Bus Suspension System using Matlab Software”, has been defended in front of examiners team and approved as a partial fulfillment of the requirements for getting the Bachelor degree of Engineering in Automotive Department of Muhammadiyah University of Surakarta.

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(Ir. Agus Riyanto, MT) (Ir. Sartono Putro, MT)
ABSTRACT


The research is presented as a development of an active suspension system for quarter-car model to improve the system’s performance of car by applying a Proportional Integral Derivative (PID) controller. The method used to achieve the goal of this research is by using computer simulation in Matlab.

The research is started by modeling bus suspension system as a quarter model in a free body diagram to get the equations of motion. Then, this equations of motion is transformed into state space and transfer function model to get the loop control. After getting the open loop and the closed loop system, the design of PID controller is done. The controller design deals with the selection of proportional, integral, and derivative gain parameters ($K_p$, $K_i$, and $K_d$).

The results from simulation show that by applying PID controller to the suspension system, performance of the system has been improved. It reduced the settling time of natural response from 33.5 seconds to less than 5 seconds. The peak amplitude and the rise time have been also improved, which are from $2.25 \times 10^{-5}$ m and 0.24 seconds becoming $-8.8 \times 10^{-3}$ m, and 0.13 seconds, respectively. Further, the steady state error is $3.35 \times 10^{-6}$ m which indicates that the system has satisfied the passenger comfort.

Key words: Active Suspension, Quarter Car Model, PID Controller
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   The writer realizes that this research paper is far from being perfect, so the writer sincerely welcomes any constructive comment, criticism, and suggestion.

Wassalamu ‘alaikum Wr. Wb.

Surakarta, July 2011
The Writer
MOTTO

Try to not become a man of success, but rather, try to become a man of value.

Wise man talks because they have something to say. Fool man talks because they have to say something.

If you cannot be a smart person, so be a good person.

“Verily, never will Allah change the condition of a people until they change it (their state of goodness)”

...(Q.S. Ar-Ra’du: 11)

“Nay, seek (Allah’s) help with patient perseverance and prayer: It is indeed hard, except to those who bring a lowly spirit”

...(Q.S. Al-Baqarah: 45)