International Journal of Engineering, Management and Humanities (IJEMH)
Volume 4, Issue 3, May-June, 2023 pp: 137-140 www.ijemh.com

In-Wheel Suspension Technology

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Date of Submission: 20-05-2023 Date of Acceptance: 02-06-2023

ABSTRACT: In recent years, in-wheel suspension technology has gained significant attention in the automotive industry due to its potential to enhance vehicle performance, handling, and energy efficiency. This research paper provides a comprehensive review of in-wheel suspension systems, including their working principles, design considerations, advantages, challenges, and potential applications. The paper also explores the impact of in-wheel suspension technology on vehicle dynamics, ride comfort, and energy consumption. Furthermore, emerging trends and future research directions in this field are discussed, aiming to provide valuable insights for researchers and engineers working on the development and implementation of in-wheel suspension systems.
KEYWORDS: Suspension, Two-Wheeler,

I. INTRODUCTION

Many of the 2 Wheelers or Motorcycles have each front and rear suspension systems. The mechanical system is a rendezvous of tires, air in tires, springs or dampers, shock absorbers and linkages that connects a vehicle to its wheels and permits relative motion between the Suspension systems and that they should support each road handling and ride quality, that is at odds with one another. Suspension systems in bikes are an essential component that helps to improve rider comfort, handling, and safety. Bikes can have different types of suspension systems depending on the intended use and style of the bike. Some common types of suspension systems used in bikes include:

[1]. Front suspension: Also known as a suspension fork, this type of suspension system is located on the front wheel of the bike and helps to absorb shock and vibrations when riding over rough terrain. It typically consists of a pair of hydraulic or coil springs and a set of telescoping forks that can be adjusted for preload, compression, and rebound damping.

[2]. Rear suspension: This type of suspension system is located on the rear wheel of the bike and helps to absorb shock and vibrations when riding over rough terrain. It typically consists of a pair of hydraulic or coil springs and a set of linkages that connect the rear wheel to the frame of the bike. Rear suspension systems can be classified into different types such as a single pivot, four-bar linkage, or a Horst Link suspension.

[3]. Full suspension: This type of suspension system combines both front and rear suspension systems, providing the maximum level of shock absorption and handling for the rider. Full suspension bikes are common in mountain biking where riders need to navigate over technical terrain.

[4]. Rigid suspension: This type of suspension system does not have any suspension components and relies on the frame and tires to absorb shocks and vibrations when riding over rough terrain. Rigid suspension bikes are commonly used in road cycling, track cycling, and BMX biking.

When designing a suspension system for a bike, several factors must be considered, such as the weight of the rider, the intended use of the bike, and the type of terrain the bike will be used on. It is essential to select the appropriate spring rate and damping settings for the suspension system to ensure that it performs optimally and provides the rider with the desired level of comfort and handling.

This paper is mainly concerned with researching on In-Wheel Suspension System for Two-Wheeler (Bikes). It is a type of suspension system where the shock absorbers and springs are located inside the wheels of a vehicle. This means that the suspension components are directly attached to the wheel hub, rather than being mounted separately on the chassis or body of the vehicle.

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II. DESIGN OF TYPICAL SUSPENSION SYSTEM FOR BIKES


The design of a suspension system for bikes typically involves several key steps:

[1]. Determine the intended use of the bike: The type of suspension system needed for a bike will depend on the intended use of the bike. For example, a bike used for cross-country mountain biking will require a different suspension system than a bike used for road cycling.

[2]. Determine the rider weight: The weight of the rider is an important factor in determining the appropriate spring rate and damping settings for the suspension system.

[3]. Select the type of suspension system: Based on the intended use of the bike, select the type of suspension system. Front suspension systems are commonly used in road cycling and hybrid bikes, while full suspension systems are used in mountain bikes.

[4]. Determine the spring rate: The spring rate is a measure of the stiffness of the suspension springs and is typically determined based on the weight of the rider and the desired ride characteristics. The spring rate can be calculated using the rider weight and the sag measurement.

[5]. Determine the damping rate: The damping rate is a measure of the resistance to motion provided by the shock absorbers and is typically determined based on the spring rate and the desired ride characteristics. The damping rate can be adjusted based on the type of terrain that the bike will be used on.

[6]. Determine the suspension travel: The amount of suspension travel required is typically determined based on the weight of the rider and the type of terrain that the bike will be used on. The suspension travel is the maximum distance that the suspension system can compress and is typically measured in millimetres.

[7]. Determine the suspension geometry: The suspension geometry, including the placement and angle of the suspension arms, can impact handling and ride characteristics. The suspension geometry can be optimized based on the intended use of the bike.

[8]. Test the suspension system: Once the suspension system is designed, it should be tested to ensure that it performs as expected. This can be done through computer simulations and physical testing.

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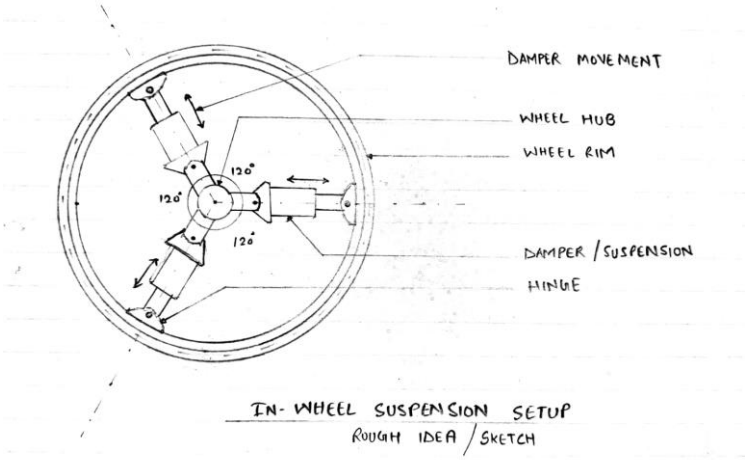
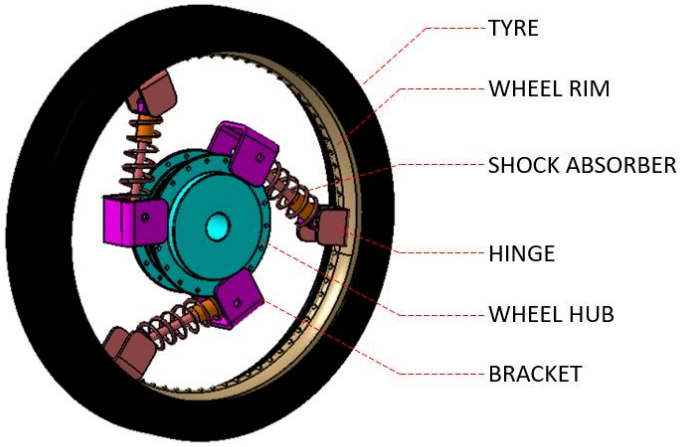
III. IN-WHEEL SUSPENSION TECHNOLOGY: OVERVIEW

As per project requirements, brainstorming and ideas, we came up with a rough design sketch of how we envision the setup to look like.

In this setup, we have taken the reference from the Company Soft wheel who are already working on this technology for Wheelchairs and Bicycles

Suspension arms are set equidistant around a central hub to provide shock absorption, no matter the angle of impact from an obstacle. The advanced suspension system is placed around a central hub and actuates only when an obstacle or rough terrain is encountered, immediately returning the vehicle and rider to a level ride. The system provides 360° suspension, no matter the angle of impact.





UPGRADED DESIGN

IV. MANUFACTURING/FABRICATION

After finalizing the Design, the following steps can be carried out for manufacturing or fabrication of the setup.

[1]. Normal gas welding can be done to the shock absorber to attach the mag wheel to the hub with the help of customized hinges.

[2]. According to the strength, accessibility, and budget of the customer the type of welding can be decided.

[3]. Using nut and bolt assemblies of shock absorber with rim and hub.

[4]. Rivets can be used for assemblies.

V. OBJECTIVES

[1]. To understand the importance of suspensions in automobile
[2]. To improve comfort and ride quality in automobile.
[3]. To reduce impact of bump and damage caused due to road conditions.
[4]. To increase the traction between the tires and road surfaces.
[5]. To provide isolation from high frequency vibration from tire excitation

VI. CONCLUSION

There are several advantages to in-wheel suspension. One is that it allows for a more compact suspension system, which can be beneficial in vehicles with limited space. In-wheel suspension can also improve ride comfort and handling, as it allows each wheel to react independently to bumps and road irregularities. This can lead to better traction, stability, and overall performance.

Another potential advantage of in-wheel suspension is that it can reduce unsprung weight, which is the weight of the suspension components that are not supported by the vehicle's springs. By reducing unsprung weight, in-wheel suspension can improve handling and reduce wear and tear on other parts of the vehicle.

However, there are also some potential disadvantages to in-wheel suspension. One is that it can be more complex and expensive to design and manufacture than traditional suspension systems. In addition, in-wheel suspension can make it more difficult to change or replace tires, as the suspension components are integrated into the wheel itself.

Overall, in-wheel suspension is a technology that has been used in some experimental and concept vehicles, but it is not yet widely used in production vehicles. However, it is an area of active research and development, and may become more common in the future as automotive technology continues to evolve.

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