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Vibration Control by Advanced Suspension System

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Abstract - *Vibration control by suspension plays a major role in the handling characteristics as well as characteristics of a vehicle and overall vehicle performance. In this paper*

particularly various types of suspension systems are discussed. The present paper focuses on multi duct type ER fluid dampers. The rheological properties of ER material are extremely sensitive to electric fields. Modulation of electric field in ER damper results in corresponding change in device forces. The multi duct type ER damper can be used in automobile suspension as a semi-active suspension system. It can handle force up to 8 KN because of large duct size.

Key Words:

Vibration control, ER fluid, Modulation, Damper, automobile Suspension.

1. INTRODUCTION

Vibration is term that describes oscillations of mechanical systems. It is defined by frequency and amplitude. Either the motion of physical object or structure or alternatively an oscillating force applied to a mechanical system is vibration in generic sense. Vibrations are either deterministic or random. Deterministic vibrations follows regular pattern i.e. can be predicted by past history. If vibrations are random then they are unpredictable, except on the basis of probability. Vibration problem occur where there are rotating or moving parts in machinery. Apart from the machinery itself, the surrounding structure also faces the vibration hazard because of this vibrating machinery. The common examples are locomotives, diesel engines mounted on unsound foundations, whirling of shafts, etc. The main causes of vibration are as follows:

1. Unbalanced forces in the machine. These forces are produced from within the machine itself.

2. Dry friction between the two mating surfaces. This produces what are known as self excited vibration.

3. External excitable ms. these excitations may be periodic, random, or the nature of an impact produced external to the vibrating system.

4. Earthquakes. These are responsible for the failure of many buildings, dams, etc.

5. Winds. These may cause the vibration of transmission and telephone lines under certain conditions.

Must not be used. Other font types may be used if needed for special purposes.

2. TYPES OF SUSPENSION SYSTEMS:

Vehicle suspension can be treated as a dynamic system using vehicle properties and simulating the response of the vehicle to various inputs and disturbances. Suspension serves the basic function of isolating passengers and the chassis from the roughness of the road to provide a more comfortable ride. Due to developments in the control technology, electronically controlled suspensions have gained more interest. These suspensions have active components controlled by a microprocessor. By using this arrangement, significant achievements in vehicle response can be carried out. As per the developments held in the suspension systems, they are categorized into three types as follows.

a) Passive suspension system

b) Semi-active suspension system

c) Active suspension

2.1 advantages of passive suspension system.

1. When the road wheel comes across a bump or pit on the road, it is subjected to vertical forces, tensile or compressive, depending upon the nature of the road irregularity. These are absorbed by the elastic compression, shear, bending or twisting of the spring. The mode of spring resistance depends upon the type and material of the spring used.

2. It prevents the road shocks from being transmitted to the vehicle components through the various springs.

3. To safeguard the occupants from road shocks. The shocks from road are absorbed by the dampers which release by compressing.

4. This depends upon the position of centre of gravity relative to the ground, the wheelbase, and other suspension characteristics. In the same way, torque loads during acceleration tend the front of the vehicle to be

lifted. These forces on account of braking and driving are carried directly by deflecting the springs, by wishbone arms or by radius rods.

5. Passive suspension system is cheaper than the newly designed suspension systems.

2.2 Limitations:

1. Performance: The performance of passive suspension systems is not quite good as compare to air suspensions.

2. If the cost to performance ratio is considered then performance is increases as the cost is increases. By observing the graphical representation it is clear that passive systems are not comfortable for low cost systems.

3. In passive suspension systems vibrations are isolated with the help of various mechanical components such as coil, leaf springs. These results in wear and tear of the mechanical components. This becomes a costlier one.

4. Torsion bar spring does not take the breaking or driving thrust so that additional linkages have to be provided for the purpose.

5. Due to absence of friction force in torsion springs, damping which is a necessity to control the vibrations produced due to road shocks.

2.3 Active suspension systems:

Increased competition on the automotive market has forced companies to research alternative strategies to classical passive suspension systems. In order to improve handling and comfort performance, instead of a conventional static spring and damper system, semiactive and active systems are being developed. A semi-active suspension system involves the use of a dampers or spring with variable gain. Such systems can only operate on three fixed positions: soft, medium and hard damping or stiffness. Additionally, a semi-active system can only absorb the energy from the motion of the car body.

TRW's Active Suspension Control Systems ASCS helps to resolve the conflict between ride comfort and handling by replacing the rigid drop links of one stabilizer bar end against a hydraulic actuator (active stabilizer bar). These actuators are controlled by an Electro-Hydraulic- Control-Unit (EHCU) depending on the sensed driving conditions.

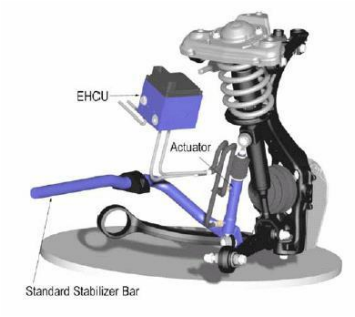

Fig -1: Active suspension

3. CONCLUSION

As from above discussion it is clear that a semi -active suspension system is an effective mean of improving ride and handling of vehicle than conventional passive system. Active suspension are not only capable of providing a better straight-line than semi-active suspension, they are also capable of reacting pitch roll motions, increasing passenger comfort. However semi- active suspension consumes small amount of power and less weight and simple than active suspension. Semi-active suspension dampers have a tendency to produce vibrations at high frequency, which are not present in the passive components they are replacing. An optional solution from the point of view of cost comfort could be a combination of active roll with a semi-active suspension.

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