Modelling of Battrey Pack Design using PowerTrain Sizing Calculations

Prepared by:
Nishantkumar V Patel

About Project

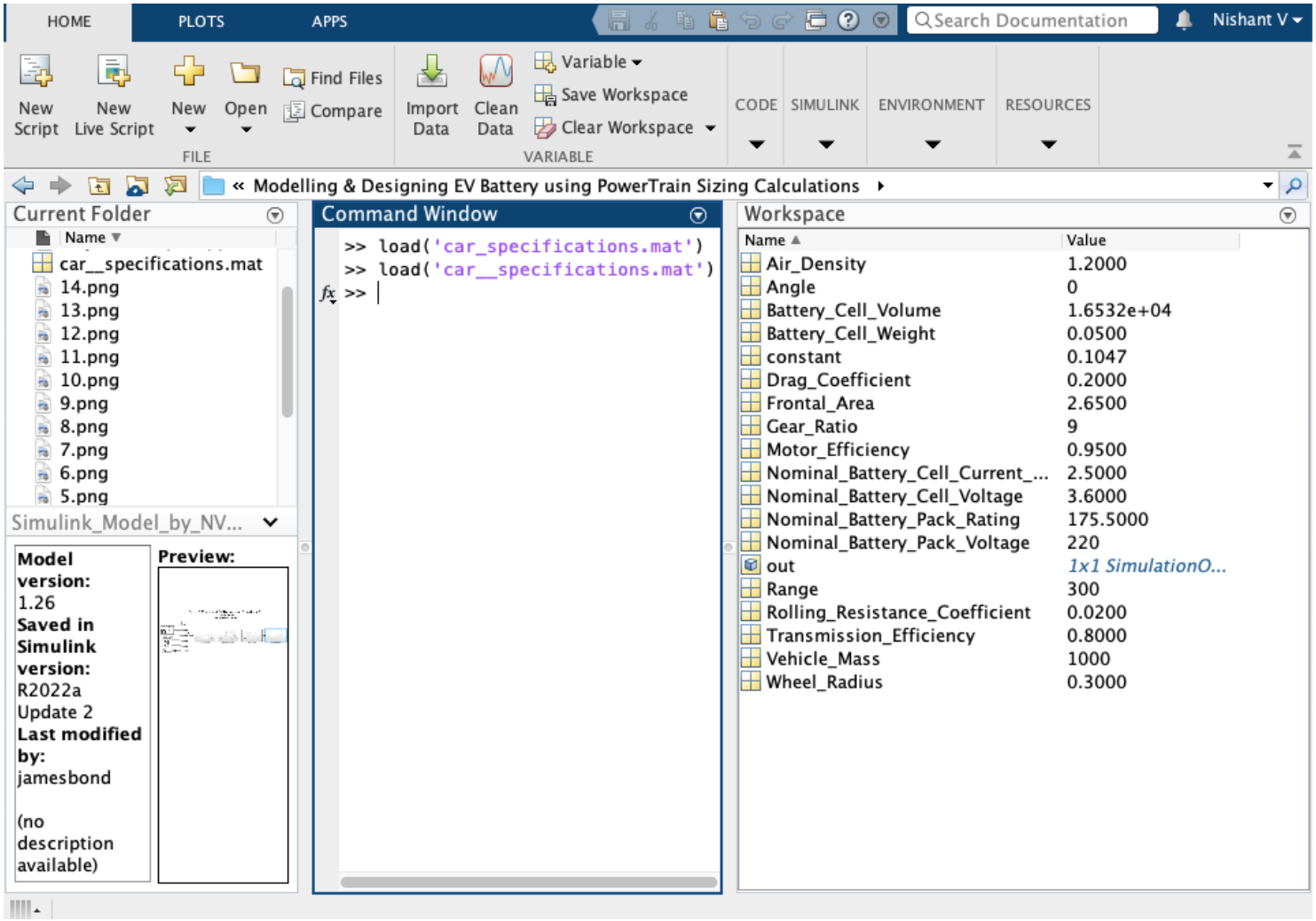
- In this modelling project I modelled the different components of Powertrain like motor, transmission, wheel with breaking down them into subystem in Simulink.

- Using powertrain sizing reverse calculation from drive cycle and velocity as main input to model's powertrain system by drive cycle, I calculated from the wheel/ chassis subsystem to motor subsystem to transmission and at the end lastly to Battery subsystem to design the whole car battery pack weight, volume, total how may numbers of battery cells are required to form ther final batery pack system and also within that how many of themneeded to be in series and parallel connections.
- Here I have taken the dimensions, weight and regarding sepcfications of hypothetical car.

- I have considered the LG Chem 18650 2500 mAh battery cell for car battery pack designation.
- In addition, I expect my car model with range of 300 km.
- According to this taken battery cell and range I am going to design the battery pack parameters.

- So, lets get Started…

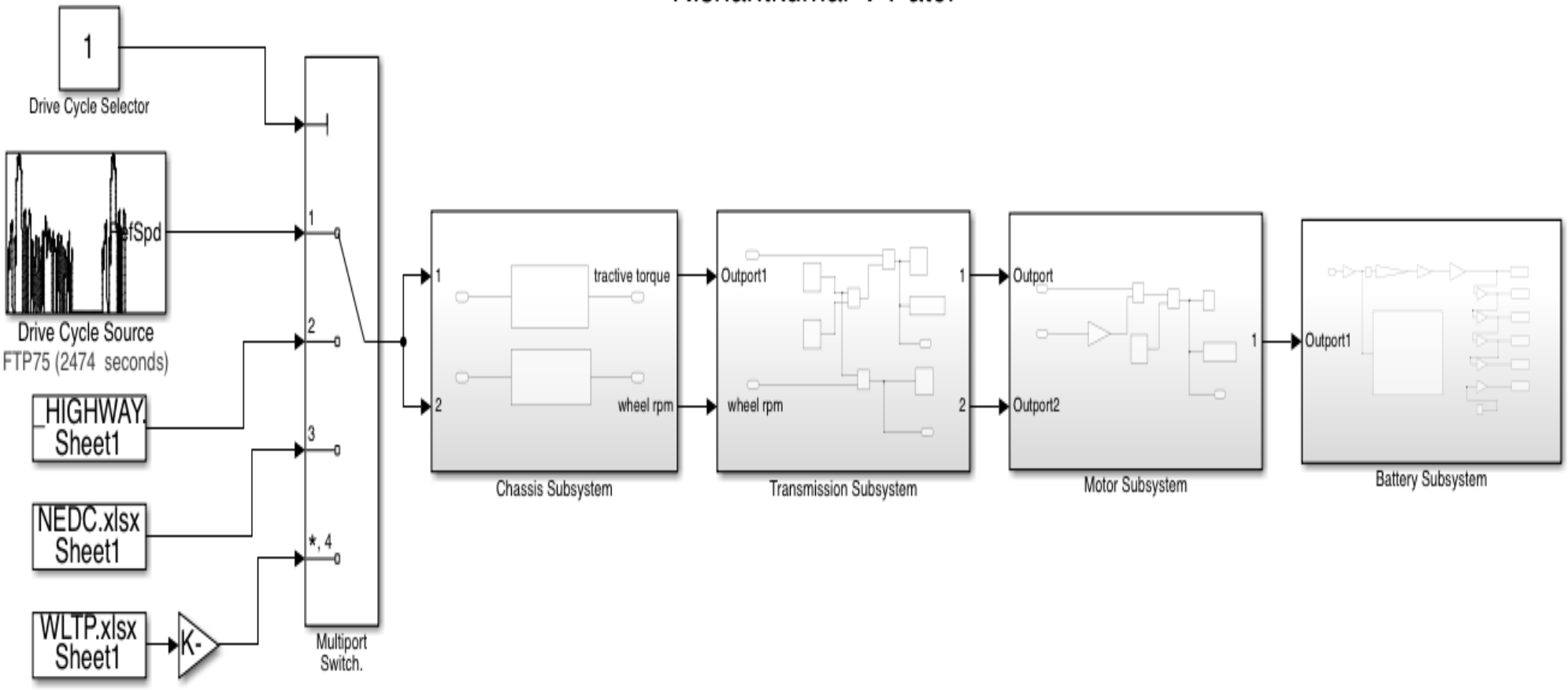
Car Specifications & Model



- The workspace shows the different variables created for providing the specifications and parameters to simulink model.

Design & Modelling of EV Battery using PowerTrain Sizing

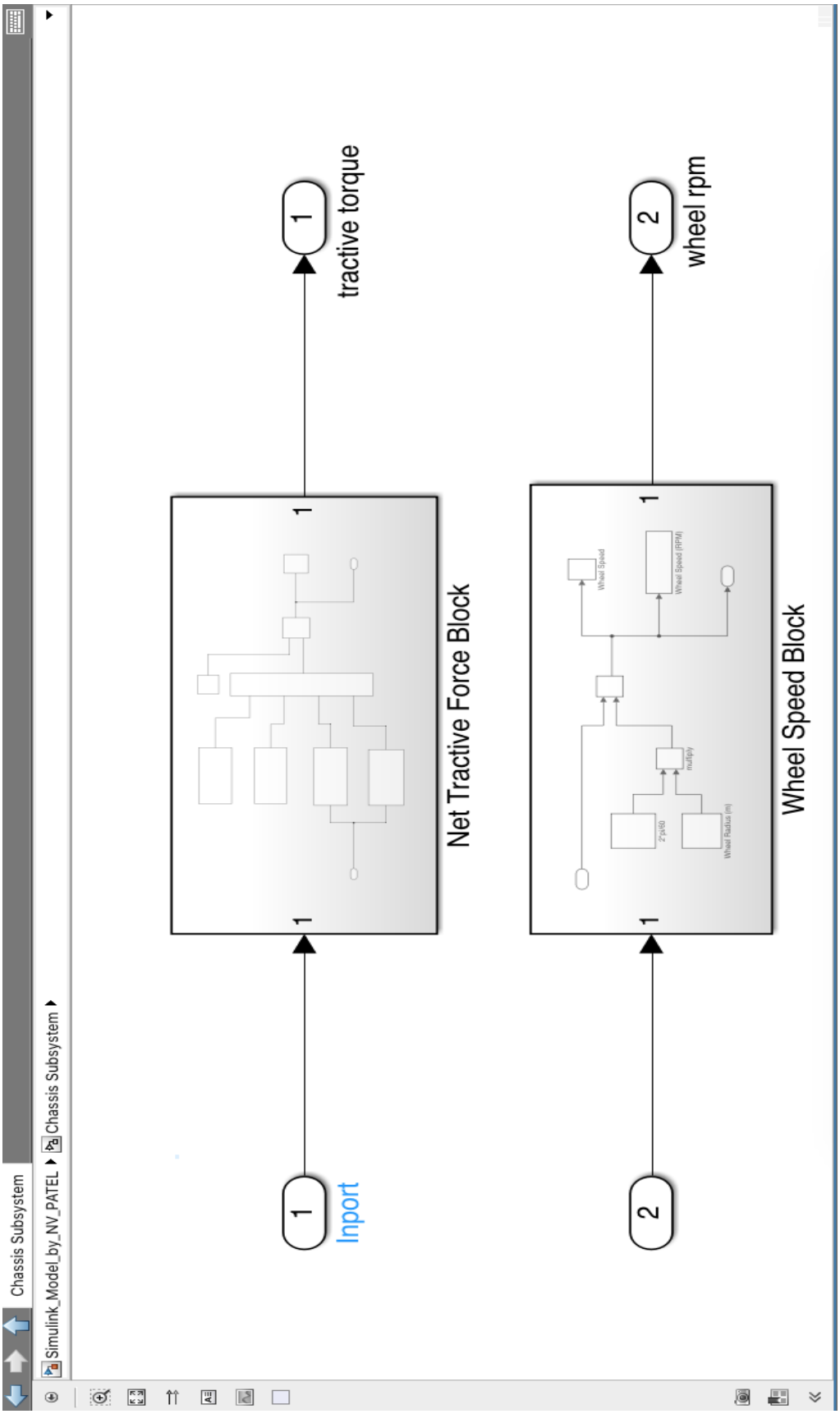
Modelled by
Nishantkumar V Patel



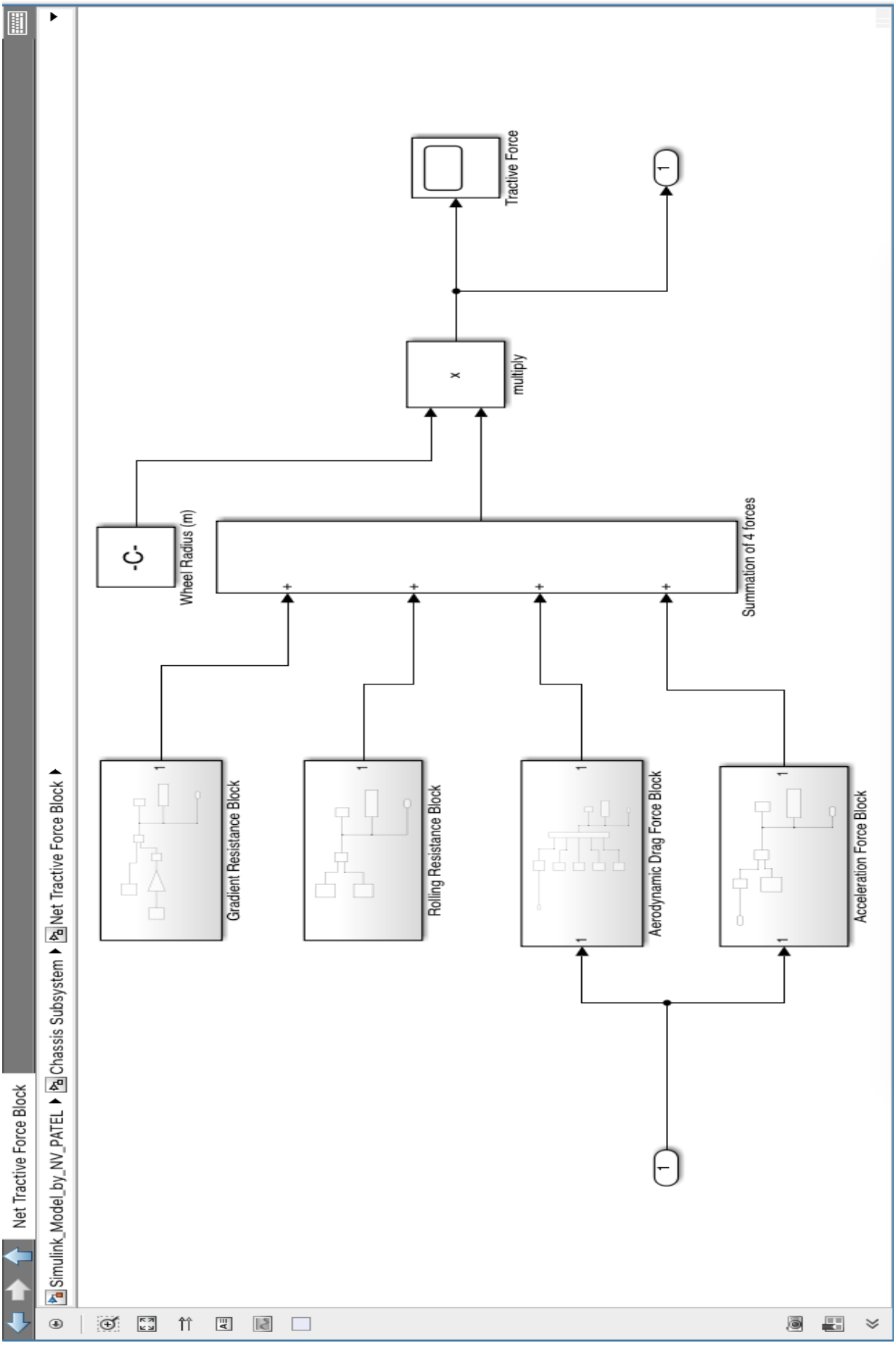
- I have 3 different drive cycle from spreadsheet files. One can switch to any drive cycle for simulation as I have provided the ‘multiport switch block’ to switch to any of three drive cycle. FTP 75 is standard drive cycle available in Simulink library browser. It has 2474 seconds simulation time and I have simulate the whole model based on this drive cycle with mentioned simulation time.

- I have divided the simulink model into 4-subsystems. And at last I have estimated the battery pack parameters.

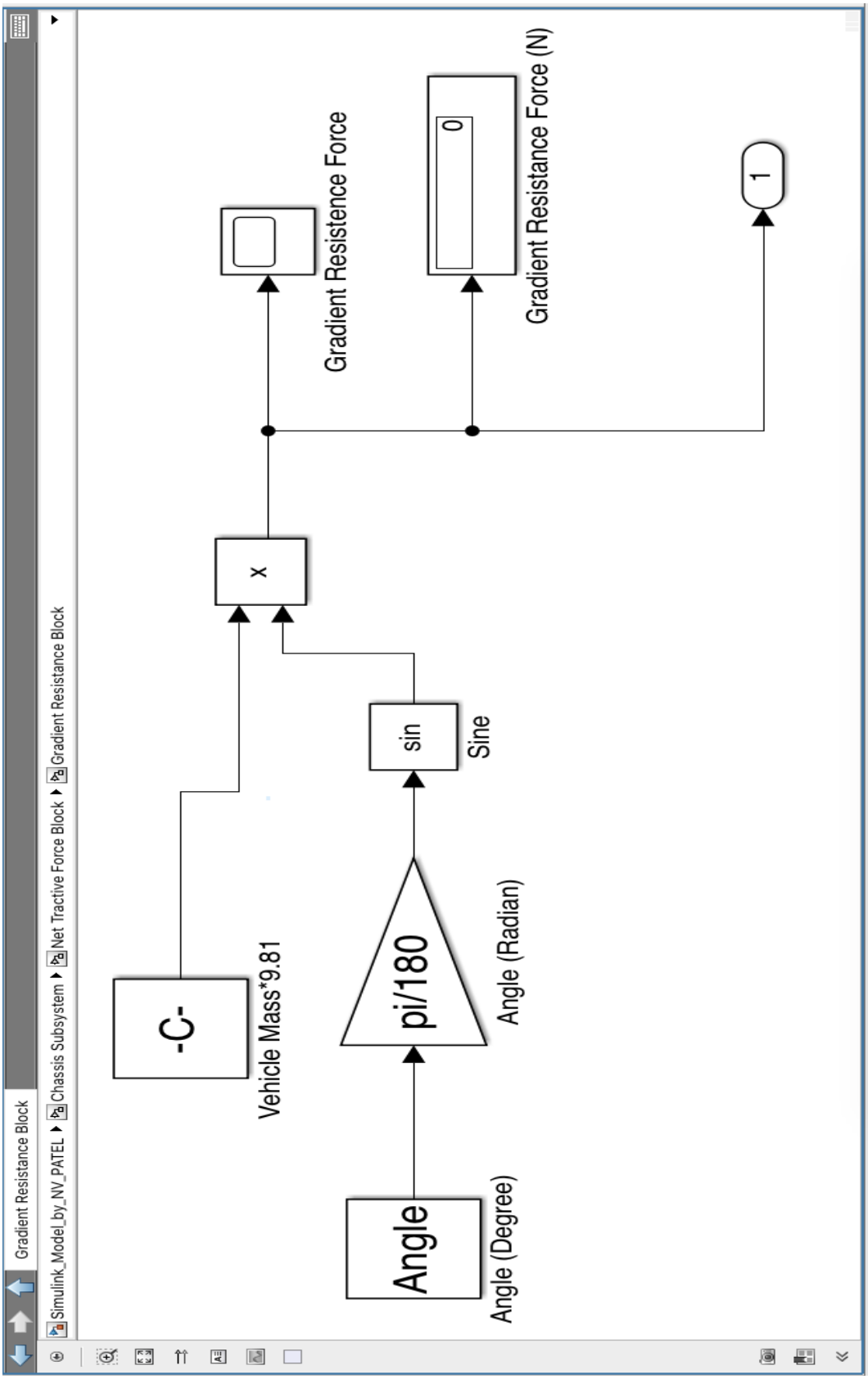
a.) Chassis Subsystem:



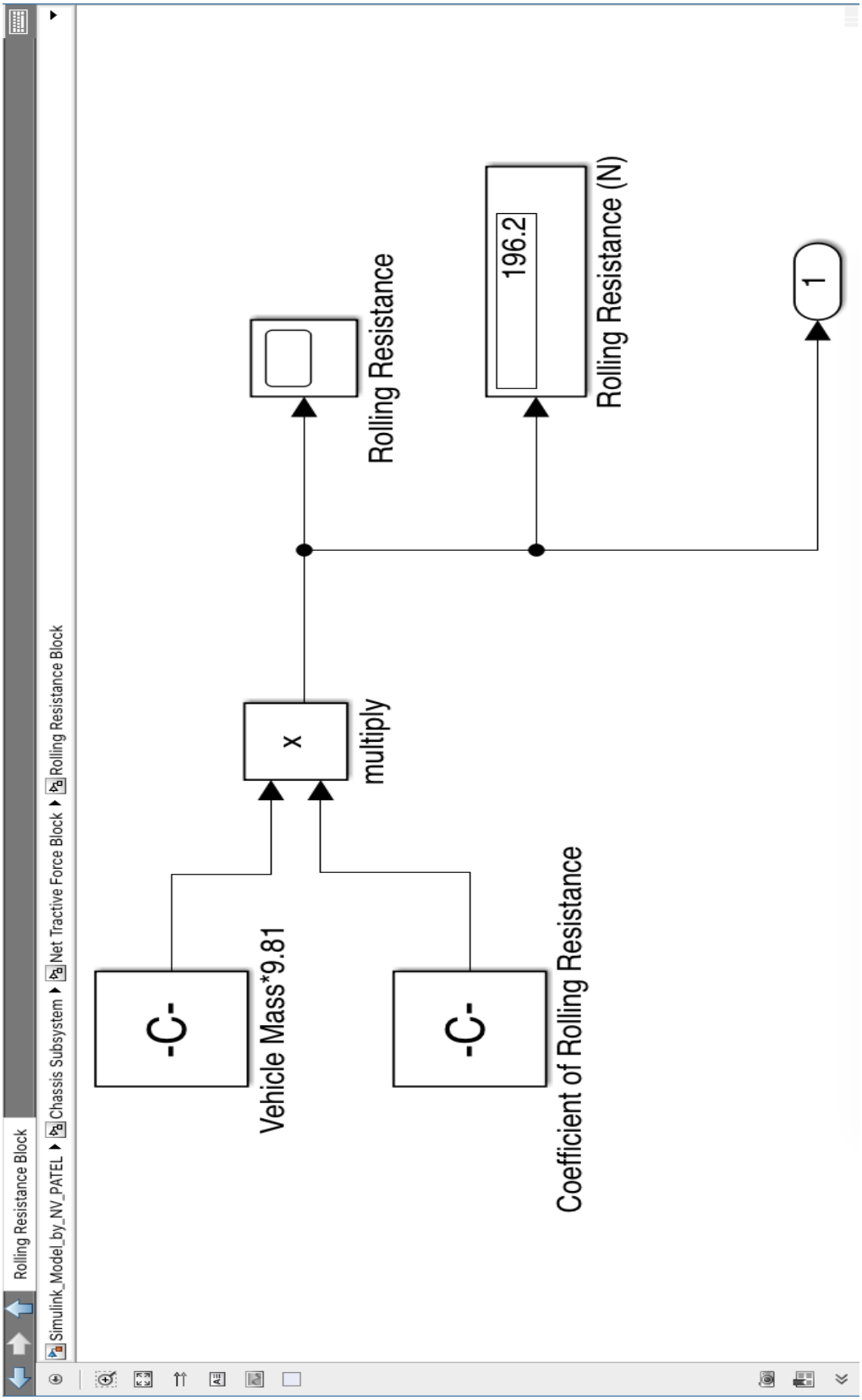
a.1) Net Tractive Force Block:



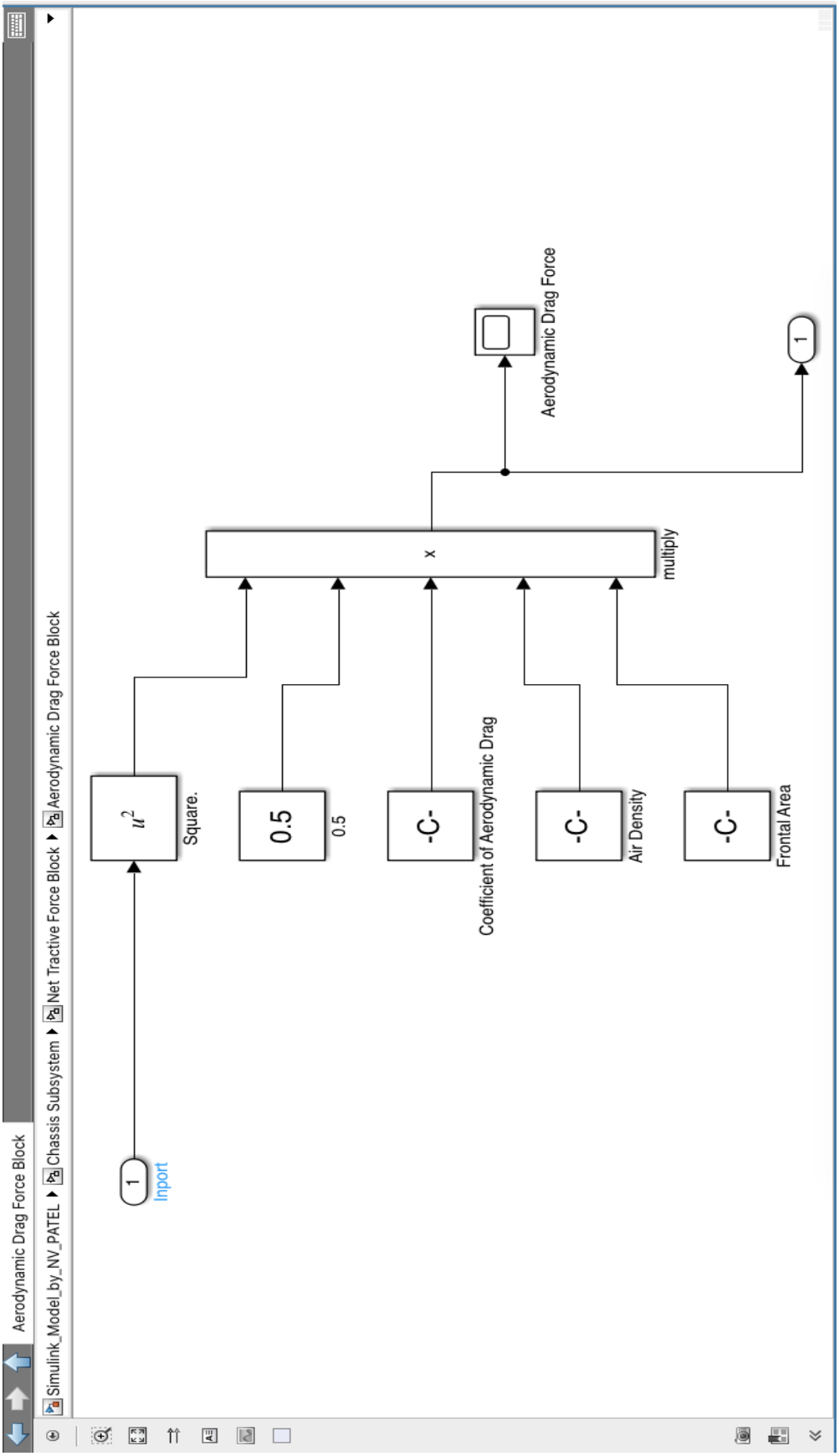
a.1.1) Gradient Resistance Force:



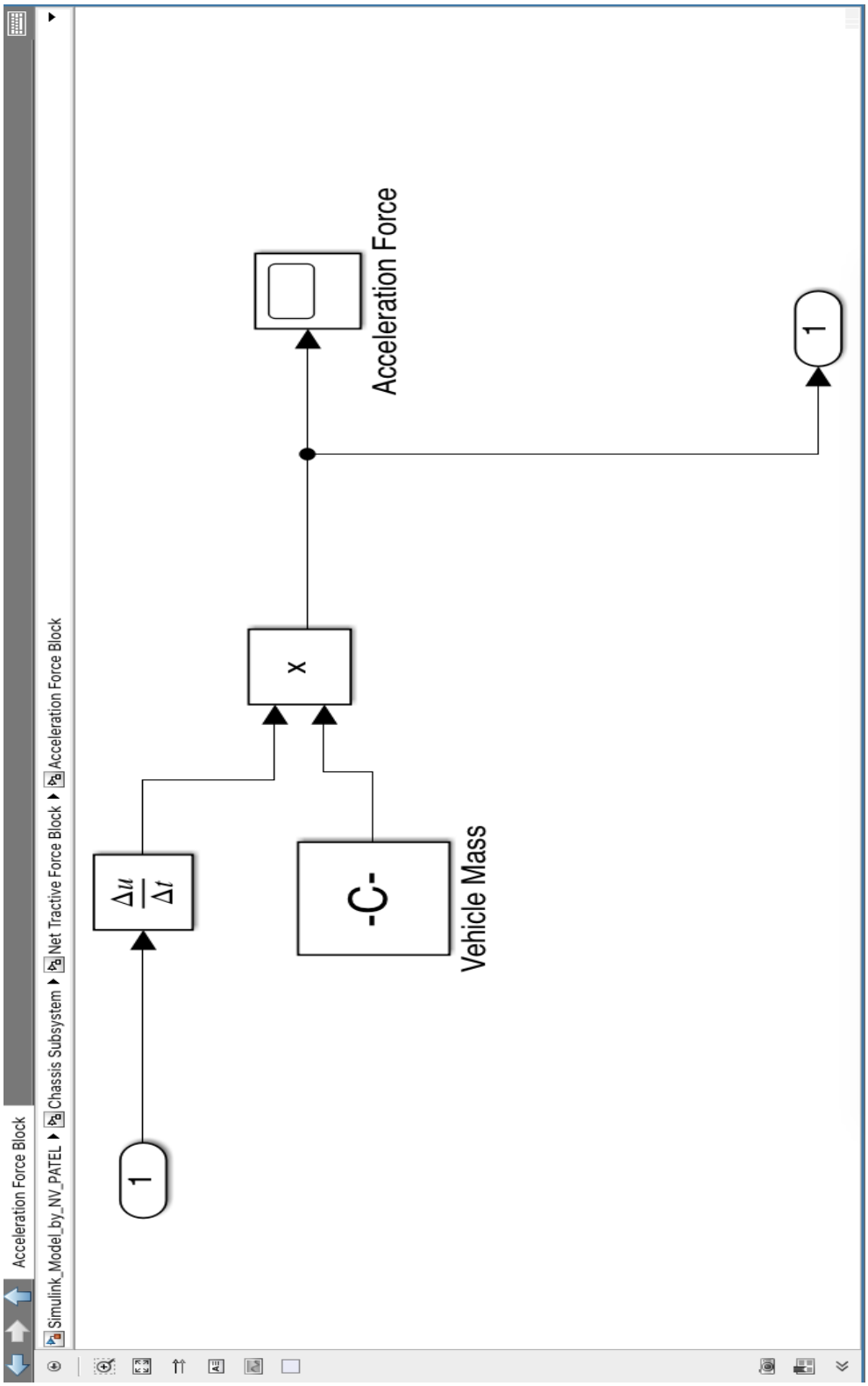
a.1.2) Rolling Resistance:



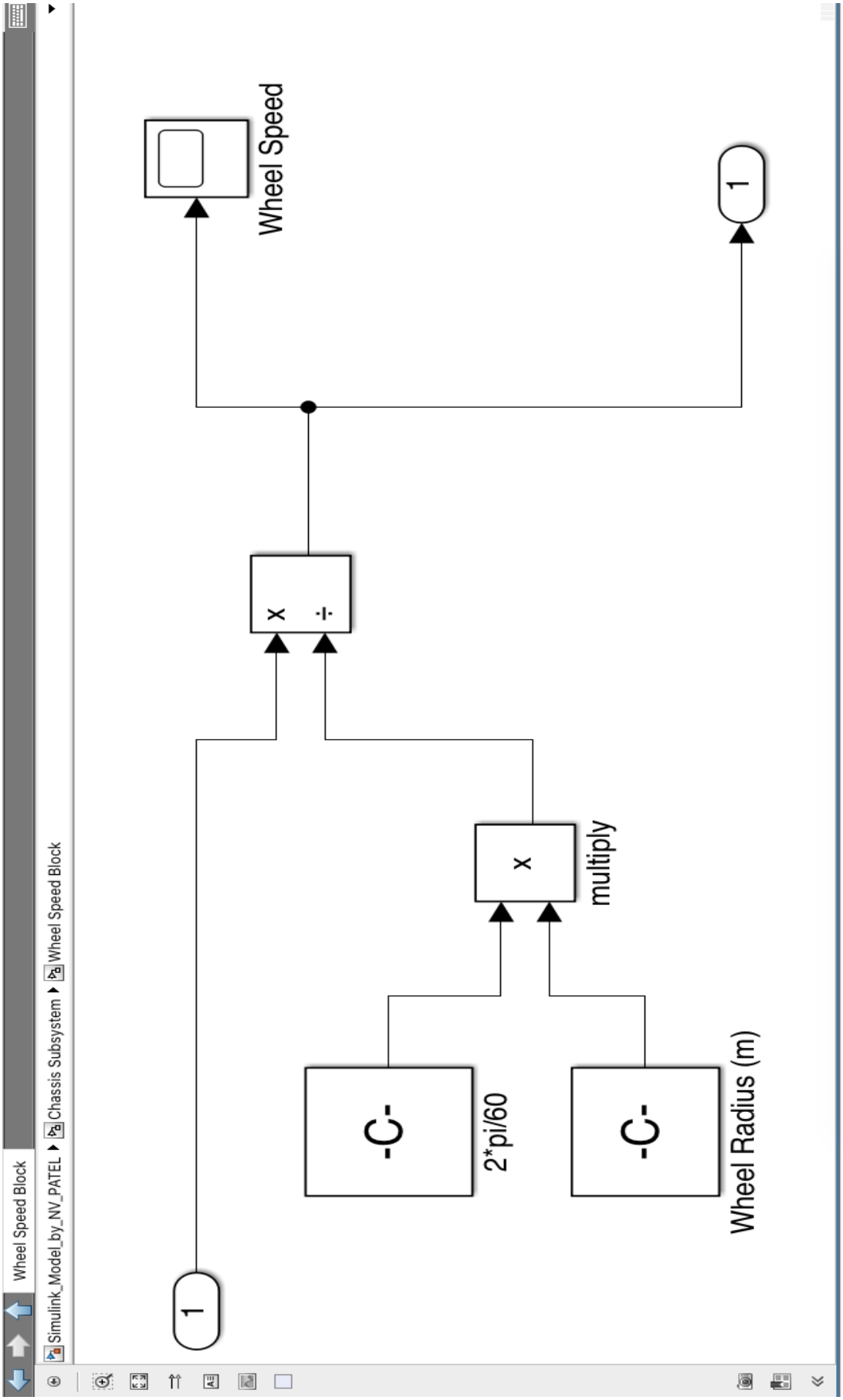
a.1.3) Aerodynamic Drag Force:



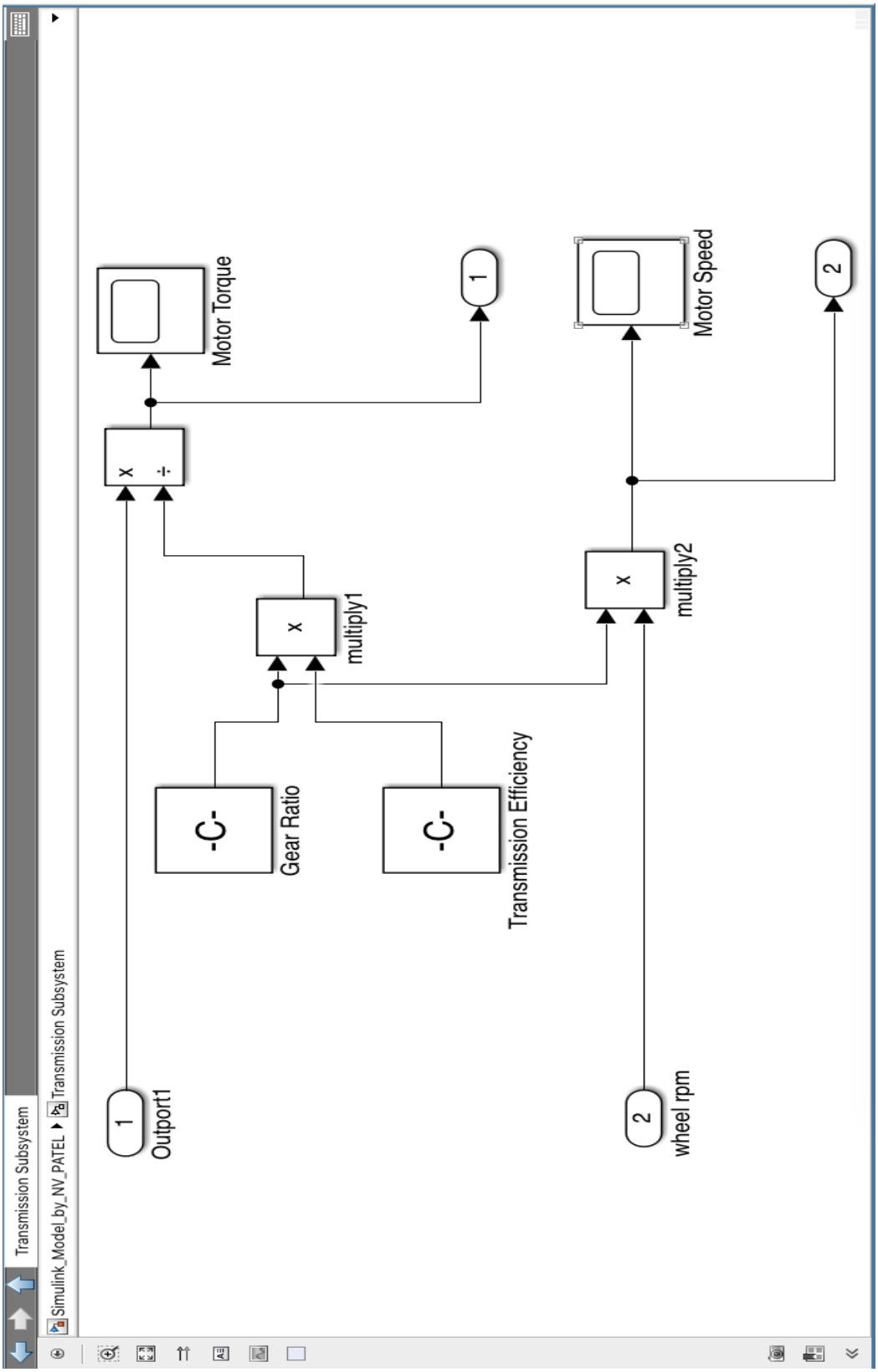
a.1.4) Acceleration Force:



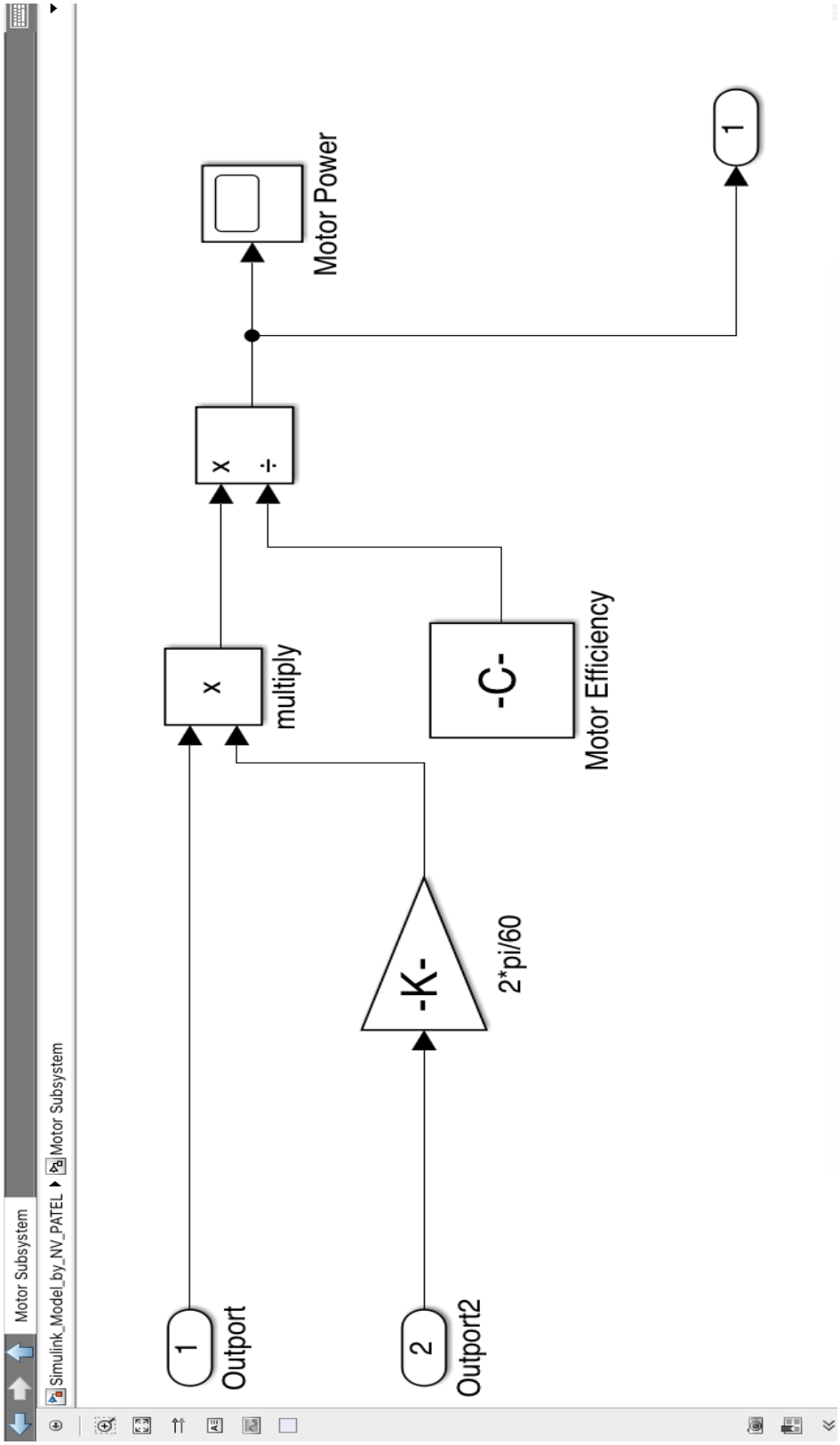
a.2) Wheel Speed Block:



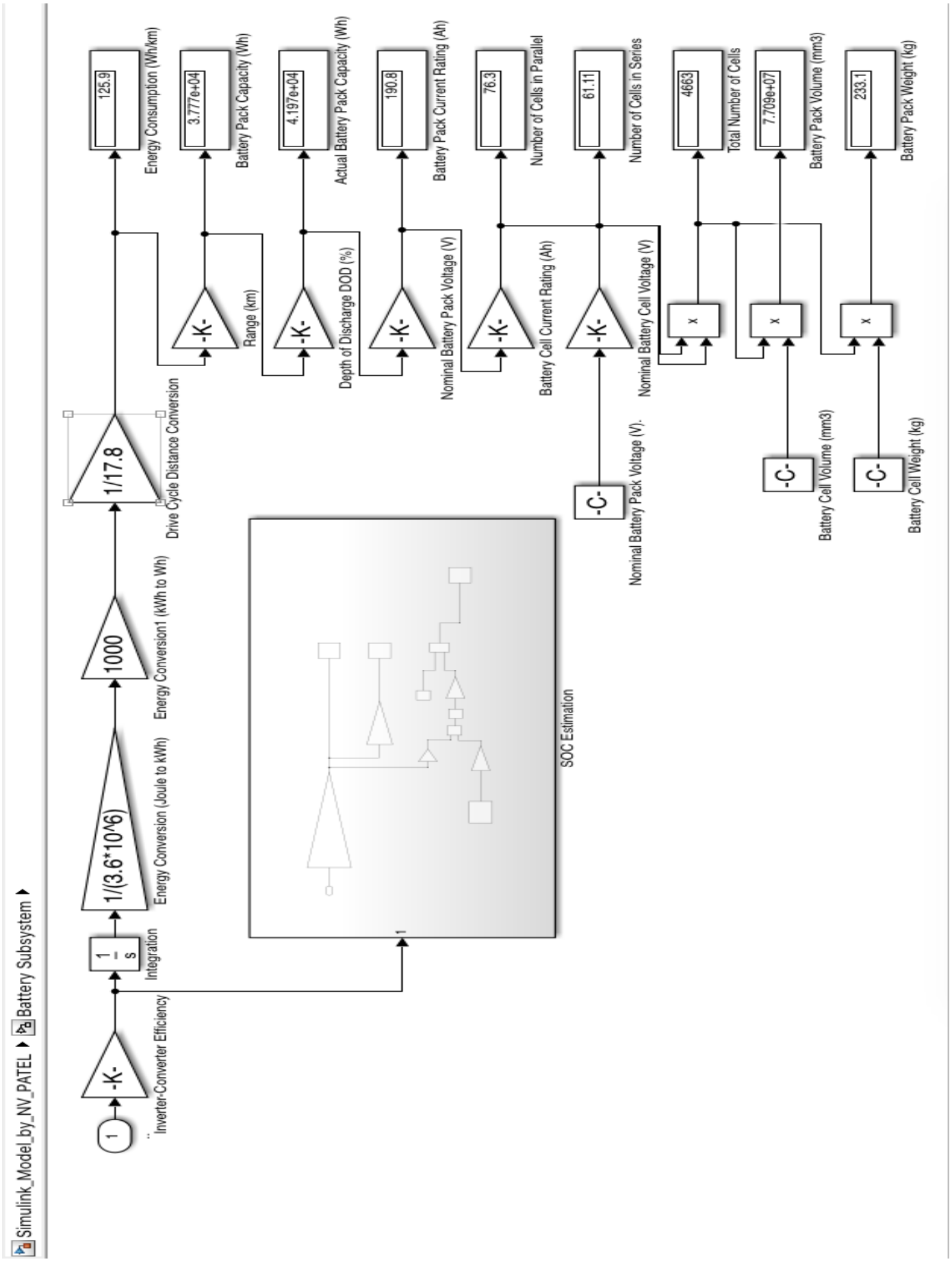
b.) Transmission Subsystem:



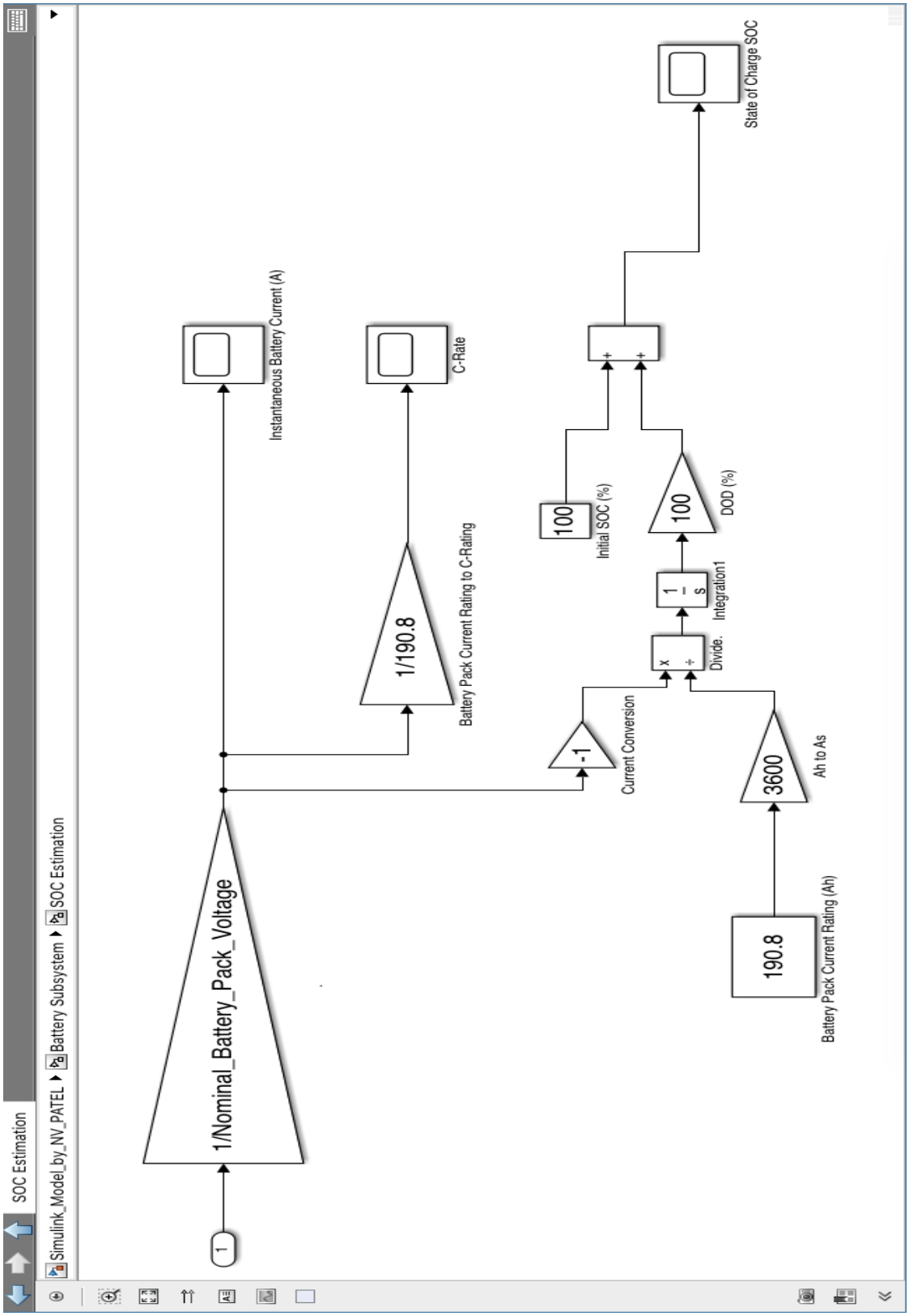
c.) Motor Subsystem:



d.) Battery Subsystem:



SOC Estimation:



Battery Pack Designation Parameters: