Rolling Radius

Canopy Equation:

The rolling radius of the tyre (in the case of using the Canopy radius equations) is governed by a subset of the **krLoaded** terms via the following relation:

$$R_{\text{effroll}} = R_0 + \left(k_2 + k_6|F_z|\right) n^2 + k_3 p_{\text{inf}} + k_4|F_z| + k_5|F_z|^2$$

This captures the inflation and growth-with-speed effects but effectively keeps the belt radius almost constant.

Pacejka Equation:

The Pacejka rolling radius equation is given below for reference:

$$R_{\text{effroll}} = R_0 \left(1 + q_{\text{v1}} \left(\frac{n\,R_0}{V_0}\right)^2\right) - \frac{F_{\text{z0}}}{k_{\text{Vert}}} \left(D_{\text{Reff}} \arctan\left(B_{\text{Reff}}\,\rho^d\right) + F_{\text{Reff}}\,\rho^d\right)$$

Where:

$$\rho^d = \frac{R_0 - r_{\text{Loaded}} + q_{\text{v1}} R_0 (n R_0 / V_0)^2}{\frac{F_{\text{z0}}}{k_{\text{Vert}}}}$$

Pacejka with pInflation Equation:

The "Pacejka with pInflation" rolling radius equation is given below for reference:

$$R_{\text{effroll}} = R_{\text{R0}} \left(q_{\text{re0}} + q_{\text{v1}} \left(\frac{n\,R_{\text{R0}}}{V_0}\right)^2\right) - \frac{F_{\text{z0}}}{c_{\text{z}}} \left(D_{\text{Reff}} \arctan\left(B_{\text{Reff}} \frac{F_{\text{z}}}{F_{\text{z0}}}\right) + F_{\text{Reff}} \frac{F_{\text{z}}}{F_{\text{z0}}}\right)$$

Where:

$$c_{\text{z0}} = \frac{F_{\text{z0}}}{R_0} \sqrt{q_{\text{fz1}}^2 + 4 q_{\text{fz2}}}$$

$$c_{\text{z}} = c_{\text{z0}} \left(1 + p_{\text{fz1}}\, dp_{\text{i}}\right)$$

$$dp_{\text{i}} = \frac{p_{\text{i}} - p_{\text{i0}}}{p_{\text{i0}}}$$

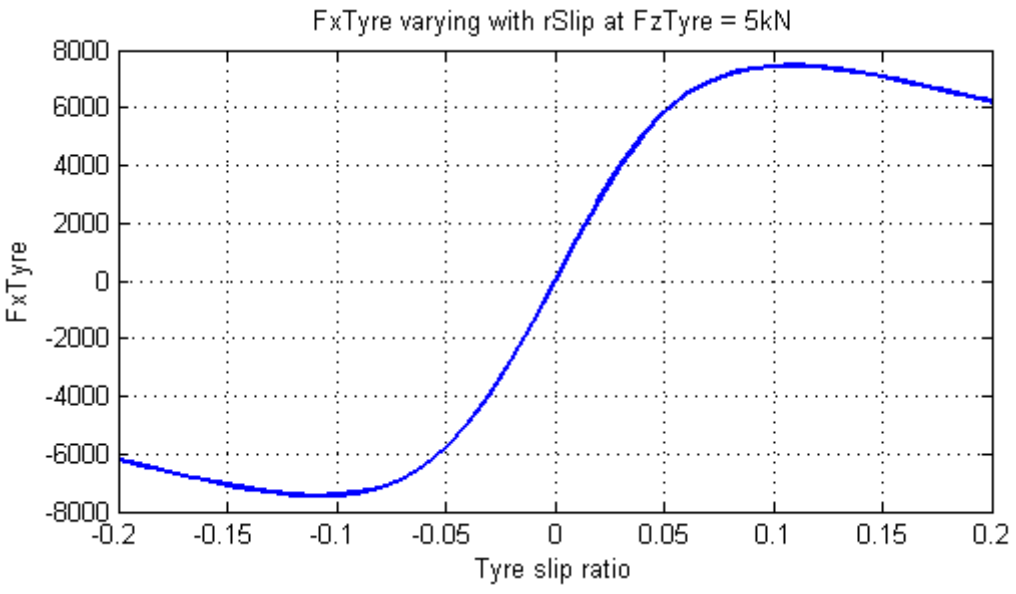
$$R_{\text{R0}} = \begin{cases} \text{RRollingUnloaded} & \text{if defined;} \\ \text{RUnloaded} & \text{otherwise.} \end{cases}$$

Slip Behaviour

The core slip behaviour of the tyre is illustrated in the figure below. This illustrates a number of the key features of tyre behaviour:

1. A linear relationship between FxTyre and rSlipTyre at low levels of slip.
2. A point at which peak FxTyre is achieved.
3. A decrease in FxTyre at higher levels of slip.

The parameters of the tyre model control the shape of this curve.



Grip Loss With Slip

At either high or low slip values the force generated by the tyres will decrease with increasing slip. The rate of this decrease is controlled by the parameters **dFx_drSlipPostPeak** and **dFy_daSlipPostPeak**. The figure below shows the effect of varying one of these parameters.