Review of Force Transmissibility Test using Shock Absorber

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Abstract— Shock absorber is the example of under damped vibration system. Shock absorber is one of important component in vehicle suspension system. This paper is mainly focuses on measurement of transmissibility of the shock absorber and the analysis of various load and speed. Transmissibility it is the effectiveness of vibration isolating material. For the measurement of transmissibility of the shock absorber is design and developed. In experiment of is carried out at different load and speed which lead to the output in terms of sinusoidal waveform. This waveform is used to find out the transmissibility at different load – speed combination. The result obtained is used to find out the behavior of transmissibility at justified load and speed.

Keywords: Shock Absorber, Force Transmissibility, Load Cell Sensor

I. INTRODUCTION

From the machine to the supporting structure on which machine is mounted. Driving comfort are the primary design objectives in development of an automobiles shock – isolation system which transmits fewer amounts of vibration to the person setting on vehicle. Shock absorber is subjected to vibratory forces is the necessary component in the vehicle suspension system. It is example of the under damped vibration system; creating the vibration under the external load on it. It is absorbs some amount of force, motion and transmits remaining amount of force and motion to the person sitting on the vehicle. Shock absorber is used in every vehicle running in this world. There have been many companies since then producing shock absorber for different vehicle. Transmissibility has always been a very important dynamic characteristic of a shock absorber. In simple terms, Transmissibility can be defined as the effectiveness of shock absorber to absorb the shock absorber or any device is isolates the vibrations from the body. A shock absorber or damper is a mechanical or hydraulic device designed to absorb and damped shock impulses. It does this by converting the kinetic energy of shock into another form of energy. The shock absorber is a suspension system which design mechanically to control shock impulse and dissipate kinetic energy. It reduces the amplitude of disturbances leading to increase in comfort and improved ride quality. Shock absorber minimizes the effect of travelling on rough ground. Now a day modern vehicle comes along with strong shock absorber to tolerate any type of bouncy condition. The suspension system of an automobile is one which separates the wheel assembly from the body.

Attempts have been made previously to find out various shock absorber properties by various approaches. If the external force is removed after giving an initial displacement to the system, the system vibrates on its own due to internal elastic force such vibration are known as free vibration. This experimental research work presents a model to calculate the force transmissibility of shock absorber at various loading condition. This experiment is measure of transmissibility.

II. PROBLEM SPECIFICATION

The aim of the project is to study and analyze single degree of freedom spring-mass-damper system and plot it is dynamic characteristics curve for different value of spring stiffness for various load conditions.

III. OBJECTIVES

- To test on suspension for different types of loads and stiffness to find out optimum force transmissibility.
- To determine dynamic characteristics of shock absorber.
- Suspension will be test for multiple stiffness by varying load, speed and different forces.
- Force transmissibility develops a suspension testing set-up for testing a various suspension.

IV. TRANSMISSIBILITY

The transmission of the vibration can be specified by the term force transmissibility.

A. Force Transmissibility

Force Transmissibility is defined as the ration of the force transmitted to the supporting structure or foundation, Ft to that force impressed upon the system, F0. Force transmissibility measures the effectiveness of the vibration insulating material.

Force transmissibility (F_T)=

$$\frac{\text{Force transmitted to the foundation } (F_t)}{\text{Force impressed upon the system}(F_0)}$$

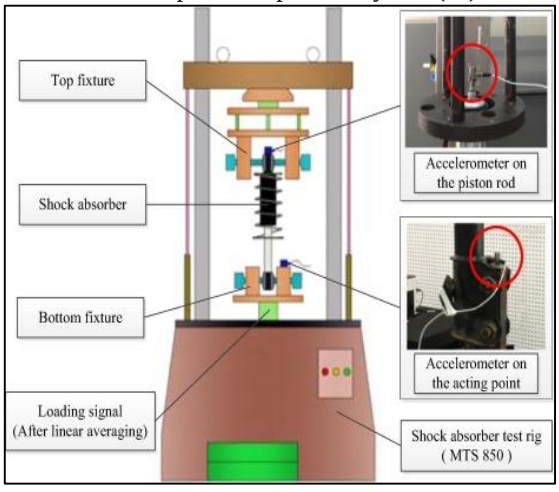

Fig. 1: Force Transmissibility

B. Motion Transmissibility

In case of the force vibrations due to the excitation of the support, motion transmissibility is defined as the ratio of absolute amplitude of the mass body to the amplitude of the base excitation.

Motion Transmissibility (MT) =

$$\frac{\text{Absolute amplitude of mass (body)}}{\text{Amplitude of base excitation}}$$

C. Damping

It is the dissipation of energy in an oscillating system .Limits maximum amplitude at natural frequency.

D. Deflection

It is the distance an elastic body or spring moves when subjected to static or dynamic forces.

E. Shock

A condition where the equilibrium of a system is disrupted by sudden acceleration or deceleration or by a sudden change in direction or magnitude of a velocity.

F. Spring rate or Spring Stiffness(K):-s

It is the force required to deflect a unit distance. Stiffness is the slope of a curve showing force on the Y- axis and deflection on the X-axis. The unit of spring stiffness (k) is N-s/m.

V. COMPONENTS

A. Shock absorber

A shock absorber is a Mechanical device which is used to eliminate or damped sudden shock waves in system. The main function of shock absorber is to absorb the shocks and damped then as soon as possible so that smooth ride can be obtained.

Fig. 2: Shock Absorber

B. Load Cell Sensor

A load cell is a Transducer which converts force into a measurable Electrical output. A load cell is a type of Transducer, specifically a force transducer. They convert a force such as tension, compression, pressure, or torque into an electrical signal that can be measured and standardized.

Fig. 3: Load Cell Sensor

C. Load cell Display unit

It can show the measurable reading of the load cell sensor for the different load conditions .It works with strain gauge type load cell for various load capacities.

Fig. 4: Load cell Display Unit

D. Actuator

An Actuator is a mechanical element which can converts pressure force into the linear movement of the cylinder rod in the form of load on shock absorber. It gives the linear movement for different load conditions through control valve or force applied.

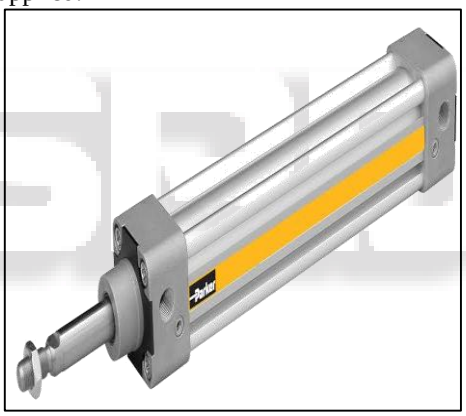

Fig. 5: Actuator

E. Fixture

It is an important part of the assembly unit. It holds the shock absorber in the vertical direction at the both top and bottom side. The Upper fixture is rigidly fixed to the top side and similarly Lower fixture is rigidly fixed to the bottom side.

Fig. 6: Fixture

F. Foundation

It is a structure that supports the gravity load of a mechanical system. It supports all the components mounted on the system such as shock absorber, load cell sensor, load cell display unit, actuator etc.

VI. CONCLUSION

From this suspension experimental set-up we can test multiple number of suspension at different loads, forces and speeds. By changing different conditions of load we can find out optimum force transmissibility. With ultimate objective of studying and plotting dynamic characteristics for suspension system. However it concludes the project work with following points

1) The suspension system gives best performance when designed to be slightly under-damped.
2) From this experimental results and graphs we can conclude that for good ride, transmissibility should be as low as possible and this can be attained by using low damping constant and high spring stiffness.

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