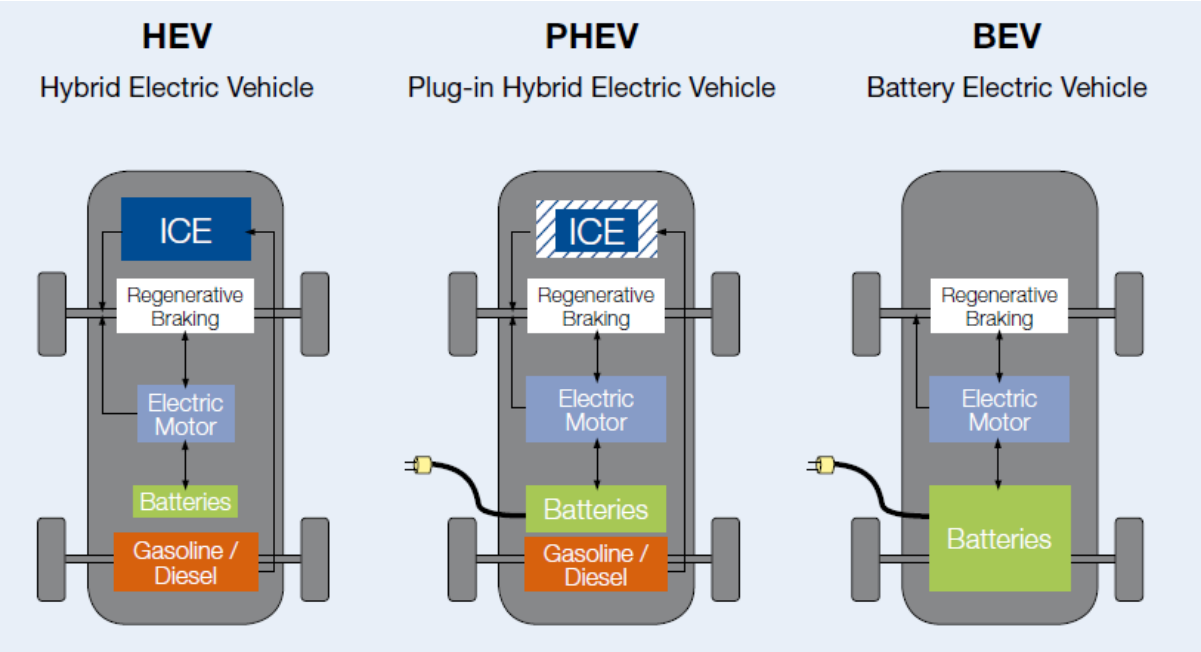
**1.Title –** Matlab model of electric car.

**2.Objective –**

- To Design and modelling of electric car subsystems, connect and perform simulation using Simulink.
- Analyse the plots.

**3.Introduction –**

Electric vehicles are vehicle that at least partially on electricity. Unlike conventional vehicles that use a gasoline or diesel powered engine. Electric vehicle can be categorized into three categories – HEVs, PHEVs, BEVs. Hybrid electric vehicles are powered by both petrol and electricity. Plug in hybrid vehicles are powered by conventional energy and electric energy, PHEVs can be externally charged at charging outlet. Battery electric vehicles are fully powered by electric energy. Main components of electric vehicle are – Battery, Inverter and converter, Master controller, Component controller, Motor and auxiliaries.

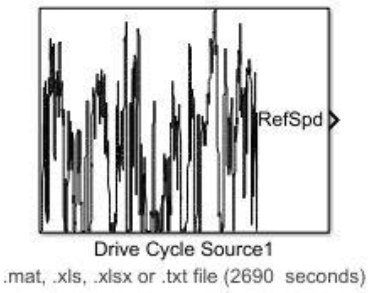


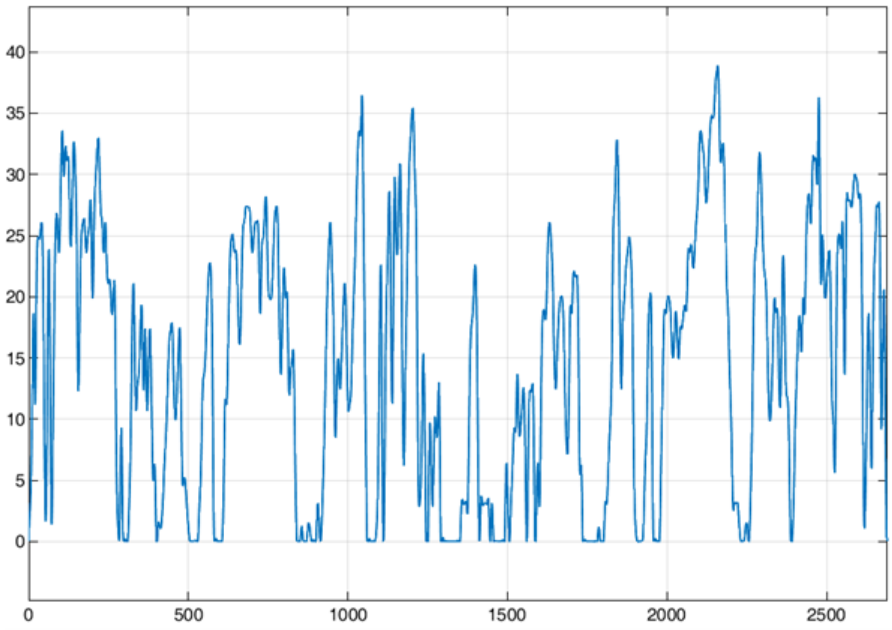

**4.Description –**

Modelling involves a representation of actual system. Consider a bike, it has hundreds of components. Each can be modelled separately and can be assembled together to make a subsystem in Simulink to perform simulation. Doing experiment on real bike would be very difficult but Simulink makes these experiment very easy to perform and analyse.

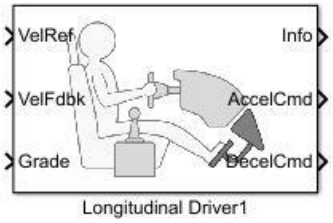
**Blocks used –**

Diving cycle Source – It specifies a standard driving cycle, files for driving cycle can be imported. We are using Indian urban driving cycle in this model.



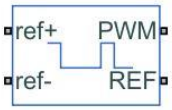



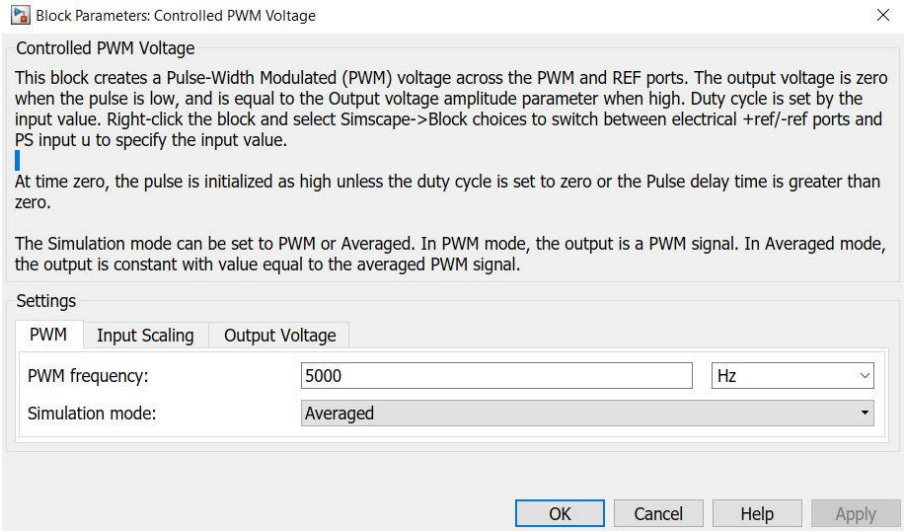

Longitudinal driver – This block tracks and controls longitudinal speed. It takes driving cycle or others signal as reference speed and vehicle speed (calculated by model) can be given as feedback. It gives acceleration and deceleration signal as output.




Scope – It displays signal.

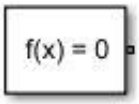
Controller PWM Voltage – it creates PWM voltage across PWM and reference port. Output voltage will be zero when pulse is low and equal to amplitude voltage when high. we are giving PWM frequency – 5000.



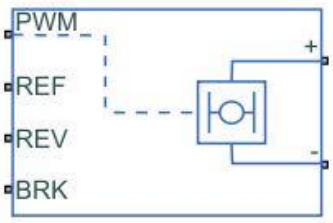



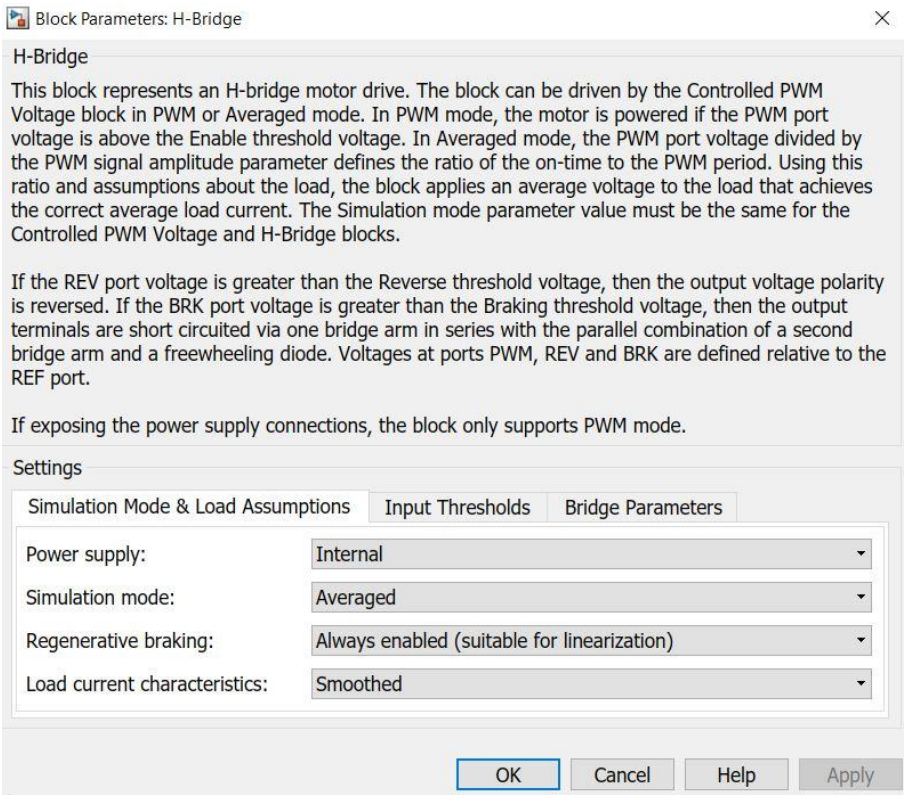

Controlled voltage source – it represents an ideal voltage source, which provides specified voltage regardless current.it is connected with controller voltage PWM voltage block.

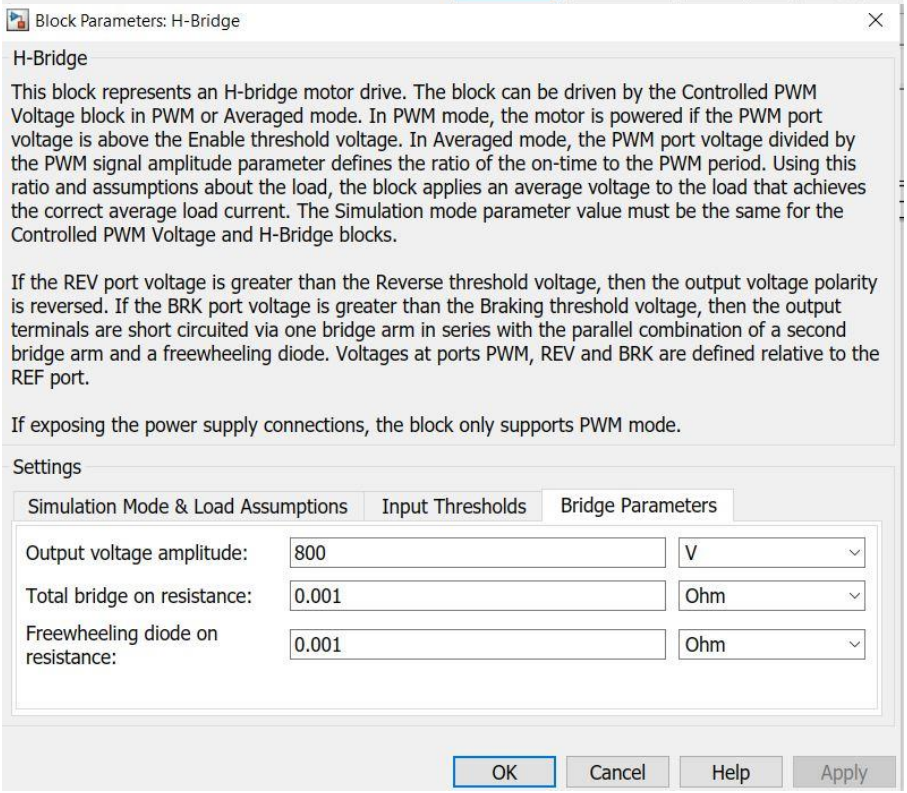
Solver configuration – it provides solver setting information to model.



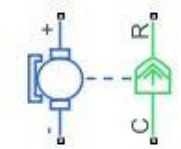

H- Bridge – it represents H-bridge motor driver. We run it in averaged mode and power supply mode is internal with voltage 800V.it takes PWM signal, reference voltage for reversing voltage, braking signal which short circuits output terminal as input. output port is connected to dc motor.

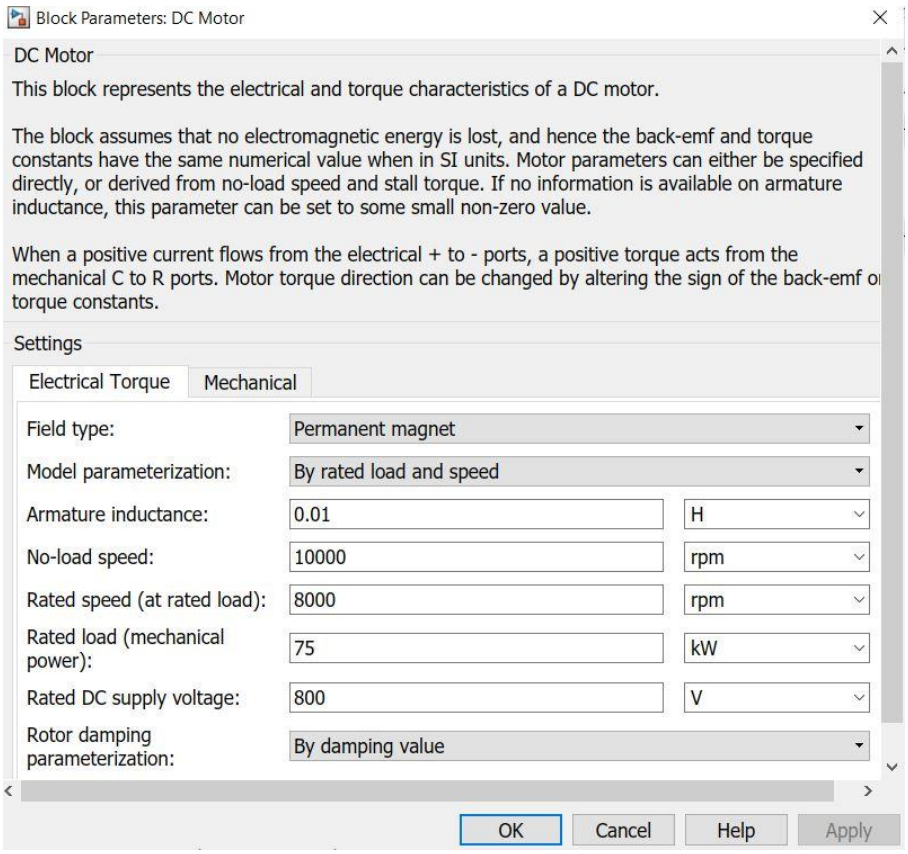




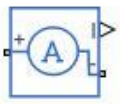




DC motor – this block represents a DC motor with specific toque and speed characteristic. Input port of this block takes voltage. It has mechanical rotational conserving port as output. We are using permanent magnate type DC motor in this model with 10000RPM speed at no load, 8000RPM rated speed, 75KW rated load.

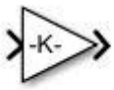


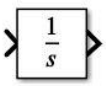

Ammeter – it measures current and it is connected with motor and h bride in series. It is used to indicate state of charge.



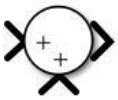

Gain – this block multiplies input with a constant value.



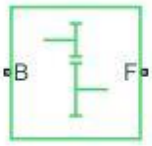

Integrator – it integrates input signal with respect to time.




Sum – it adds input values.

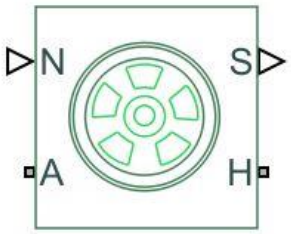


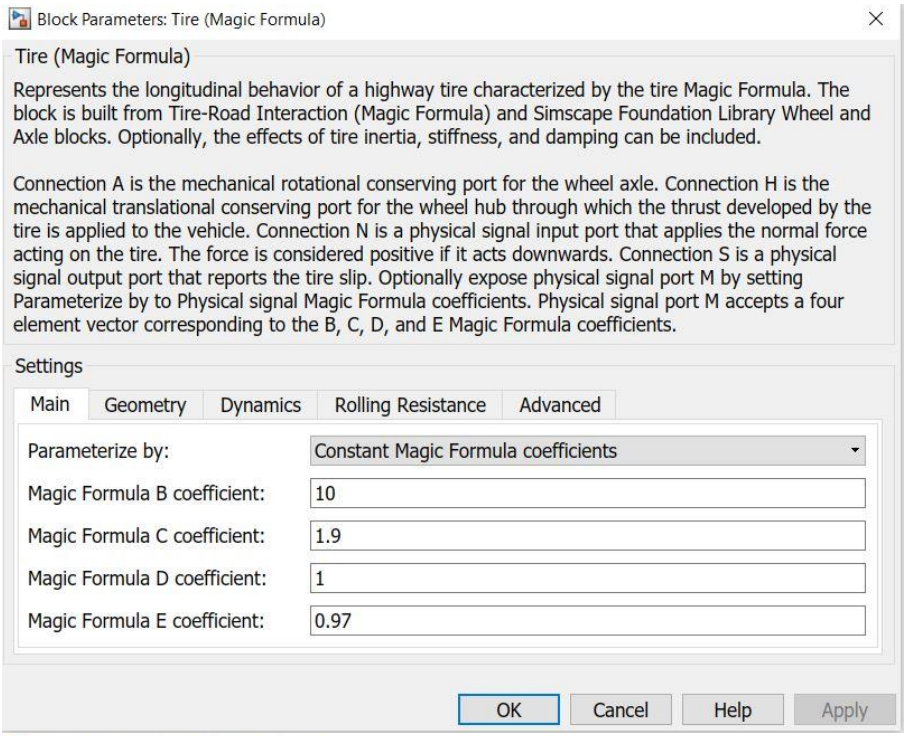
Simple gear -it represents a gear box that constrains the connected driveline axes of the base gear and follower gear, corotate with specified gear ratio. We are 4 as gear ratio.

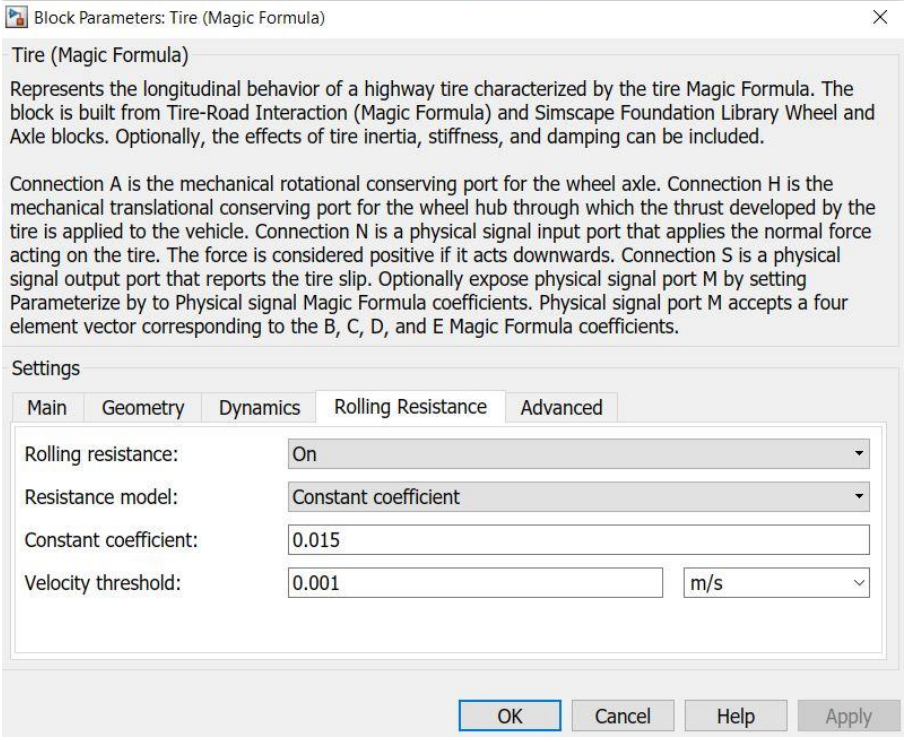



Inertia – it represents mechanical rotational inertia. We are giving 0.01 kg*m^2 as inertia.

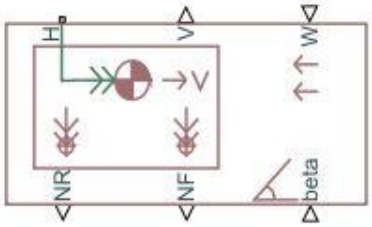
Tire (magic formula) – it represents a tire longitudinal behaviour given by the magic formula, which is equation based on four coefficients.it takes normal force and value of coefficients as input and provide slip as an output. We are connecting axle and hub to vehicle body block.

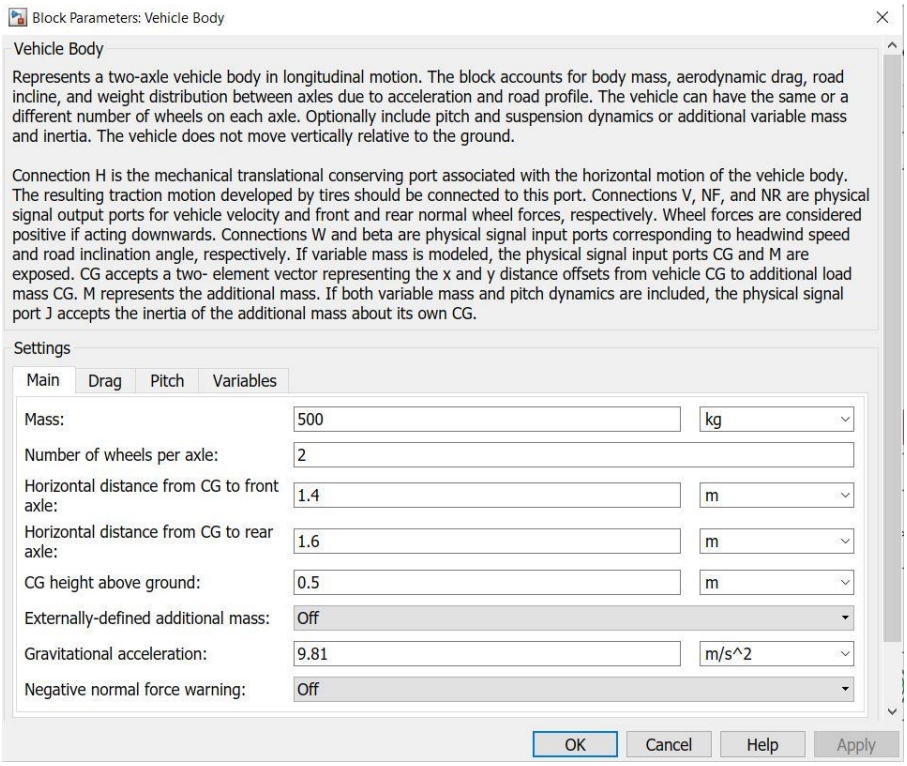




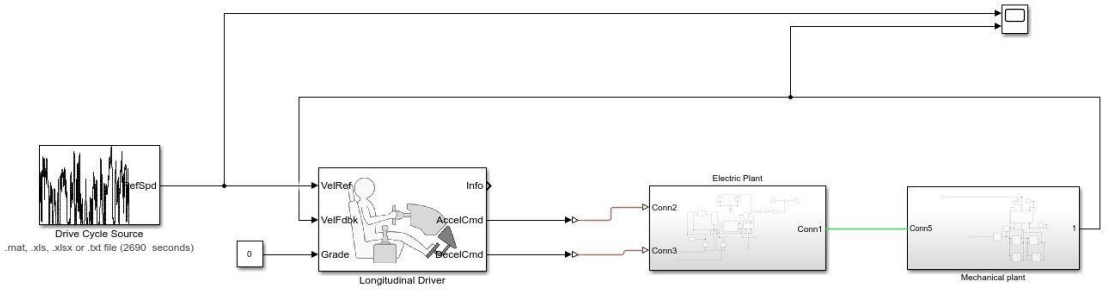

Vehicle body – the vehicle body block represents two axle vehicle body.it takes wind speed, grade angle as input and provides longitudinal velocity, normal force as output. Tire are connected to hub port of this block.



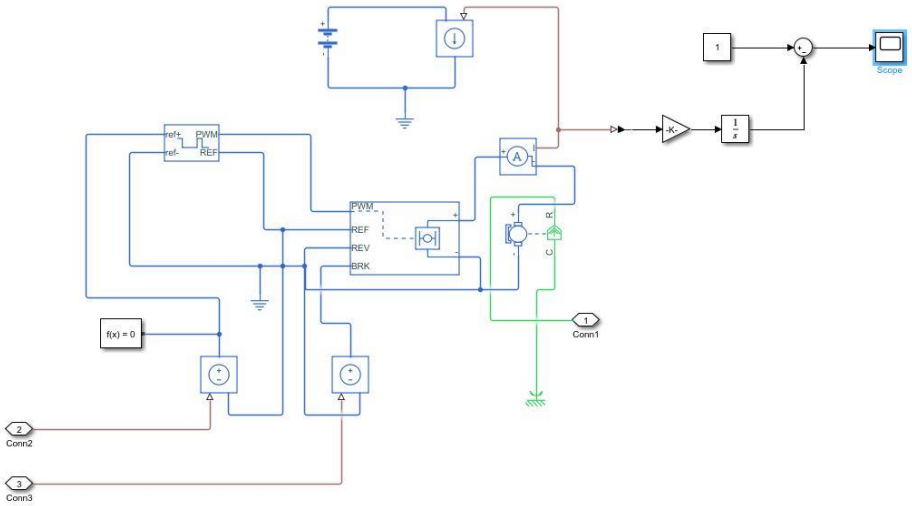




Constant – this block provides constant, it could be for Simulink system or physical system.

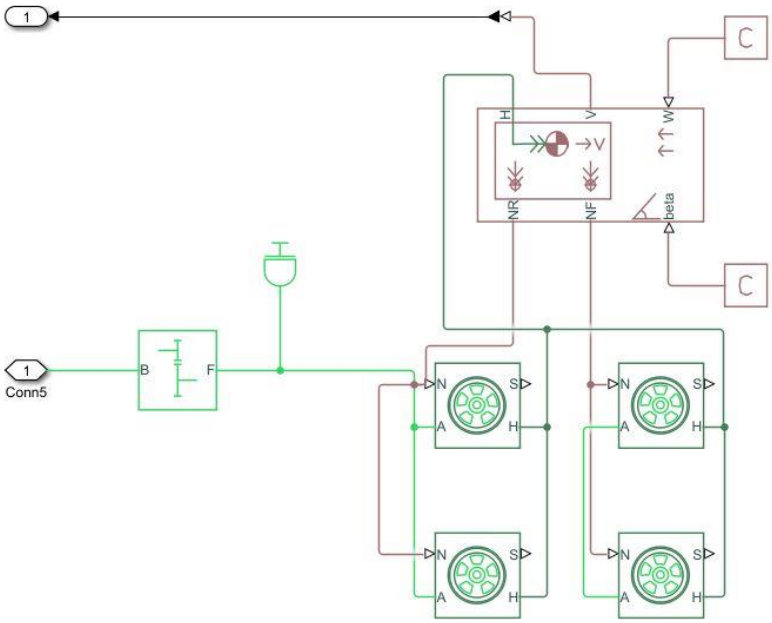

**Electric vehicle model –**




Electric plant

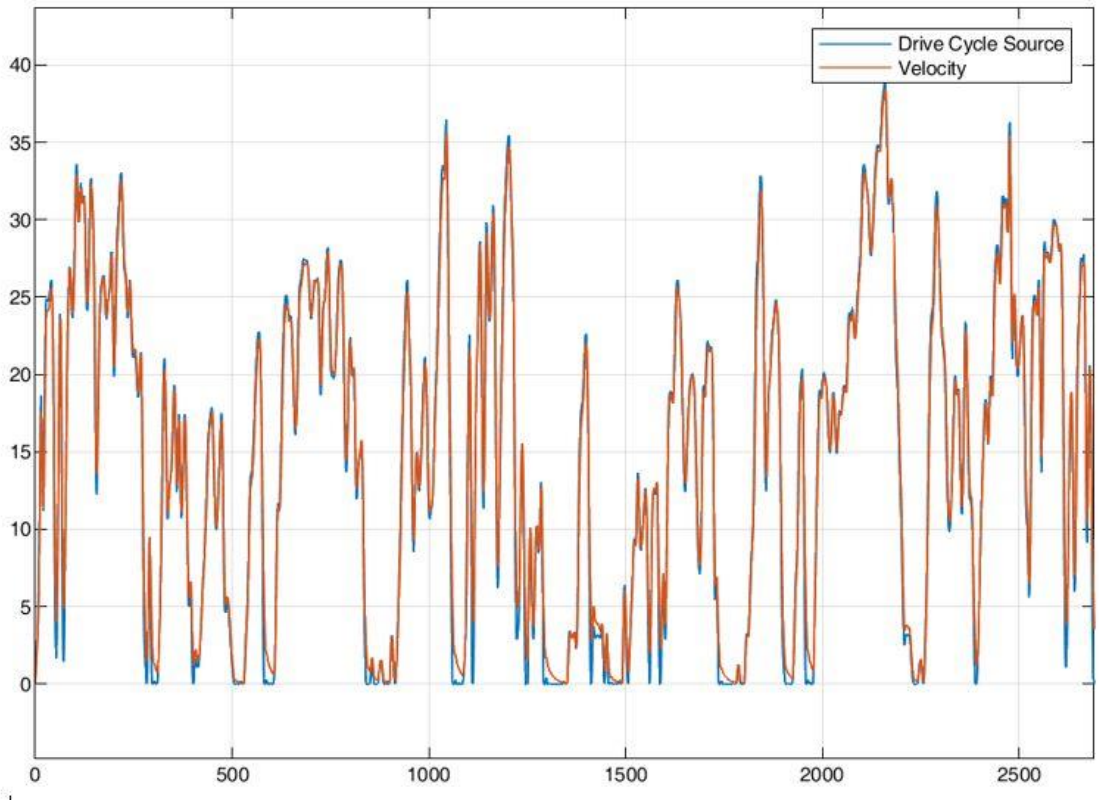



Drivetrain

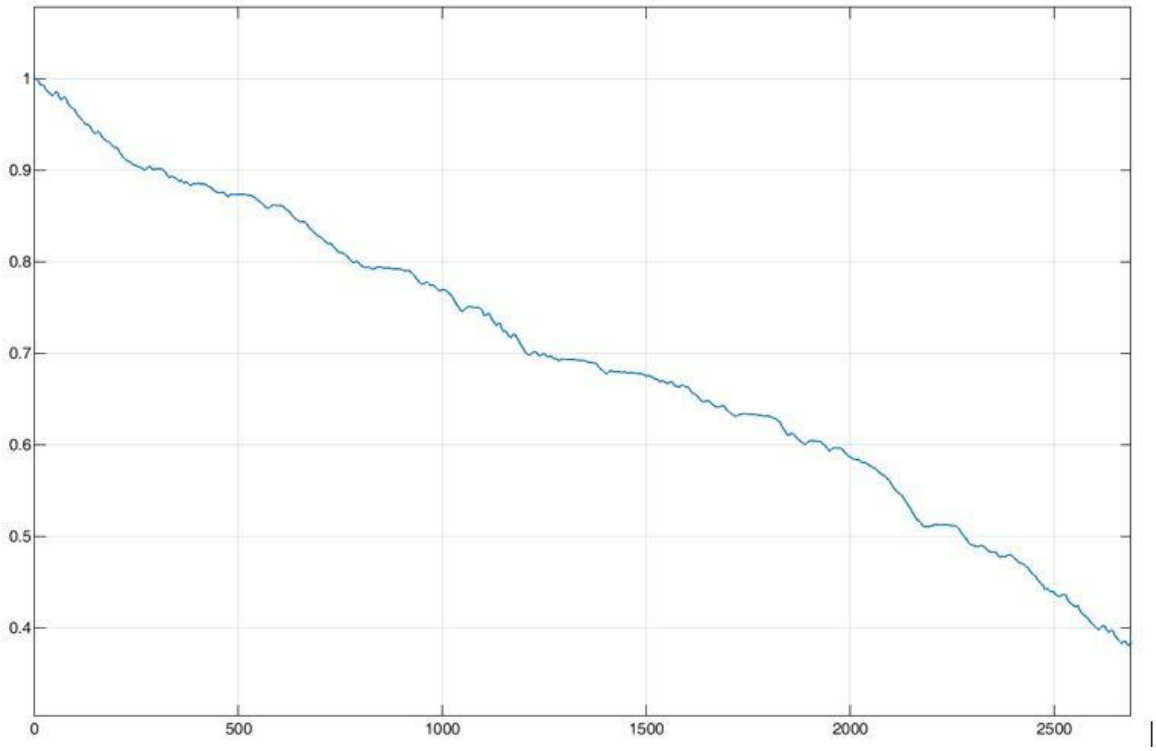



**Results –**

We can in plot that vehicle speed is imitating driving cycle, so we can say our model is working fine.




State of charge was 100% at the beginning of simulation and after simulation SOC is only 38%




**5.Conclusion –**

We used Simulink blocks to model electric vehicle. We used driving cycle as a reference speed and vehicle speed we got mimics it, So we can say our model is performing well. There are others plots which can give us valuable information about like state of charge, rotor speed etc.