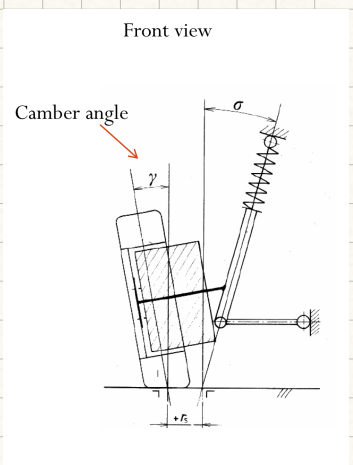
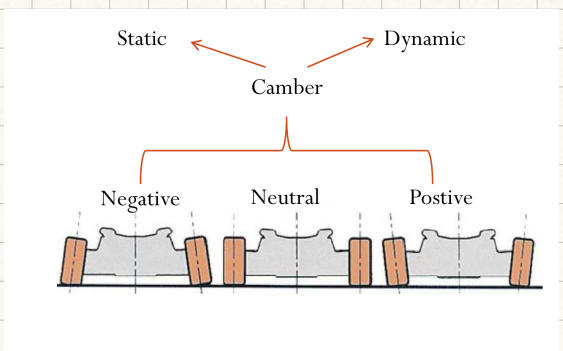
Suspensions

Functions

1) Isolate sprung mass (M_s) from unsprung mass (M_u) (comfort)
2) Transfer (react to) control forces
3) Limit roll motion
4) Limit load transfer
5) Control wheel motion (proper ranges for kinematic parameters).

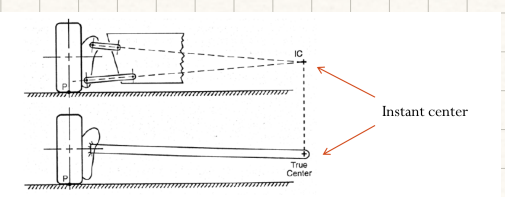
Camber angle

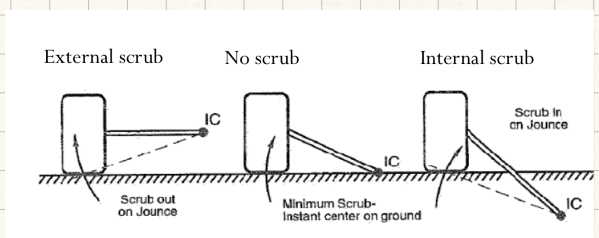




Aim is to maximize the contact area.

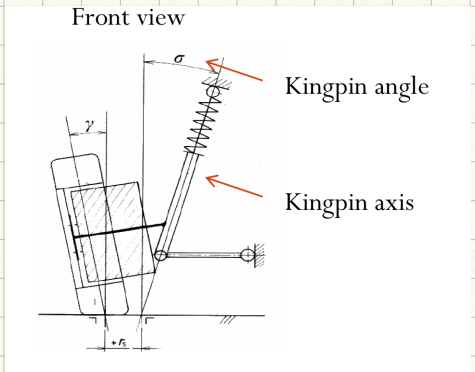
Scrub

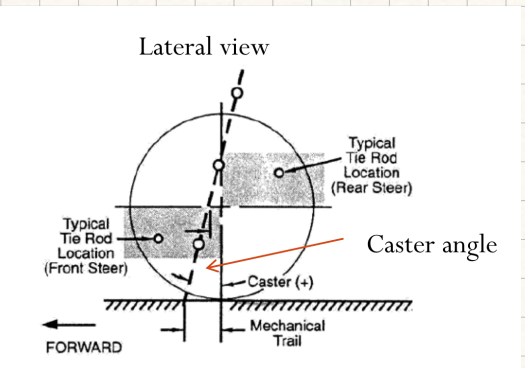




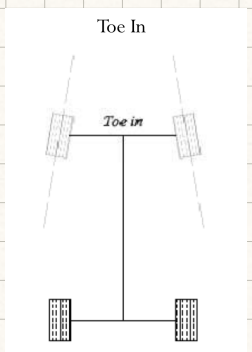
- Track variation
- Unwanted lateral dynamics

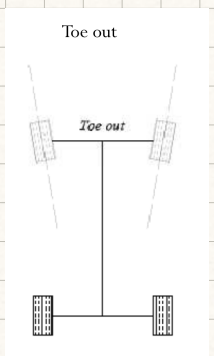
Kingpin axis and angle





Toe angle

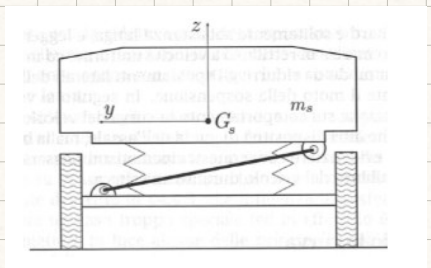




Impact on lateral slip

Types of suspensions

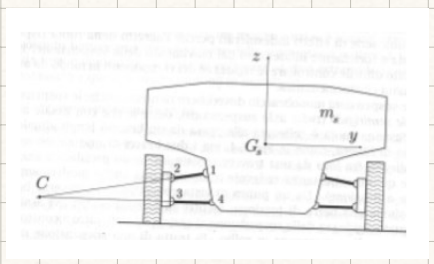
1) Solid axle suspensions
   - Solid axles
   - 2 DoF mechanism
   - Ease of manufacturing



2) Independent suspensions

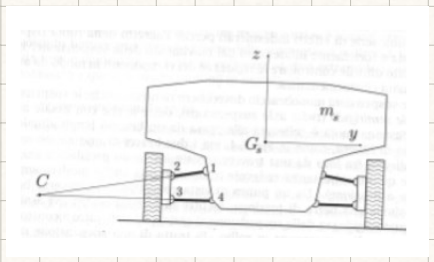
4 DoF mechanism per wheel

- Bigger space to host the engine
- μ limited
- Higher roll stiffness
- Independent motion for the wheels



4-bar linkage susp.

4-bar / double wishbone



Pros:

- Low weight
- Flexible design
- Low aerodynamic drag

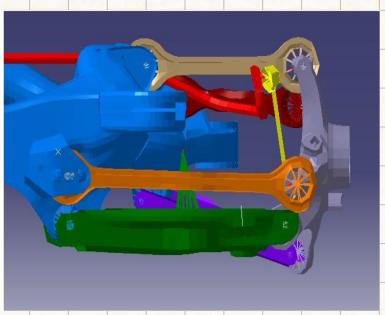
Cons:

- Camber worsening for the inner wheel

Applications:

- Front suspensions for vehicles with rear traction (Longitudinal engine)

Multi-link



Pros:

- Flexible design
- 3D kinematic chain

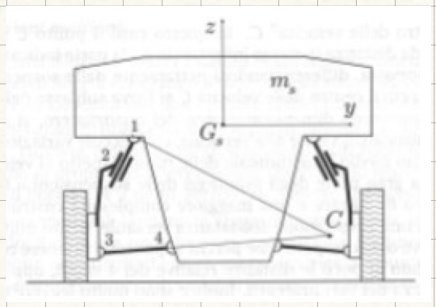
Cons:

- Difficult development

Applications:

- Rear suspensions

MacPherson



Pros:

- Wide room for engine and transmission
- Load distribution along a wide region
- Reduced number of components

Cons:

- Huge size in z-direction (height)

Applications:

- Front suspensions

Anti-features:

Acceleration:

- Anti-squat
- Anti-pitch

Braking:

- Anti-dive
- Anti-lift