4. Mechanical Subsystem

Q2. Suspension Types:

SOLUTION – As we know suspension systems are used in vehicles to absorb shocks, improve ride comfort, and maintain stability. The main types of suspension systems are:

1.Independent Suspension

- **Mac Pherson Strut: A simple, cost-effective front suspension that uses the top of a telescopic damper as the upper steering pivot.**
- **Double Wishbone: It uses two arms (upper and lower) to provide better handling and stability.**
- **Multi-Link suspension: It uses multiple arms for better control, used in high-performance and luxury cars.**

2. Dependent Suspension

- **Solid axle(Live axle): Both wheels are connected via a solid beam, so movement in one wheel affects the other.**
- **Leaf Spring suspension: It uses multiple layers of metal strips for shock absorption.**

#Trailing Arm suspension: (can be both dependent or independent)It connects the wheel of a vehicle to its main body (chassis) using a strong metal arm.

3. Semi-Independent Suspension

- **Torsion Beam Suspension: It is a cost-effective suspension used in small cars, with a beam that twists to allow some independent movement.**

DETAILED EXPLANATION ON <u>DOUBLE WISHBONE SUSPENSION:</u>

Structure:

- **Two Wishbone-Shaped Arms:** The wheel is connected to the chassis by two wishbone-shaped arms (upper and lower control arms).
- **Coil Spring or Air Spring:** A coil spring or air spring is used to provide the suspension force.
- **Shock Absorber:** A shock absorber is used to dampen the oscillations of the spring.

- **Ball Joints:** Ball joints connect the control arms to the wheel hub and chassis, allowing for movement in multiple directions.

Practical Applications:

- **High-Performance Vehicles:** Double wishbone suspensions are commonly used in sports cars and racing cars due to their excellent handling characteristics.
- **Off-Road Vehicles:** They are also used in off-road vehicles to provide good wheel articulation and control over rough terrain.
- **Luxury Vehicles:** Some luxury cars use double wishbone suspensions for their superior ride comfort and handling.

Advantages:

- **Excellent Handling:** Provides precise control over wheel movement, resulting in good handling and stability.
- **Adjustability:** Allows for adjustments to camber, caster, and toe angles, which can be used to fine-tune the vehicle's handling characteristics.
- **Good Ride Comfort:** Can provide a comfortable ride even on rough roads.

Disadvantages:

- **Complexity:** More complex and expensive to manufacture than some other suspension types.
- **Space Requirements:** Requires more space than some other suspension types, which can be a constraint in compact vehicles.

SOURCE: Google chrome, youtube and AI overview.