

Transient Response Characteristics

- * Lateral acceleration
- * Yaw Velocity gain
- * Curvature Response

Lateral acceleration Gain

It is the ratio between the lateral acceleration and steering angle

$$LAG = \frac{V^2}{\frac{Rg}{\delta}}$$

$$\delta = \frac{L}{R} + K_{us} \cdot \frac{V^2}{Rg}$$

$$LAG = \frac{V^2/Rg}{R \left(L + K_{us} \cdot \frac{V^2}{g} \right)}$$

$$LAG = \frac{V^2/Lg}{\left(1 + \frac{K_{us} \cdot V^2}{Lg} \right)}$$

Lateral acceleration gain for neutral
steer $K_{us} = 0$

$$LAG = \frac{v^2}{Lg}$$

For ~~over~~ understeer, $K_{us} = +ve \Rightarrow k_{us} = 1$

$$LAG = \frac{v^2/Lg}{1 + \frac{v^2}{Lg}}$$

For oversteer, $K_{us} = -ve \Rightarrow k_{us} = -1$

$$LAG = \frac{v^2/Lg}{1 - \frac{v^2}{Lg}}$$

Yaw Velocity gain

It is the ratio between Yaw Velocity
and Steering angle.

$$YAG = \frac{v/R}{\delta} = \frac{v/R}{L/R + k_{us} \cdot \frac{v^2}{Rg}}$$

$$= \frac{V/R}{L/R \left(1 + K_{us} \frac{V^2}{Lg} \right)}$$

$$Y_{AG} = \frac{V/L}{1 + K_{us} \frac{V^2}{Lg}}$$

For neutral steer $K_{us} = 0$

$$Y_{AG} = V/L$$

For Understeer $K_{us} = +1$

$$Y_{AG} = \frac{V/L}{1 + \frac{V^2}{Lg}}$$

For Oversteer $K_{us} = -1$

$$Y_{AG} = \frac{V/L}{1 - \frac{V^2}{Lg}}$$

Curvature Response

Curvature Response is the ratio between the curvature to steering angle

$$CR = \frac{1/R}{1 + K_{us} \frac{v^2}{Rg}}$$

For Neutral steer $K_{us} = 0$

$$CR = 1/R$$

For understeer $K_{us} = +1$

$$CR = \frac{1/L}{1 + v^2/Lg}$$

For Oversteer $K_{us} = -1$

$$CR = \frac{1/L}{1 - v^2/Lg}$$

