

Automobile Engine and Breaking Vibration Control and Prediction Using GMT Spring Material

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ABSTRACT: Ride comfort, driving stability and drivability are vital factors in terms of vehicle performance and the customer satisfaction. The vibration that reduces the vehicle performance and it need to be controlled to some extent such that the vehicle performance will be improved. The IC engine is made up of reciprocating and rotating parts and they produce unbalanced forces during their operation and produce the vibratory output at the vehicle supporting members. The vibration reduction will be possible by minimizing unbalanced forces and by providing the anti-vibration mounts at the engine-vehicle interface as well as to minimize suspension deflection, which results in improvement of tire grip with the road surface, thus, brake, traction control and vehicle maneuverability can be considerably improved. Many researches were made to find the causes for the vibration and to reduce the vibrations at the engine supports. Then also here is a research gap on the vibration isolation of the engine. In this work, an attempt is made to represent the state-of-the-art for the engine vibrations and its isolations.

KEYWORDS: Transportation, Automobile, Vibrations, Vibration Isolation, Surface Pavement

I.INTRODUCTION

An active suspension system possesses the ability to reduce acceleration of sprung mass continuously as well as to minimize suspension deflection, which results in improvement of tire grip with the road surface, thus, brake, traction control and vehicle maneuverability can be considerably improved. Today, a rebellious race is taking place among the automotive industry so as to produce highly developed models. One of the performance requirements is advanced suspension systems which prevent the road disturbances to affect the passenger comfort while increasing riding capabilities and performing a smooth drive. While the purpose of the suspension system is to provide a smooth ride in the car and to help maintain control of the vehicle over rough terrain or in case of sudden stops, increasing ride comfort results in larger suspension stroke and smaller damping in the wheel hop mode. Many control methods have been proposed to overcome these suspension problems.

The concentrated mass in vehicle and if not properly designed it will cause vibrations and transfer to the supporting structures ride comfort, driving stability and drivability are important factors for the performance of a vehicle and are affected by the engine vibrations. Because of the environmental considerations, as well as changes in consumer preferences regarding vibration induced must be reduced. Vibration behavior of an IC engine depends on unbalanced reciprocating and rotating parts, cyclic variation in gas pressure, shaking forces due to the reciprocating parts and structural characteristics of the mounts. Engine vibrations are caused due to the reciprocating and rotating masses of the engine. The variations of inertial forces are due to the combustion and the compression differences of the piston cylinder arrangement during their operation. The engine inertial forces leads to the unbalanced forces of the engine and they are quiet varying with respect to speed, fuel supply and combustion characteristics of the fuel. To predict the vibration output of an engine and to minimize the possible durability and consumer perceived quality problems

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associated with engine vibration, a robust and accurate design and simulation model is needed. To reduce the engine vibration proper mounting must be provided as dampers at the interface of the engine and chassis.

In a vehicle having a frame and an engine carried in the frame in a predetermined position, the improvement of a passive engine torque resisting strut and vibration damper between the engine and the frame comprising

In a vehicle with its engine mounted in the frame so engine torque and vibration affects the vehicle performance, the improvement of damper means passively sensing changes in engine torque and vibration which comprises

II. PROBLEM FINDING

Springs are elastic bodies (generally metal) that can be twisted, pulled, or stretched by some force. They can return to their original shape when the force is released. In other words it is also termed as a resilient member.

The are normally automobile industry using, Steel spring for vibration control the vehicle suspension, vibration isolator that also made steel material used. But now steel material is energy released did slow then also high wear, corrosion heavy affect on environmental. So the are using composite material will use our future scope material select GMT.

GMT material compare to steel 80% of kinetic impact load energy change to potential energy and Resistance to a wide range of chemical agents including acid rain and salt spray, conditions under which metal parts would suffer. This results in much reduced maintenance and repair costs.

Resilience – the ability to deform and spring back to their original shape without major damage. Shape memory and impact tolerance are two of the biggest advantages of composites, particularly within the transport industry.

Low weight – with substantial savings in weight over similar metal parts (25% the weight of steel, 30% lighter than aluminum) cost savings are noticeable with installation, handling and particularly fuel consumption, when in service. Even greater weight savings are achieved when two components, previously manufactured out of steel or aluminum, are combined in one composite structure. This also gives savings in the installation process.

Adhesive and coating compatibility – since composites and adhesives/coatings share a similar polymeric make-up, they are widely compatible with one another.

Thermal properties – composite structures act as very good insulators, whilst retaining their shape while not becoming brittle in cold temperatures.

Strength – comparable to aluminum and steel, strength characteristics of many materials can be reproduced through research and development with reinforcements glass. Innovative designs which were previously impractical can be achieved with composites with no loss in performance or strength.

Safety – mat-reinforced composites are low in electrical conductivity and are efficient fire retardants, which makes them a good choice for covering electrical parts.

Reduced cost – effective techniques have been developed which produce a post-mould paint-finish type surface which requires no further processing, thus eliminating the need for time consuming and expensive finishing. For composites which have been designed to be painted, the part manufacture can include allowances for a surface finish suitable for the keying-in and adhesion of the finish

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III. EXPERIMENTAL METHODOLOGY

A. Vibration Isolators

Consider a vibrating engine, bolted to a rigid chassis. The force transmitted to the is equal to the force generated in the engine. The transmitted force can be decreased by adding a suspension and damping elements (often called vibration isolaters) add an additional level of mass (sometimes called a seismic mass, again a block of cast concrete) and suspension.

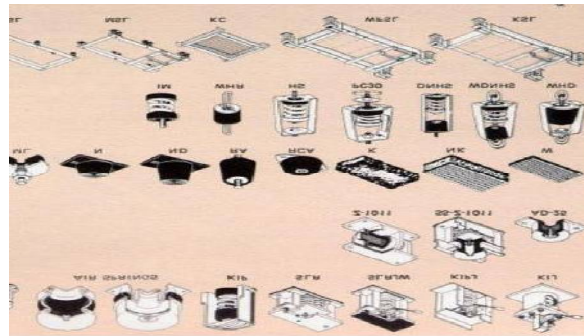


Fig. 1. Vibration isolaters.

B. Off the Shelf Vibration Isolation Products.



Fig. 2. Vibration isolaters products

C. Glass-Mat-Reinforced Thermoplastics (GMT)

Quadrant is considered the world market leader in the production of classic glass-mat-reinforced thermoplastics (GMT). This semi-finished product in panel form was developed primarily as a substitute for metals (steel, aluminum etc.) and its main purchasers can be found in the automotive industry. This is where it is frequently pressed on the industrial scale into complex 3D structural components, although it is also used as panels.

Classic GMT materials consist of glass fiber mats manufactured to the company's own patents and impregnated with polypropylene in a second process step. The result is lightweight composite materials with outstanding impact resistance but benign crash behavior. Its low relative density, excellent hardness and rigidity even at low temperatures, resistance to moisture and chemicals, durability and ease of recycling have established GMT as an extremely successful alternative to such materials as plywood and other industrial materials.

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The GMT materials manufactured by QPC are based on polypropylene (PP), polyamide (PA) and thermoplastic polyester (TPP). Reinforcement is provided by long fibers and/or endless glass mat technology. And this is the key to GMT's success. For unreinforced and short-fiber-reinforced thermoplastics become brittle at low temperatures and shatter dangerously in crashes. Its special long fiber technology ensures high energy absorption before fracture and thereafter benign failure behavior without sharp lines of fracture.

D. Providing GMT Spring and Damper

The equation of motion is $F = m\ddot{x} + c\dot{x} + kx$. Maximum stress occurred in damper and minimum in vehicle. But wearing of damper is less than spring. This method impact kinetic energy 80% Change potential energy. Automobile using normal spring (steel, copper) compare to composite material GMT spring control impact kinetic energy change to potential energy of vibration and best vibration prediction of GMT spring will use.

IV. RESULT AND DISCUSSION

Vibration isolation is the process of isolating an object, such as a piece of equipment, from the source of vibrations. Vibration is undesirable in many domains, primarily engineered systems and habitable spaces, and methods have been developed to prevent the transfer of vibration to such systems. Vibrations propagate via mechanical waves and certain mechanical linkages conduct vibrations more efficiently than others. Passive vibration isolation makes use of materials and mechanical linkages that absorb and damp these mechanical waves. Passive vibration isolation" refers to vibration isolation or mitigation of vibrations by passive techniques such as rubber pads or mechanical springs, Pads or sheets of flexible materials such as elastomers, rubber, cork, dense foam and laminate materials.

Every object on a flexible support has a fundamental natural frequency. When vibration is applied, energy is transferred most efficiently at the natural frequency, somewhat efficiently below the natural frequency, and with increasing inefficiency (decreasing efficiency) above the natural frequency.

This type of material affect environmental condition and highly wearing, correction, etc so will select composite material GMT. This material is lightweight composite materials with outstanding impact resistance for impact kinetic energy 80% change potential energy.

V. CONCLUSION

From different methods of isolator, damper with mass is more efficient than all. Model which has only spring is less efficient. All the methods isolate vibration from the engine. In present days active vibration control is been used, but in this project, GMT spring vibration control has been analysed. Passive vibration control is cost effective than active vibration control.

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