



## PURE ROLLING

### FRONT WHEEL

Forces

$$\underbrace{N_f \sin \theta_f}_{\text{sliding friction}} - \underbrace{C_a \cdot D \cdot \frac{\rho}{2} \dot{x}_f^2}_{\text{Airdrag}} = m_f \ddot{x}_f$$

$$N_f \cos \theta_f - m_f g = 0$$

Torques

$$T - \underbrace{d_f \cdot N_f \cos \theta_f}_{\text{rolling resistance}} = J_f \ddot{\theta}_f$$

### REAR WHEEL

Forces

$$F_r - N_r \sin \theta_r = m_r \ddot{x}_r$$

$$N_r \cos \theta_r - m_r g = 0$$

Torques

$$F_r \cdot r - d_r N_r \cos \theta_r = J_r \ddot{\theta}_r$$

↑  
or it should be  
 $r \cdot N_r \cos \theta_r$ ?

## NOTES

- PURE ROLLING has been considered on both the wheels
- $F_f$  is an internal force, and therefore it has been not considered
- $F_f = -F_r$  (III dynamic principle)
- Same radius of the wheels