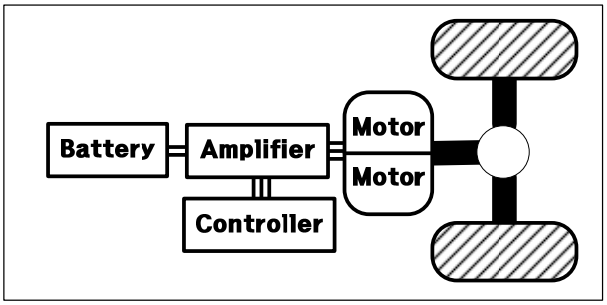
SEOUL NATIONAL UNIVERSITY
SCHOOL OF MECHANICAL AND AEROSPACE ENGINEERING

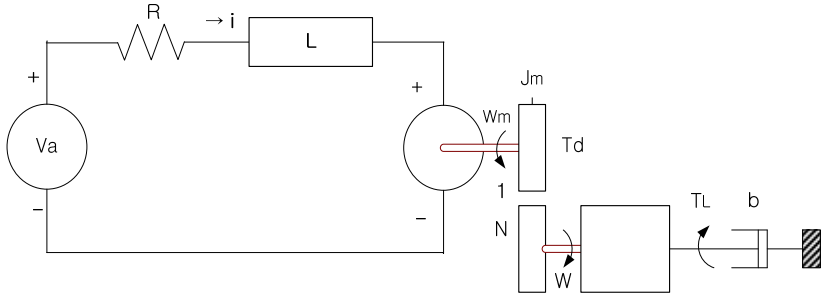
SYSTEM ANALYSIS **Spring 2015**

HW#7 **Assigned: May 12 (Tues)**
May 19 (Tues)

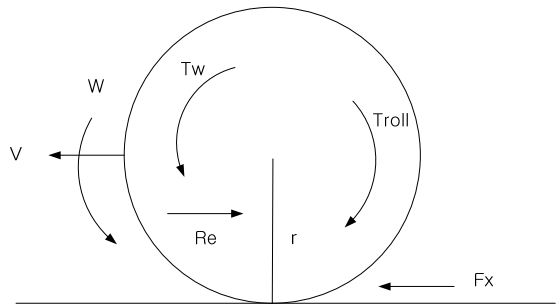
Electric Vehicle Model



Electric Motor and wheel model



Wheel Dynamics



wheel

$$J_w \frac{d\omega}{dt} = T_w - F_x r - T_{roll}$$

$$m_w \frac{dv}{dt} = -m_w g \sin\theta + F_x - R_e$$

Vehicle body

$$M \frac{dv}{dt} = R_e - Mg \sin\theta - C_a v^2$$

Motor

$$V_a = Ri + L\frac{di}{dt} + K_b \omega_m$$

$$J_m \frac{d\omega_m}{dt} = K_T i - T_d$$

$$N = \frac{\omega_m}{\omega} = \frac{T_w}{T_d}$$

Parameters

Motor

$L = 3 \times 10^{-3} H$

$J_m = 1 kgm^2$

$N = 2$

Vehicle

$J_w = 1.35 \times 4 kgm^2 \quad M = 2000 kg$

$m_w = 50 \times 4 kg \quad r = 0.3 m$

$C_a = 0.35 N/(m/s)^2$

$T_{roll} = r \times 0.01 Mg$

Assume that the number of driving motor is 2 and, V_{max}=600V, R=1Ω then Calculate K_T to satisfy following performance:

(1) starting acceleration =0.6g

(2) maximum climbing gradient =10deg at the vehicle speed of 10km/h

(3) maximum speed =150km/h