Research on simple test and adjustment method of vehicle comfort

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Abstract. This paper analyzes an application in the field of automobile manufacturing, and makes a more in-depth study on the test and control methods of vehicle comfort, focusing on the mechanical movement of the vehicle in the vertical direction and the pitching motion around the horizontal axis. Analyze and adjust the comfort of the vehicle through an adaptive adjustment system.

Keywords: test method of comfort; mechanical movement and movement around the horizontal axis; improvement of vehicle comfort

1. Introduction
With the continuous development of China's economy, people's demands for quality of life are constantly improving, and the demand for automobiles is also growing. In the process of purchasing cars, the comfort of cars is one of the important indicators for people to buy cars. The comfort of the vehicle is mainly influenced by two factors, one is the vertical acceleration caused by the mechanical movement in the vertical direction of the vehicle during operation, and the other part is the unevenness of the road surface caused by the actual road condition of the road surface. The flexibility and so on. What this paper discusses is to test the comfort of the car during operation and to study the adjustment method to adjust the comfort of the vehicle.

2. Vehicle comfort
Vehicle comfort usually refers to the fitness value of the vehicle during the operation. During the operation of the vehicle, the comfort of the vehicle is called smoothness due to complicated factors such as road conditions, so the comfort and comfort are basically the same.

2.1. Factors affecting vehicle comfort
The main influencing factors of vehicle comfort are divided into the main factors in the vehicle body and the secondary factors outside the vehicle body. The main factors affect the adjustment of tires, suspension systems, shock absorbers, and damping components; the secondary factors are the road roughness, human physiology, and psychological subjective feelings on road speed and acceleration; this time focuses on the influencing factors in the car.
2.2. Main factors affecting the interior system
The factors affecting the comfort of the vehicle are mainly the vertical vibration acceleration, so reducing the acceleration in the vertical direction improves the comfort of the vehicle. The main shock absorbing originals in the vertical direction are wheels, hangers, shock absorbers, bushings, gaskets, seats, and the like.

2.3. Factors affecting comfort of each subsystem of the in-vehicle system
The factors affecting the comfort of the vehicle are: the size of the wheel and the thickness of the tire, the type of suspension system and the connection of each structure, the elastic strength of the shock absorber, the material softness of the bushing (pad), Seat comfort.

2.3.1. Introduction to the suspension system. Suspension is a general term for all force transmission devices between the frame of a car and the axle or wheel. Its function is to transmit the force and force between the wheel and the frame, and the buffer is transmitted to the frame by the uneven road surface. Or the impact of the body and attenuate the resulting vibration to ensure that the car can travel smoothly [1]. The suspension system of the car is divided into non-Independent suspension and Independent suspension. Two, non-Independent suspension The wheels are mounted on both ends of an integral axle. When one side of the wheel jumps, the other side of the wheel also jumps, causing the entire body to vibrate or tilt [2]; the independently suspended axle is divided into two sections, each of which is made up of a coil spring Separately mounted under the frame, when one side of the wheel jumps, the other side of the wheel is unaffected, and the wheels on both sides can move independently, improving the stability and comfort of the car [3]. Due to the increasing demands of modern people for the comfort of vehicles, non-independent suspension systems have gradually been eliminated. Common independent suspension systems include multi-link suspension systems, McPherson suspension systems, trailing arm suspension systems, etc. [4].

2.3.2. Working methods and use of the suspension system. The damping method of the suspension system is mainly the ring spring as the main damping mode, because of its good performance, low cost and easy production. When the spring receives the external force, it will be elastically deformed to generate elastic potential energy. We call this energy energy storage. The amplitude of the oscillation of the spring during the rebound of the external work tends to exceed its original length until the occurrence of frictional resistance slows down the free oscillation caused by the spring rebound. The task of the shock absorber is to reduce the free oscillation amplitude of the spring [5]).
2.4. Theoretical basis for testing vehicle comfort
The vibration of the vehicle is generated by the vertical acceleration of the vehicle. The vertical acceleration of the vibration of the vehicle is generated by the excitation of the vehicle by the external environment, and the comfort of the vehicle is the coefficient [6] that the excitation received by the vehicle is reduced after the damping adjustment of the interior system.

2.5. The internal structure of the vehicle to improve vehicle comfort
From the above, the internal structure of the vehicle can well reduce the vertical acceleration during the running of the vehicle and improve the comfort [7]. The spring is changed into a soft coil spring and the damping coefficient is reduced. The degree of softening of the gasket and the bushing is adjusted to make it easy to deform, and the four joints between the frame and the sub-frame are added with a soft pad to make it the vibration transmitted to the frame on the sub-frame can absorb a lot of vibrations. The main point on the dynamic bearing is added to the radial bushing to transform the vertical vibration into a lateral vibration to improve the comfort of the vehicle. The wheel bushing is replaced by a hydraulic bushing that reduces vibration during cornering and provides better responsiveness to the hydraulic bushing. The purpose of improving vehicle comfort is achieved by improving the position of each vehicle that can transmit vibration [8].

2.6. Test test of vehicle comfort
The experiment will set up three vehicles, and set the first vehicle to the comparison target by adopting the standard without damping strategy; the second vehicle will be tested by the commonly used damping method on the market; the third will adopt the lifting vehicle. The comfort method is tested on it.

The method of testing comfort is to install a device for measuring the magnitude of the force on the vehicle (hereinafter referred to as the device). Now assume that the weight of the human body is m, and the device is subjected to an impact in the up and down direction to generate a function due to the reaction of the internal structure of the vehicle body to the vertical vibration. The value of the device when the recording force is downward is the maximum weight received, and the maximum weight is assumed to be w. The weight minus the weight of the person gives the body some extra downward force.

Formula: \((wm) / m = \text{coefficient (the human body receives a transient g value)}\)

1 experiment with the first car
According to the measurement, \(W=6.8\text{kg}\) is taken into the formula to find: \(G= (6.8\text{KG-M})/M\)

2 experiment with the second car
According to the measurement: \(W=4.6\text{kg}\) Brought into the formula to find: \(G= (4.6\text{KG-M})/M\)

3 experiment on the third car
According to the measurement, \(W=4.1\text{kg}\) is taken into the formula to find: \(G= (4.1\text{KG-M})/M\)

2.7. Comparison of experimental results
According to the comparison between the first car and two or three cars, the improved g value is smaller than the unmodified g value, and the comparison of the g value results in a great improvement in the comfort of the vehicle after the improvement. It can be used as a practical method to improve vehicle comfort.

3. Conclusion
According to the experimental results of vehicle comfort, the improved vehicle comfort can better reduce the vibration acceleration in the vertical direction, thereby reducing the impact of the vehicle on the human body during driving and improving the comfort of the vehicle[9]. The research results obtained through continuous experiment, optimization and testing have improved the comfort, safety and stability of the car as a whole, and provided broad application prospects for future vehicle research[10].
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