acceleration $m\frac{d^2x}{dt^2} = F_t - F_d - F_r$ deceleration $m\frac{d^2x}{dt^2} = -F_d - F_r$

$F_d = \frac{1}{2} C_d \rho A v^2$

$F_r = C_r m g$

$T - r_w F_t = I\alpha$

$F_t = \frac{T}{r_w} - m_w r_w \alpha$

wheel slip criteria

$F_t > \mu_s \frac{m}{2} g$

$x = r_w \theta$

$\theta = \frac{x}{r_w}$ $\alpha = \frac{d^2\theta}{dt^2} = \frac{1}{r_w}\frac{d^2x}{dt^2}$

$F_p = P_{gauge} \cdot A_p$

$T = r_g \cdot F_p$

acceleration

$m\frac{d^2x}{dt^2} = F_t - \frac{1}{2} C_d \rho A \left(\frac{dx}{dt}\right)^2 - C_r m g \Rightarrow \frac{d^2x}{dt^2} = \frac{F_t - F_d - F_r}{m}$

decelerat

$$\boxed{m\frac{d^2x}{dt^2} = -\frac{1}{2} C_d \rho A \left(\frac{dx}{dt}\right)^2 - C_r m g}$$

$F_t = \frac{T}{r_w} - m_w r_w \alpha$

$= \frac{T}{r_w} - m_w r_w \left(\frac{1}{r_w}\frac{d^2x}{dt^2}\right)$

$= \frac{r_g F_p}{r_w} - m_w r_w \left(\frac{1}{r_w}\frac{d^2x}{dt^2}\right)$

$F_t = \frac{r_g (P_{gauge} A_p)}{r_w} - m_w\left(\frac{d^2x}{dt^2}\right)$

acceleration

$m\frac{d^2x}{dt^2} = \left(\frac{r_g P_g A_p}{r_w} - m_w \frac{d^2x}{dt^2}\right) - \frac{1}{2} C_d \rho A v^2 - C_r m g$

$m\frac{d^2x}{dt^2} + m_w \frac{d^2x}{dt^2} = \frac{r_g P_g A_p}{r_w} - \frac{1}{2} C_d \rho A v^2 - C_r m g$

$\frac{d^2x}{dt^2}(m + m_w) =$ "

acceleration

$$\boxed{\frac{d^2x}{dt^2} = \frac{\frac{r_g P_g A_p}{r_w} - \frac{1}{2} C_d \rho A v^2 - C_r m g}{m + m_w}}$$