Modeling and Simulation

Second semester 2021/2022

Modeling and Simulation Project

Instructor : Dr.Hani Mohsen

Electric vehicle simulation

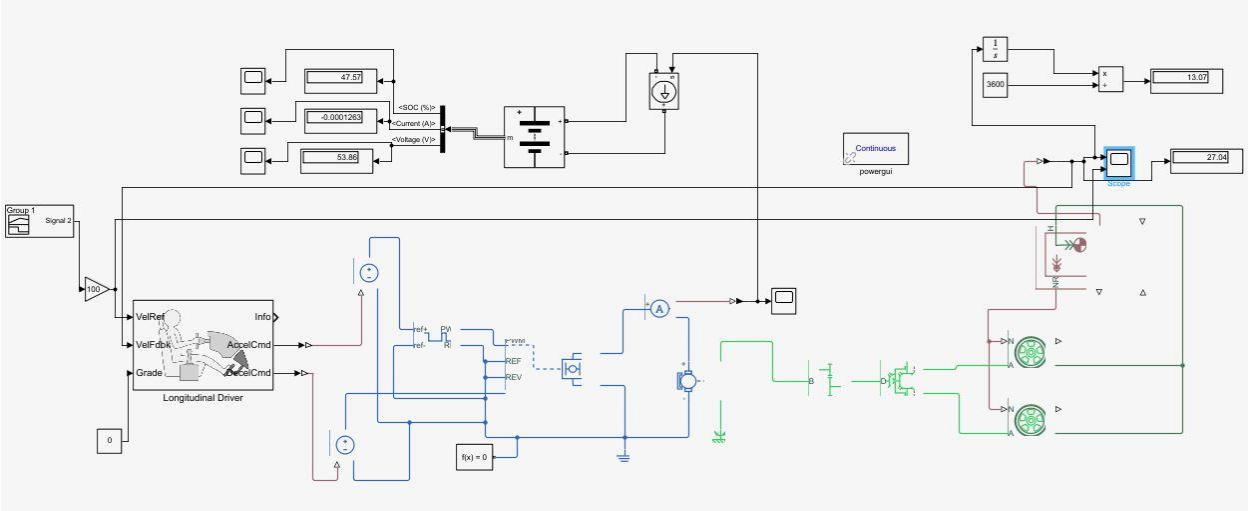
Done by:

Amro Habboush 20181102011

Rami abu al nadi 20181102047

➢ Introduction:

A n EV is a shortened acronym for an electric vehicle. EVs are vehicles that are either partially or fully powered on electric power. Electric vehicles have low running costs as they have less moving parts for maintaining and also very environmentally friendly as they use little or no fossil fuels (petrol or diesel).



➢Components:

1-Signal builder and gain

2-Longitudinal driver

3-Controlled voltage source X2

4-Controlled PWM voltage

5-H-bridge

6-Current sensor

7-DC motor

8-Controlled current source

9-Battary

10-Powergui

11-Simple gear

12-Differential

13-Tire X2

14-Vehicle body

15-Scope X5

16-Display X5

17-Bus selector

18-Constants and integrator

19-Refrences

20-Solver configuration

➢ Instructions

i. Type ssc_new in the Matlab command window to open a new model file.

ii. Place the tires and vehicle body and connect them, then connect the tires with the differential and the differential with the gear box then with the reference.

iii. Connect the DC motor with the gear (mechanical C-R) port.

iv. Connect the electrical port (-) with the ground and the (+) with the output of current sensor.

v. Connect the current sensor input with the (+) output of the h-bridge and the (-) side of h-bridge with the ground.

vi. Connect the h-bridge PWM input with the PWM from controlled PWM voltage and the REF of it with the REF of the h-bridge and then to the ground. Also, connect the REV of h-bridge and ref(-) of the controlled PWM voltage with the ground.

vii. Connect the ref(+) of the controlled PWM voltage with the output of the controlled voltage source 1 and the BRK of the h-bridge with the output of the controlled voltage source 2. Also, connect both controlled voltage source 1 and 2 with the ground.

viii. Connect the accelCmd from longitudinal driver with controlled voltage source 1 and the decelCmd from longitudinal with controlled voltage source 2.

ix. Add a constant to the grade from longitudinal driver inputs and let it be 0. Connect the output of the gain with the VelRef

from longitudinal driver inputs and the velocity of the vehicle body with VelFdbk.

x. Connect the input of the gain with the output of the signal builder after changing the time of it to 1000.

xi. To see the outputs we connect the output velocity of the vehicle's body with a scope and display and compare it with the output of the gain. Also, we take the velocity of the vehicle's body to an integrator and thein into a product with constant 3600.

xii. We use a scope at the current sensor to see the current with time.

xiii. We connect the mask (M) of the battery with a bus selector then to 3 scopes and 3 displays to see:
A- The SOC% (the battery remaining capacity)
B- The current
C- The voltage

➢ Parameters:

We got the parameters from:

1- Trail and error.
2- Real life electric cars

Signal builder time = 1000 sec

PWM frequency = 1000 H

Threshold voltage =0.0001 V

PWM signal amplitude = 1 V

Reverse threshold voltage = 0.0001 V

Braking threshold voltage= 0.0001 V

Output voltage amplitude = 50 V

Total bridge on resistance = 0.1 Ohm

Follower to base = 2

Carrier to driveshaft = 4

Mass = 600 kg

Nominal voltage = 50 V

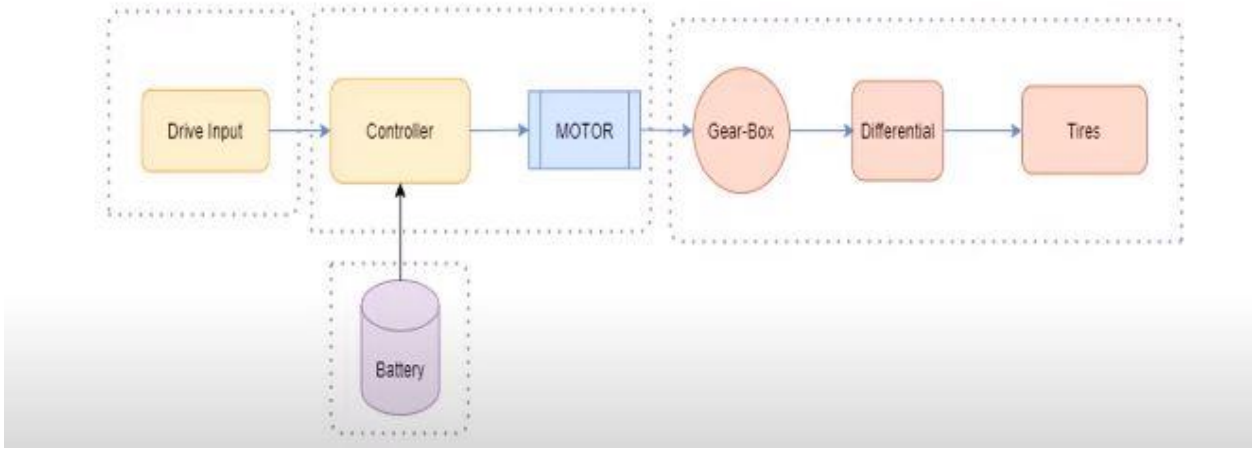
Rated capacity = 50 Ah

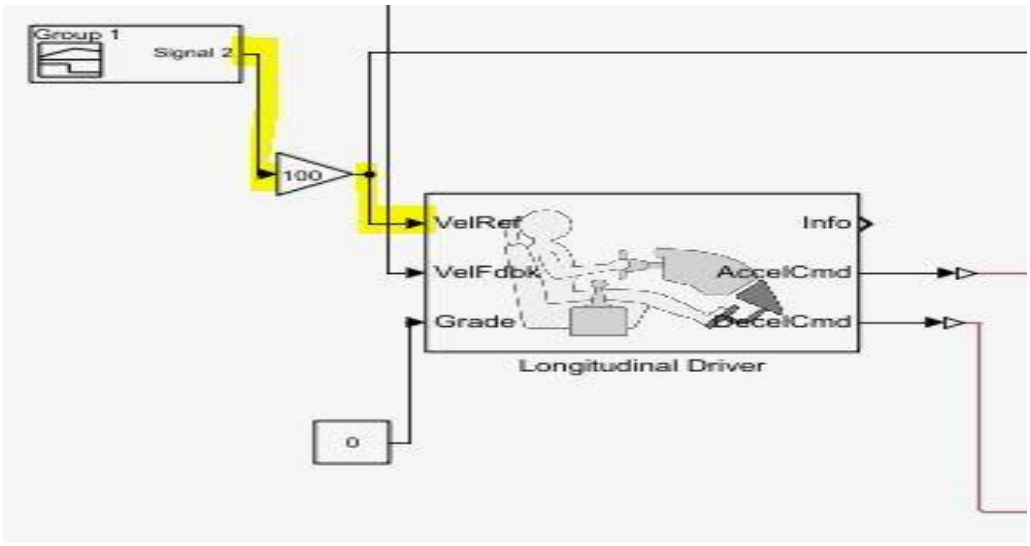
Initial state-of-charge (%) = 100

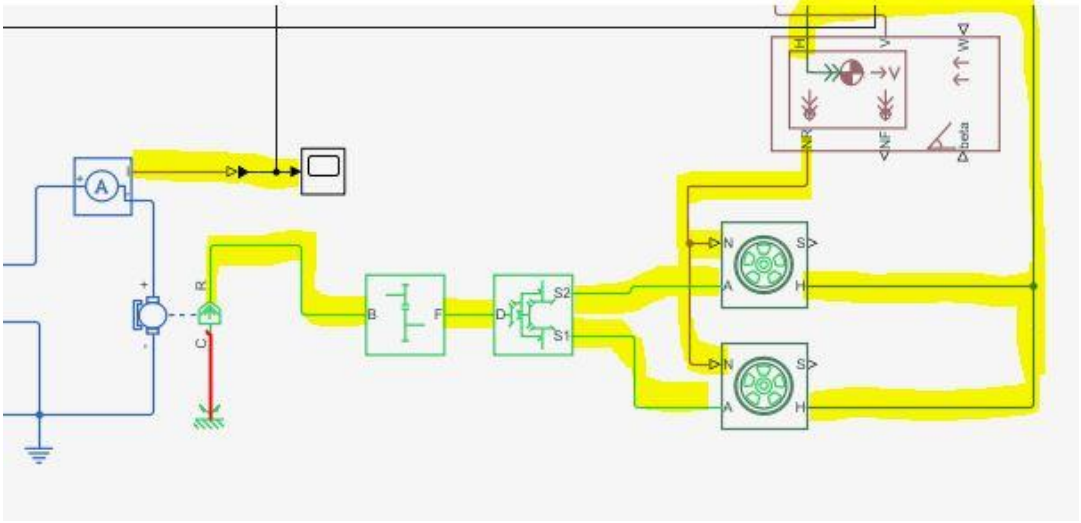
Battery response time (s) = 30

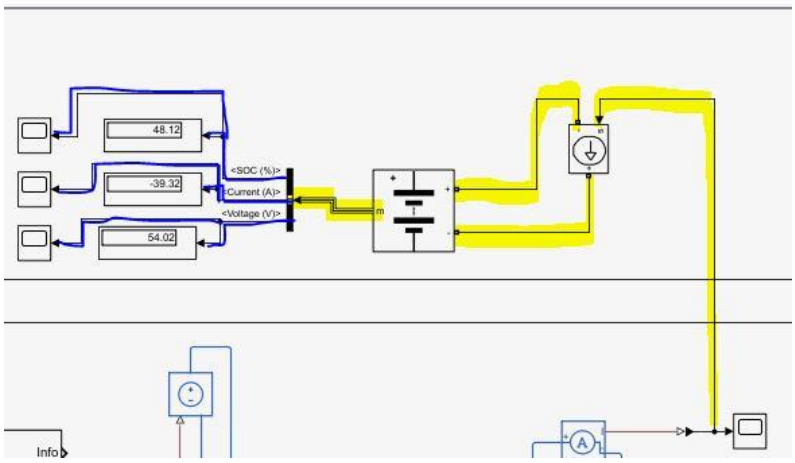
➢ Principle of operation:

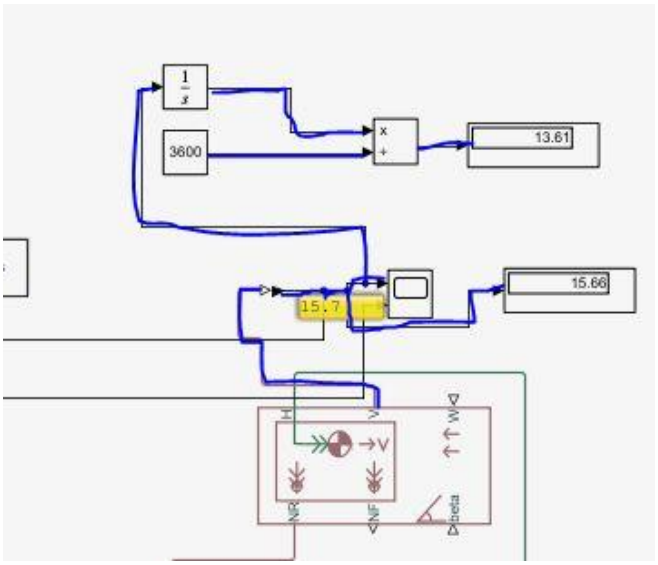
the drive input goes to the controller as a signal, the battery is also connected to the controller (so the controller take the power from it). The controller is connected to the motor to control the movement with time (mechanical and electrical). The mechanical part of the motor is connected to the gear box which is connected to the differential to give the power to the tires.


Drive Input
Controller
MOTOR
Gear-Box
Differential
Tires
Battery


Group 1
Signal 2
100
VelRef
VelFdbk
Grade
Info
AccelCmd
DecelCmd
Longitudinal Driver
0


A
R
C
B
F
D
S2
S1
N
S
A
H
V
W
beta





➢ Simulink model: