



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35.

Accredited by NBA – AICTE and Accredited by NAAC – UGC with ‘A++’
Grade

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai.



DEPARTMENT OF AUTOMOBILE ENGINEERING

**COURSE NAME : 23AUT101 – ELEMENTS OF
AUTOMOTIVE SYSTEM**

I YEAR /II SEMESTER

Unit 4 – Linked & Air Suspension System



linked suspension system



- A linked suspension system, also known as a multi-link suspension, is a type of vehicle suspension system that uses multiple arms (or links) to control the movement of the wheel. This design allows for more precise control over the wheel's motion, improving handling, ride comfort, and stability. Multi-link suspensions are commonly found in modern passenger cars, especially in performance and luxury vehicles, due to their superior performance characteristics.





Components of a Linked Suspension System



Control Arms (Links): Multiple arms or links connect the wheel hub to the vehicle chassis. These arms can be of various lengths and orientations.

Bushings: Rubber or polyurethane components that cushion the connections between the links and the chassis, reducing noise and vibrations.

Shock Absorbers: Dampen the oscillations from road irregularities, providing a smoother ride.

Springs: Coil springs or air springs that support the vehicle's weight and absorb shocks.

Subframe: A secondary frame that some of the suspension components attach to, providing additional rigidity and reducing noise and vibrations.

Sway Bar (Stabilizer Bar): A bar that connects the left and right sides of the suspension, reducing body roll during cornering.



Types of Linked Suspension Systems

- Multi-Link Suspension
- Double Wishbone Suspension

1. Multi-Link Suspension

A multi-link suspension uses three or more lateral arms, along with one or more longitudinal arms, to control the motion of each wheel independently. This setup allows for a high degree of flexibility in tuning the suspension geometry for optimal handling and comfort.



Advantages:

- **Superior Handling:** Provides precise control over wheel movement, improving handling and stability.
- **Ride Comfort:** Excellent ability to absorb shocks and vibrations, providing a smoother ride.
- **Adjustability:** Highly adjustable, allowing for fine-tuning of camber, toe, and caster angles.

Disadvantages:

- **Complexity:** More complex and expensive to design, manufacture, and maintain compared to simpler suspension systems.
- **Space Requirements:** Requires more space, which can limit its application in smaller vehicles.



2. Double Wishbone Suspension

A double wishbone suspension, also known as an A-arm suspension, uses two wishbone-shaped arms (upper and lower control arms) to control the motion of the wheel. Each arm has two mounting points to the chassis and one to the wheel hub.

Advantages:

Performance: Provides excellent handling characteristics and ride quality.

Camber Control: Maintains optimal tire contact with the road by controlling camber changes during suspension movement.

Disadvantages:

Complexity: More complex and expensive than simpler suspension designs like MacPherson strut.

Space Requirements: Requires more vertical space, which can limit its application in certain vehicle designs.



Applications

- **Performance Vehicles:** High-performance cars often use multi-link or double wishbone suspensions to maximize handling and stability.
- **Luxury Vehicles:** Luxury cars use these suspensions to provide superior ride comfort and handling.
- **SUVs and Crossovers:** Higher-end SUVs and crossovers may use multi-link suspensions to balance off-road capability with on-road comfort.



Air Suspension system



Air suspension systems use air springs instead of traditional steel springs, offering a range of benefits, including adjustable ride height and improved ride quality. They are commonly found in luxury vehicles, heavy-duty trucks, and buses, as well as some performance cars.

Components of an Air Suspension System

Air Springs (Air Bags): These are rubber and fabric bellows that contain compressed air. They replace traditional coil or leaf springs.

Air Compressor: A device that compresses air to fill the air springs.

Air Lines: Tubes that transport compressed air from the compressor to the air springs.



Air Suspension system



Valves: Control the flow of air into and out of the air springs to adjust ride height and stiffness.

Height Sensors: Measure the vehicle's height and send signals to the control unit to adjust air pressure accordingly.

Control Unit: The electronic system that manages air pressure in the springs based on input from height sensors.

Air Reservoir: Stores compressed air to ensure immediate availability for adjusting the air springs.



Working Principle



An air suspension system operates by adjusting the amount of air in the air springs to maintain the desired ride height and vehicle stability.

Ride Height Adjustment: Height sensors detect changes in the vehicle's height due to load or road conditions. If the height deviates from the preset level, the control unit signals the compressor to add or release air from the air springs.

Damping Control: Advanced systems can also adjust the damping characteristics by controlling the stiffness of the air springs. This provides a balance between ride comfort and handling performance.



Advantages of Air Suspension Systems

- **Ride Comfort:** Provides a smooth and comfortable ride by absorbing road irregularities effectively.
- **Adjustable Ride Height:** Can adjust ride height for different driving conditions and loads, improving versatility.
- **Load-Leveling:** Maintains consistent vehicle height regardless of load, enhancing safety and stability.
- **Improved Handling:** Enhances vehicle handling by adjusting stiffness and damping characteristics.



Disadvantages of Air Suspension Systems

- **Cost:** More expensive to purchase and maintain compared to traditional suspension systems.
- **Complexity:** More components and electronic controls increase the complexity of the system.
- **Potential for Failure:** More components mean more potential points of failure, requiring regular maintenance.



Applications

- **Luxury Vehicles:** Provides superior ride comfort and customizable driving modes.
- **Commercial Vehicles:** Enhances load handling and ride quality for trucks and buses.
- **Performance Cars:** Offers adjustable ride height and damping for improved handling.
- **SUVs and Off-Road Vehicles:** Allows for adjustable ground clearance to handle different terrains.