

An Overview of the most Common Vehicle Suspension Problems

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ABSTRACT

The design of the suspension system, which transmits force between the vehicle and the ground, is principally responsible for the driving comfort of a vehicle. Importantly, a vehicle's suspension system contributes to the reliability and precision of steering and control, as well as to the friction between the vehicle and the road. The suspension system is also responsible for absorbing and dampening road stress, so that we do not feel every bump on the road when driving. Linkages, springs, and shock absorbers are the three fundamental types of suspension components. This paper introduced the most common suspension problems and the symptoms that may indicate you need a suspension system repair, where it turns out that there is a set of problems common to all vehicle suspension systems, such as poor wheel alignment, faulty shocks or struts, damaged springs, failing ball joints, and faulty control arms. Now as a conclusion of this paper, the reader can know the most common suspension system problems in vehicles and thus how to deal with these problems.

INTRODUCTION

The contemporary automobile has come a long way since the days when "self-propulsion" alone was sufficient to satisfy car owners. Suspension enhancements, greater component strength and longevity, and advancements in tire design and construction have made substantial contributions to driving comfort and safety.

Suspension generally refers to the employment of front and rear springs to suspend a vehicle's structure, body, engine, and drivetrain above the wheels. These relatively weighty assemblages are referred to as Sprung weight. Unsprung weight, on the other hand, consists of wheels and tires, brake systems, and other structural components that are not supported by springs.

LITERATURE REVIEW AND HISTORY

The springs used in automobiles and trucks nowadays are manufactured in a vast array of sorts, forms, sizes, rates, and capacities. Leaf springs, coil springs, air springs, and torsion bars are examples.

The vehicle suspension is responsible for ensuring the ground clearance of the vehicle body. In addition, to remove the body and wheel oscillations caused by uneven terrain, external forces (aerial), and the dynamic forces caused by a vehicle's changing trajectory and acceleration or deceleration (Mulla & Unaune, 2013).

A suspension system is a collection of mechanical links, springs, and dampers that connect the wheels to the chassis. It has historically served two purposes: ensuring the safety of the vehicle's handling and braking, and protecting passengers from vibrations and other influences. The suspension of a wheeled vehicle is a mechanical system of springs or shock absorbers connecting the wheels and axles to the chassis.

The suspension system is comprised of tires, springs, shock absorbers, and connections that link the vehicle's wheels, allowing it to travel adequately. Suspension systems are critical for both maneuverability and travel uniformity (Cao D, Song X, & Ahmadian, 2011). Currently, the suspension mechanism is one of the most essential components of a car's system, largely determining the vehicle's safety and driving comfort. The suspension system transmits and regulates the static and dynamic forces and reactions between the vehicle and the ground (Ghazaly & Moaaz, 2014).

The suspension system consists of springs, safety mechanisms, and connections between the vehicle's wheels. It is a procedure that physically removes the automobile body from the automobile wheel. The suspension system consists of three primary components: a structure that supports the vehicle's weight and determines the suspension geometry; a spring that converts kinetic energy into potential energy; or vice versa; and a shock absorber, a mechanical device designed to dissipate kinetic energy (Goodarzi & Khajepour, 2017). Shock absorbers are hydraulic pump-like devices that assist regulate the impact and recoil movement of the springs and suspension of a vehicle. The major function of

the shock absorber is to maintain tire contact with the road surface at all times, resulting in the safest vehicle control and brake reaction. Figure 1 is an example of a shock absorber used in the suspension system of a car.



Figure 1. An illustration of a car shock absorber.

The primary function of a vehicle's suspension system is to lessen the vertical acceleration transferred to the vehicle body (indirectly to passengers or cargo), hence assuring direct comfort in the lane. Therefore, the functions of the suspension system are to prevent the transmission of road shocks to the vehicle's components, to protect the occupant from road shocks, and to maintain the vehicle's stability while pitching or rolling while the vehicle is in motion (Dishant , Singh, & Sharma, 2017).

Suspensions are classified in accordance with Figure 2 based on the vehicle's body weight and suspension solution for eliminating vertical oscillations.

The passive suspension is the most common and consists of springs with constant or variable stiffness along the stroke and hydraulic shock absorbers with constant damping coefficients; however, there are some performing versions available, such as springs allowing body ground clearance adjustment and shock absorbers with manual damping coefficient adjustment.

For the purpose of enhancing stability and comfort, semi-active suspensions employing dampers with variable damping coefficients that change continuously or discontinuously and springs with constant or variable stiffness but no active force were created.

Using an on-board technology, active suspension regulates both the vertical movement of the body and the wheels' relative movement to the chassis in order to optimize wheel-ground contact, stabilize body motions, and boost comfort.

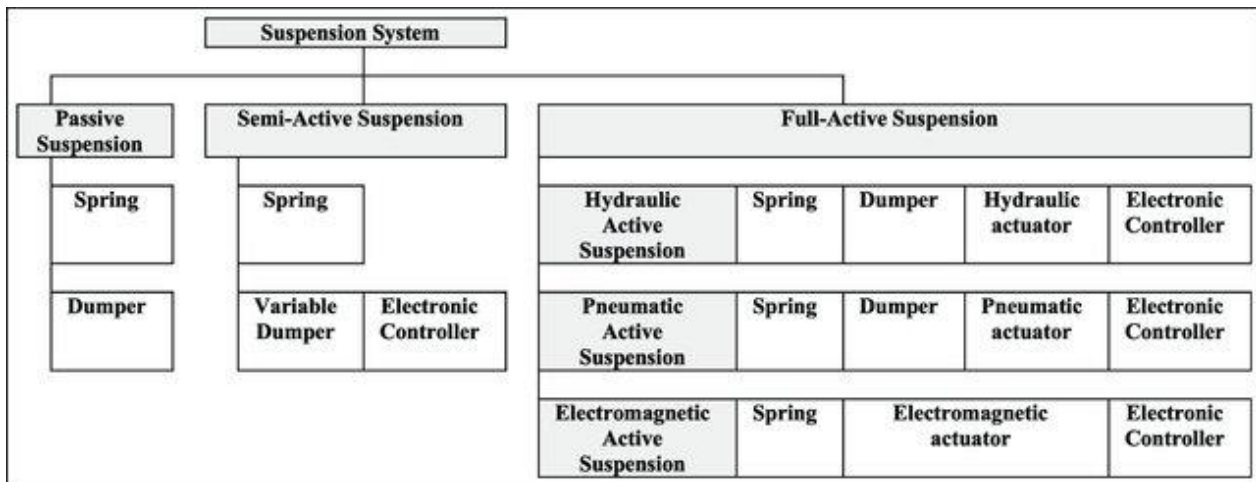


Figure 2. Classification of vehicle suspension systems.

METHODS

This part of the paper presents the most common problems that arise in vehicle suspension systems, as well as methods to solve these problems.

When it comes to suspension changes, the majority of individuals draw their ideas from fellow enthusiasts—friends or message board experts who drive a comparable vehicle. The strategy of attack? Parts procurement? These ideas typically originate from peers. Of course, websites and magazine advertisements will always provide their opinions. These brilliant images of gleaming parts and incredible claims of performance enhancements might be hypnotic.

Although peer approval of a component combination might be quite gratifying, can these sources be relied upon? This document will correct you if the buzz and internet discussion ever push you in the wrong way. Here are 8 typical suspension problems and solutions.

Poor wheel alignment:

When you suspect an issue with your suspension, you may not consider your wheels, but you should. The wheels must be pointed (literally) in the correct direction and aligned for toe-in, camber, and caster. If they are not, your straight-ahead steering will not be centered and tire wear will rise. Potholes and curbs can knock wheels out of alignment, but aligning the wheels will not repair broken springs, control arms, or other components that impact alignment. When purchasing new tires, it is advisable to have the alignment examined so that suspension problems do not reduce tread life.

Shock absorbers:

They should be termed "dampers," and as they wear out, you should see greater bouncing after a bump and a great deal of tire swaying on bumpy roads since they are unable to keep the tires firmly planted on the road. Shocks contain fluid that dampens bouncing; if they begin leaking, suspension performance will decline.

Struts:

If your vehicle's suspension is equipped with struts as opposed to shock absorbers, a banging noise when travelling over bumps is a frequent indication of issue. In many automobiles, trucks, and SUVs, the strut assembly is a key component of the suspension system; if you suspect a problem, you should visit a repair immediately. If this crucial component of your suspension breaks, you may no longer be able to drive your vehicle safely.

Springs:

Your car's springs are an essential component of its suspension. They are what support the vehicle's weight, and when they deteriorate, they might droop or break. If your vehicle is parked on a level surface but one corner is lower than the others, this indicates a broken spring. You can measure the corner height to validate your visual signal. You

may also hear clunking noises over bumps, and the vehicle may not be able to turn with confidence if its supporting spring is destroyed.

Control arms:

These hinges link the steering to the wheels so that when one is turned, the other reacts in like. Important suspension components, lower control arm bushings are more likely to wear out on front-wheel-drive vehicles than on rear-wheel-drive vehicles. Bushings are rubber and/or metal components that aid in shock absorption; when worn, they can create ride and handling issues and hasten tire wear. Likewise, a bent control arm can cause instability. Because the wheels travel back and forth during acceleration and braking, signs of wear include clunks or rattles and loose, inaccurate steering.

Ball joints:

These pivot points connect the suspension to the wheels, absorb a portion of the shock from up-and-down movement, and rotate when the steering angle changes. You will know they require replacement when you hear squeaking and creaking, particularly when rotating. If a ball joint breaks and suspension components are dragging on the pavement, you have waited too long. A mechanic can determine whether or not the ball joints need to be replaced based on the amount of wheel movement they can cause by hand or, in certain circumstances, by the wear indications on the ball joints.

RESULT AND DISCUSSION

Non-Optimal Alignment

Regarding alignments, what is your own? You've seen these threads on message boards a million times: Need the optimum alignment for this make, model, and changes. Then, a large number of individuals will provide all sorts of tribal wisdom, including "blessed settings" that typically bear the name of an individual. On Miata.net, for instance, the Lanny Alignment and the Icehawk Alignment are two popular options.

Are these assigned alignments effective? Maybe, maybe not. It depends on how closely the configuration of your vehicle matches the one used to establish the alignment. The two vehicles must also serve comparable purposes: If they compete at the same location or track, the settings will be far more beneficial.

Loose or Slipping Bolts and Adjusters

Once you have determined the correct alignment, you are set to go, right? Wrong. If a suspension component fails under load, the vehicle will return to its starting position.

Many of us drive older automobiles, and some of its components may not be brand-new. Frequently, strange handling challenges develop when an adjuster has slack in it. In a turn, it does not require much movement to achieve positive camber or toe-out. Occasionally, this is followed by a clunk or cracking sound.

CONCLUSION

This paper provided an overview of the suspension system in cars, where both the general form of the suspension system and the classification of suspension systems in vehicles were presented. The second part of the paper presented the common suspension problems and their remedies that occur in the suspension systems, showing how to deal with them, and providing simple instructions to reduce problems. As a future work, control and stability challenges in vehicles will be studied.

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