TESLA MODEL S P85

CAR CHARACTERISICS			
Torque:	600 Nm at 0 RPM	Power:	460 HP/343 kW at 8600 RPM
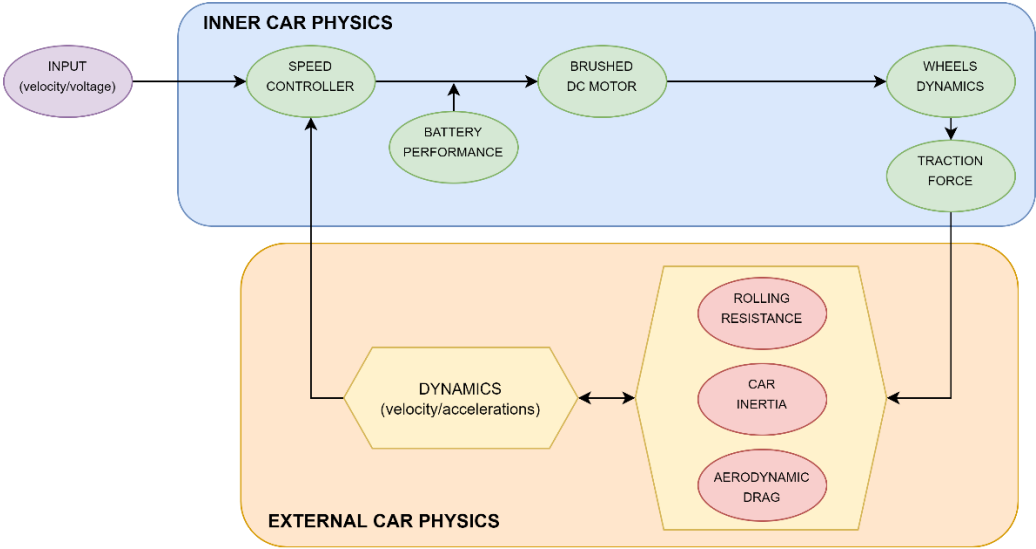
| BATTERY PERFORMANCE		
16 modules wired in series containing 6 groups of 74 cells wired parallel	Cell Nominal Voltage:	3.6 V
$Nominal\ battery\ voltage = modules \cdot groups \cdot group\ voltage$	$\Rightarrow$	$V = 16 \cdot 6 \cdot 3.6 = 346\ V$

BRUSHED DC MOTOR				
Electromotive Force:	$E(t) = K_E \cdot \omega(t)$			
Voltage (Time domain):	$V(t) = I(t) \cdot R + L\dfrac{dI(t)}{dt} + E(t)$ $\Rightarrow$ $V(t) = I(t) \cdot R + L\dfrac{dI(t)}{dt} + K_E \cdot \omega(t)$			
Voltage (Laplace domain):	$V(s) = I(s) \cdot R + s \cdot L \cdot I(s) + K_E \cdot \omega(s)$			
Motor Torque:	$T(t) = K_T \cdot I(t), \quad T(s) = K_T \cdot I(s)$ $\Rightarrow$ $T(s) = K_T \cdot \dfrac{V(s) - K_E \cdot \omega(s)}{s \cdot L + R}$			
From Data Sheet:	$R = 5.3 \cdot 10^{-3}\ Ohm$	$L = 493 \cdot 10^{-9}\ Henrys$	$K_E = 0.12\ Vs/rad$	$K_T = 0.25\ Nm/Amp$
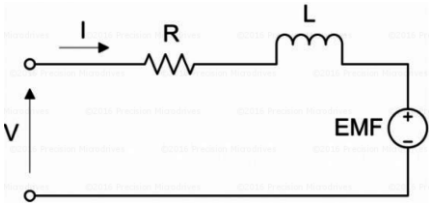
TRACTION FORCE

Wheel diameter:	$2L = 48\ cm$
Gear ratio:	$G_r = 9.73$
Overall Efficiency:	$\eta = 0.70$
Resultant Force:	$F_T = \dfrac{T}{L} \cdot G_r \cdot \eta$

T: Torque Produced by the Motor

L: Distance from center of rotation

AERODYNAMIC DRAG

Drag Coefficient:	$C_D = 0.24$	Frontal Area:	$A = 2.34\ m^2$
Density at the sea level:	$\rho = 1.225\ kg/m^3$	Drag force:	$F_D = 0.5 \cdot \rho \cdot v^2 \cdot A \cdot C_D$

ROLLING RESISTANCE

Car mass:	$m = 2100\ kg$	Rolling Resistance Coefficient:	$C_r = 0.02$	Rolling Force:	$F_R = C_r \cdot m \cdot g$

Weight

Direction of travel

Rolling Resistance

Friction Force (accelerating)

Friction Force (braking)