

BSc /HND Automotive and Motorsport Engineering

Data Acquisition and Dynamics

Session 5

Geometric Weight Transfer

Roger Dowden
roger.dowden@uwtsd.ac.uk

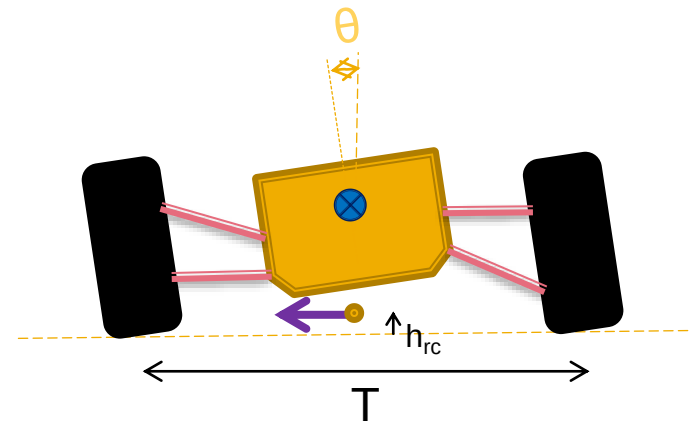
Geometric Weight Transfer

Sprung Mass Geometric Weight Transfer

We now need to calculate the weight transfer due to the sprung mass acting at roll centre height

$$WT_{SRCf} = \frac{M_{sf} \times a_y \times h_f}{T_f}$$

$$WT_{SRCr} = \frac{M_{sr} \times a_y \times h_r}{T_r}$$



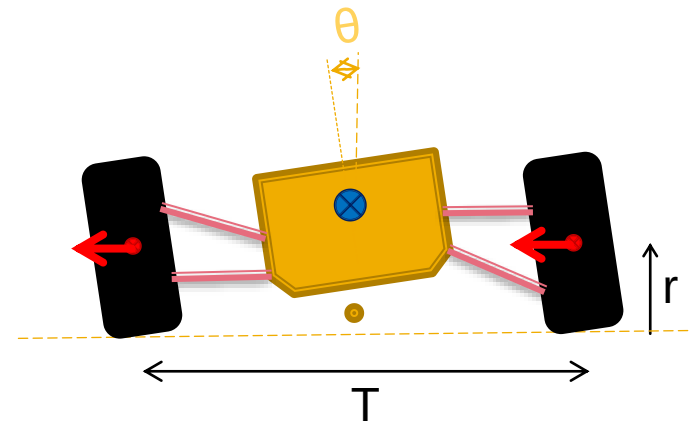
Geometric Weight Transfer

Unsprung Mass Geometric Weight Transfer

The unsprung masses are taken to act at wheel centre height and thus their weight transfer can be defined as

$$WT_{usf} = \frac{M_{usf} \times a_y \times r_f}{T_f}$$

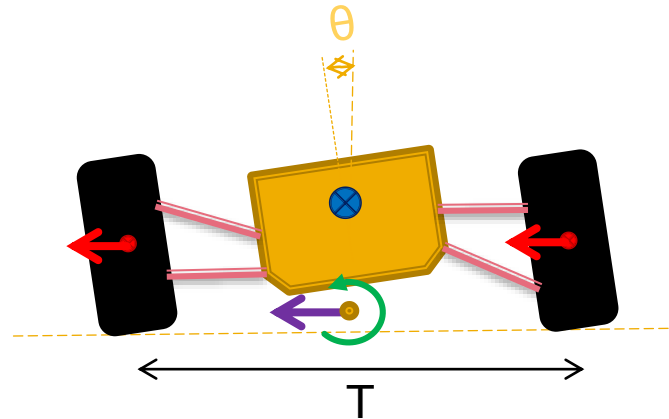
$$WT_{usr} = \frac{M_{usr} \times a_y \times r_r}{T_r}$$



Weight Transfer

Total Weight Transfer

Putting it all together gives us the total weight transfer



$$\theta = \frac{M_s \times a_y \times H}{\left(\frac{T_f^2 K_{wf}}{2} + \frac{T_r^2 K_{wr}}{2} \right)}$$

$$WT = WT_{sf} + WT_{sRCf} + WT_{usf}$$

$$WT_f = \frac{K_{wf} T_f \theta}{2} + \frac{M_{sf} \times a_y \times h_f}{T_f} + \frac{M_{usf} \times a_y \times r_f}{T_f}$$

$$WT_r = \frac{K_{wr} T_r \theta}{2} + \frac{M_{sr} \times a_y \times h_r}{T_r} + \frac{M_{usr} \times a_y \times r_r}{T_r}$$

Weight Transfer



Why calculate individual weight transfer components?

So we have made a big effort to calculate the individual weight transfer components, but these all add up to give the weight transfer calculated by the basic equation:

$$WT = \frac{M \times a_y \times h}{T}$$

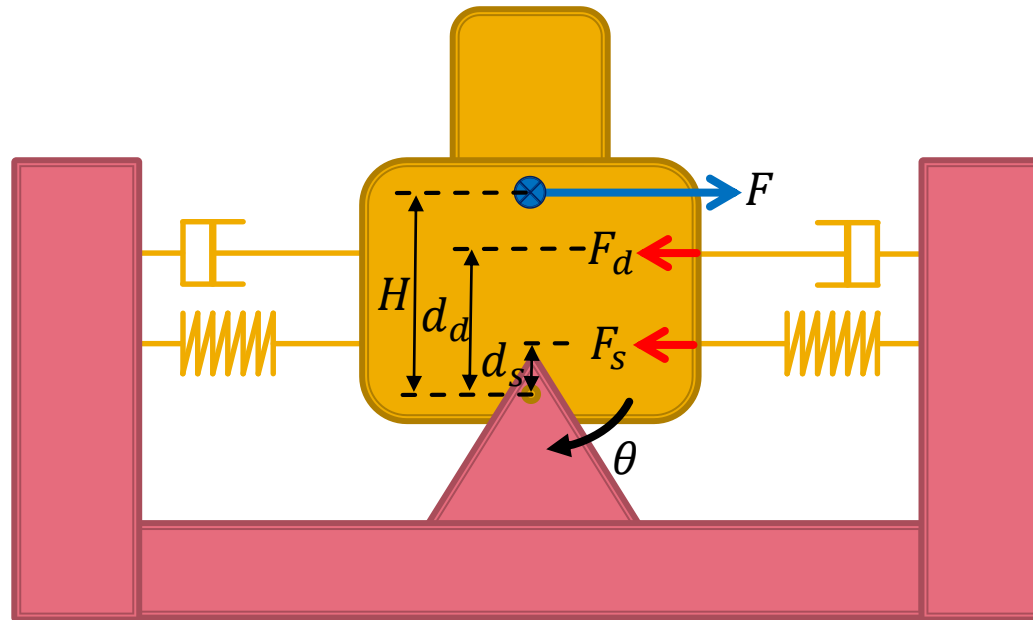
So why bother ???

Weight Transfer

Knowing how the individual wheel loads are distributed enables us to understand how the car will behave when in steady state cornering and also as the car enters and leaves the corner - transient behaviour.

Weight Transfer

Displacement - Velocity - Acceleration



Taking moments about the roll centre:

$$CWM = ACWM$$

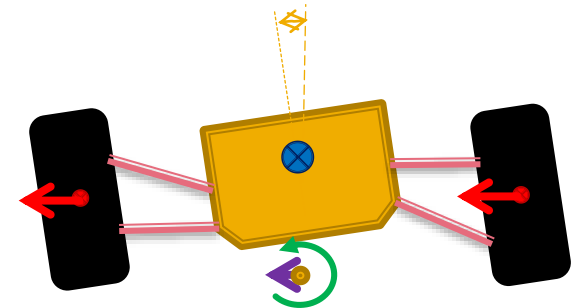
$$(F \times H) = 2[(F_s \times d_s) + (F_d \times d_d)] + I \frac{d^2 \theta}{dt^2}$$

Weight Transfer

Inertia

Low RC :

- Larger roll angle
- More elastic weight transfer
- Large roll inertia
- **SLOW WT** so vehicle response is slower
- Lower suspension jacking forces



High RC:

- Smaller roll angle
- Less elastic weight transfer
- Less roll inertia
- **FAST WT** so vehicle response is faster
- Greater suspension jacking forces

