



A REVIEW ON VIBRATIONAL ANALYSIS OF SUSPENSION SYSTEM FOR QUARTER AND HALF CAR MODEL WITH VARIOUS CONTROLLERS

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Review Article

ABSTRACT

Suspension system of an automobile not only supports the body of the vehicle, engine and passengers but also absorbs shocks arising from the roughness of the road. So, tremendous research carried out on vibrational analysis for active and passive suspension system. This paper includes review of vibrational analysis for active and passive suspension for linear and nonlinear system. Vibrational analysis usually carried out with quarter car, half car and full car model. Also uses various optimization techniques for optimum parameters for suspension system.

KEYWORDS— Passive and active suspension system, Quarter, half car model, FFT analyser, PID controller, MATLAB.

INTRODUCTION

Conventionally Automobile suspension strategies have been a compromise among three contradictory criteria of road holding, rattle space requirements and ride comfort of passenger. The suspension arrangement need to take care of the vehicle handling parameters during vehicle moving over a terrain and be responsible for effective separation of passengers from road disturbances (Robert L.W 1997). Though a passive suspension system has the capacity to collect the energy through a spring and to drive away it via a shock absorber, their factors are normally fixed. These fixed parameters support to attain a definite level of settlement among road holding and comfort by the selection of different stiffness and damping parameters (Robert L.W 1997). The passive suspensions have inherent limitations as a consequence of the choice of elastic and damping characteristics to ensure an acceptable behavior for the entire working frequency range. The need to obtain a compromise between the conflicting requirements among different vibrations modes of the vehicle justify the research of the active suspension systems, the intelligence being determined by a controller that takes data from the vehicle dynamics. The response of the passive suspension is only affected by the external excitations and the system parameters that have a direct action on the suspension. Instead, the intelligent suspension is affected by indirect parameters, such as acceleration of the roll, pitch or vertical oscillations. The way to implement intelligence in a suspension system is to use variable damping – semi-active suspension, or to create a counter-force system – active suspensions.

LITERATURE SURVEY

Shpetim Lajqi [1] et al. studied, design and optimization procedure for active and semi-active non-linear suspension systems regarding terrain vehicles. Their objectives were the ability to quickly analyze vehicle's suspension performances resulting from passive, active, or semi-active systems. They represent vehicle by mathematical model regarding a quarter of it, and equations for motion are derived and solved by using MATLAB/Simulink.

Anirudh R. Iyer [2] et al. studied, cars provided with independent suspension for the front wheels and conventional suspension for the rear wheels. When the automobile is moving, the roughness of the road keeps giving excitations to the suspension system through tyres. They discussed optimum parameters of suspension system. They shows variation in three dimensional figures.

Florin Mădăl [3] et al. their study is based on the fact that the vibratory behavior of the system with motion-dependent suspension force is considerably different than that exhibited by damped systems with constant-magnitude suspension force. They studied semi active suspension system with quarter car model. They applied simultaneous optimization technique to transform the ill-posed problem into a well posed one.

S. Prabhakar [4] et al. The aim of their study is to simulate the passive suspension system for quarter car model with variable damping and stiffness parameters. They studied that, The disturbances are mostly in the form of various modelled road profiles (terrains) that the un sprung mass (wheel) comes in direct contact with and which in turn are transmitted to the sprung mass (body) of the system causing undesirable vibration or shaking that may cause discomfort to passenger.

Cătălin Alexandru[5] et al. Their study is representing a comparative analysis between the passive and active suspension systems of the motor vehicles. Their study is performed for a half-car model, which corresponds to the guiding - suspension system of a rear axle. The optimization is carried out with the Matrix Algebra Tool. For the optimization they used two stages performing parametric studies, and optimizing the controller.

Amít A. Hingane[6] et al. The aim of their study is to representing vehicle primary suspension system along with the analysis of a semi active suspension system with Bingham model for MR damper. Also they compared the ride and handling performance of a specific vehicle with passive suspension system with semi active suspension system. They show that Semi active suspension system gives lower value of maximum sprung mass acceleration for given random road excitation.

Swati Gaur[7] et al. Their study is based on the application of PI and PID controller to control the vibration occurred in the bus suspension system. In this paper they used Proportional Integral (PI) and Proportional-Integral-Derivative (PID) controllers to control the vibrations to give smooth response of the bus suspension system and carry-out their comparison on the basis of time and frequency using Matlab-environment. Also they compared the response of open-loop, PI and PID controllers.

M.J. Fable[8] et al. They studied to find the best parameters of the passive system which provides a performance as close to the active system as possible. Also they give approach for design of the

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