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A Review on Vehicle Suspension with Urethane Buffer

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Abstract: ***Elastomers are extensively used in the automobile industry due to their excellent damping and energy absorption characteristics and low cost, to isolate the structures from vibration and shock loads. In this study, the aim is to analyse the effect of an elastomer buffer implanted in the suspension of an automobile. In this study, the effect of coil spring with and without polyurethane buffer on spring damping capabilities will be analysed. In new vehicle, performance of the suspension is better, but after some years performance of the suspension is reducing. Which also impact on suspension life, so performance of the suspension will be increased by using urethane buffer.***

Keywords: Coil spring suspension, Urethane buffer, Energy absorption, Reducing vibration, Elastomer.

I. INTRODUCTION

Coil springs are used in various applications, but over the period of time their damping performance is reduced. The automobile industry mostly uses coil spring suspension for better performance. The coil spring's capability can be improved by inserting a urethane buffer in the centre of the coil spring. A urethane buffer acts as a damper in the spring mass system. Urethane buffer is made up of polyurethane material, so its damping and energy absorption capabilities are better, and the cost of urethane buffer is low. When a buffer is inserted in the coil spring, coil spring compatibilities can be improved, and vehicle height can be restored.

In the automobile industry, elastomers are widely used to isolate the structure from vibration and shock load. has analysed the damping performance of an elastomer buffer implanted in the suspension of an automobile by FEM and numerical approach. The results prove that an elastomer buffer is effective in improving the performance of suspension. It reduces the amplitude of vibration and the oscillation time of the sprung mass. It may improve the riding comfort of automobiles and protect the suspension from unexpected shocks on bumpy roads [1]. Elastomers, rubber and rubber-like materials, are the appropriate materials for manufacturing shock absorbers and vibration isolators due to their capability of absorb input energy much better than engineering materials. These materials have unique properties: high elasticity, resistance to aggressive environmental factors, good dynamic properties, low volume compressibility, a linear relationship between stress and strain up to a strain of 15-20% [2]. Elastomers' excellent ability to store elastic energy enables the transfer of considerable stresses, thanks to which, after being released from those stresses, they practically return to their original shape without damage. Elastomer damping is often used to prevent excessive vibration amplitude in resonance. The use of elastomeric materials to construct vibration isolators and shock absorbers results from their specific physical properties of high strength, high fatigue resistance, moderate production costs, and excellent rebound and compression properties. After determining the properties of the material and its structure, as well as the installation method in an insulated machine, it is necessary to assess the effectiveness of the shock absorber application [3].

In vehicle, suspension is the most important component for comfort driving and road holding capacity. In new vehicles, suspension performance is better, but over a time of period performance of suspension is reduced, which also has an impact on suspension life. So, the performance of suspension is increased by using urethane buffer. After implementing urethane buffer, the vehicle height is restored and reduces the vibration amplitude [4]. Dynamic friction between the car tire and road surface produces vibrations that increase when an uneven road surface is passed at high speeds. All mechanical components suffer fatigue damage as a result of repeated vibration. A fatigue failure refers to the formation and propagation of cracks in engineering structures. It is responsible for approximately 90% of the overall mechanical components' failures. So, reducing vibration in engineering structures will increase the life of mechanical components [5]. analysed more than 3,000 repaired cars and concluded that the automotive suspension components need to be replaced early, i.e., within five years or after travelling over a distance of more than 73,500 km. The data derived from the Ministry of Transport, UK, indicated suspension components had a very high fault rate, i.e., 13.18% of all 24.2 million cars tested [6].

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Suspension systems is made of 4 main components consisting of springs, shock absorbers, suspension mechanism, and its interface of connections its main tasks are isolation of a car body from road roughness to comfort passenger travel and establish permanent contact between tire and road conditions to the proper performance tire is in motion. This paper presents 1 / 4 vehicle model according to road classification ISO 2631-1 is carried out road roughness as PSD function at a constant speed of a car by using MATLAB Code. in continually, studying the effect of random vibration and variable amplitude loading on the suspension system performance [7].

In the literature, there are very few studies focused on the analysis of coil spring suspension with urethane buffer. This study was initiated to investigate the study of coil spring suspension over a time period. By checking the new coil spring of the vehicle and the old coil spring of the same vehicle. An analysis of the effect on coil spring with urethane buffer. And study the coil spring suspension over a period of time.

Suspension springs gradually reduce their damping capability over a period of time. Due to this, springs are totally compressed on uneven roads. Because of these urethane buffer used in coil spring suspension.

II. COIL SPRING SUSPENSION SYSTEM

Suspension is the most important part of an automobile system, for vehicle control, stability, ride comfort, and other performance. A basic suspension system made of spring, Axel, shock-absorber, arm rod, and ball joint. Suspension systems damp the vibrations and shocks that come from moving parts of the vehicle. Coil springs are the main components of a suspension system. Coil spring also known as the helical coil springs, it is widely used in light vehicle suspension systems to store energy and keep the contact of the traveling wheel with the ground. According to Indian road condition, proper working of suspension is most important factor for safe driving and comfort driving. Fig.1. shows that the quarter car suspension model.

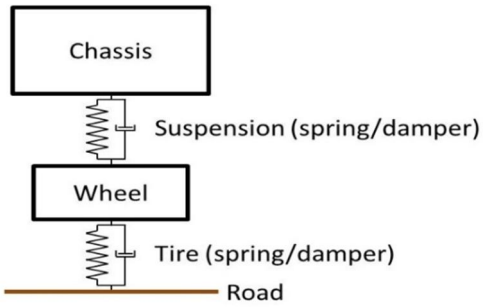

Fig.1. Quarter car suspension model

III. URETHANE BUFFER

Urethane buffer is one type of suspension pad. It is made of thermoplastic polyurethane material, so its damping, energy absorption, and elastic property is better than any material. Urethane buffer is different for different car models as per coil spring dimensions. And it is also different for rear and front suspension coil spring. Urethane buffer is one type of suspension pad, which has good shock absorbing capacity.

Fig.2. Urethane Buffer

As shown in fig. 1. Is the commercially available urethane buffer. Dimensions of the urethane buffer are as per coil spring dimensions, for example diameter of coil, pitch of coil spring etc.

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IV. EFFECT OF URETHANE BUFFER ON SUSPENSION PERFORMANCE

Urethane cushion buffer restores the vehicle height of the old vehicle. Height restores up to 3-5 cm [4]. It reduces vibration amplitude and oscillation period in a wide range of input excitation frequencies. In frequencies near and over the natural frequencies the buffer reduced the vibration amplitude in free oscillation between 30% to 45% and the effectiveness was improved in frequencies between 2 to 5 Hz.[1]. It improves the riding comfort of the automobile and protects the suspension system from unexpected shocks. According to tensile test of urethane buffer the thermoplastic polyurethane material is has good shock absorbing capacity and good elasticity [4].

V. IMPLEMENTATION OF BUFFER IN COIL SPRING

For better result and performance of urethane buffer, the main part is the appropriate location of buffer in coil spring. The maximum result can be achieved when urethane buffer is implicated in the middle of the coil spring. With the urethane buffer 23% to 48% acceleration reduces at 1Hz to 2Hz excitation frequency [8]. Maximum energy was absorbed when urethane buffer located at middle of the spring.

Fig.no.3. Coil spring with buffer

VI. CONCLUSION

In this review, the recent study on coil spring suspension with urethane buffer has been thoroughly examined. Due to its excellent damping and energy absorption characteristics, it is used to isolate the structure from vibration. Urethane buffer reduces the vibration amplitude and oscillation period in a wide range of input excitation frequencies. It may protect the suspension system from unexpected shock and improve ridding comfort. Maximum energy absorbed by urethane buffer when it is located in the middle of the coil spring. Use of urethane buffer has impact on suspension life of vehicle, it increases the life of suspension.

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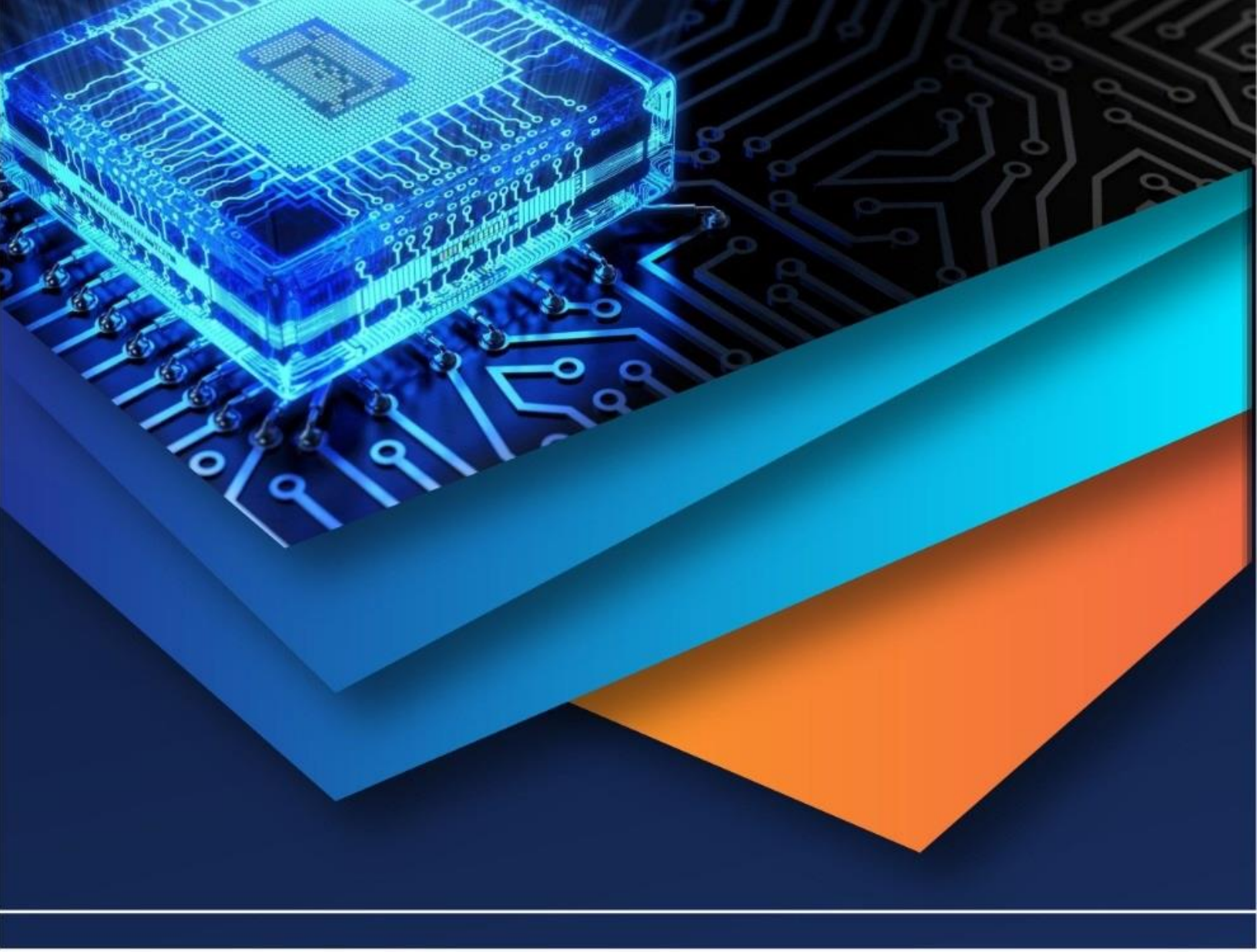

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