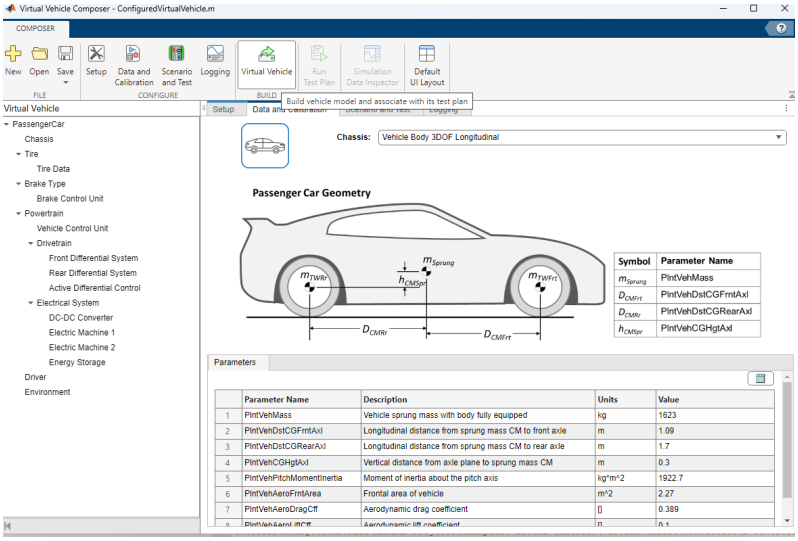
To run the NMPC energy optimization for an electric vehicle (EV) in Matlab, follow these steps:

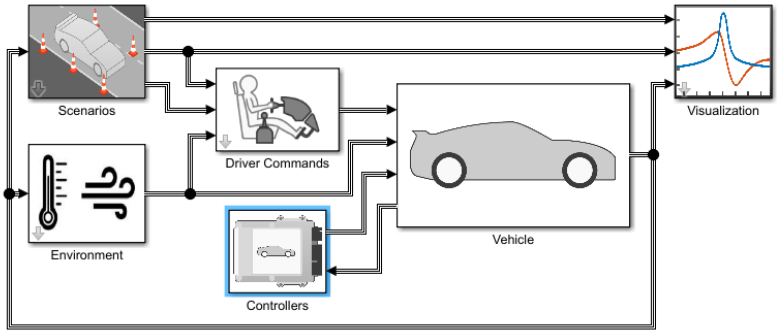
1. **Open the Virtual Vehicle from Matlab apps.**
   - Launch Matlab and navigate to the apps tab.
   - Open the Virtual Vehicle app.

2. **Click on the “new” on the left-hand top-side icon. Select the EV-2M model from Powertrain architecture and click on the configure icon.**
   - Create a new project, select the EV-2M model from the Powertrain architecture, and click on the configure icon.

3. **Build the model using the virtual vehicle build icon in the virtual vehicle composer.**
   - Build the model by clicking on the virtual vehicle build icon in the virtual vehicle composer.



4. **Once the ConfiguredVirtualVehicleModel is open, go inside the controller\VehicleControlUnit\EnergyManagement\.**
   - Navigate to the EnergyManagement section within the VehicleControlUnit controller in the ConfiguredVirtualVehicleModel.



5. Create a MATLAB Simulink user-defined function. Copy the code from EVFmincon_test_v4.m inside the block and name it NMPC controller.

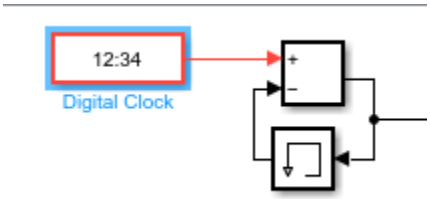
- Inside EnergyManagement, create a MATLAB Simulink user-defined function block.
- Copy the code from EVFmincon_test_v4.m into the block and name it NMPC controller.

6. Create a digital clock block, a subtract block, and a memory block just outside the NMPC controller block.

- Place a digital clock block, a subtract block, and a memory block adjacent to the NMPC controller block.

7. Connect the output of the digital clock to the plus input of the subtract block. Connect the output of the subtract block to the memory block. Connect the output of the memory block to calculate the variable step size of the model during each iteration.

- Establish connections as described: digital clock to subtract block, subtract block to memory block, and memory block to control the variable step size.

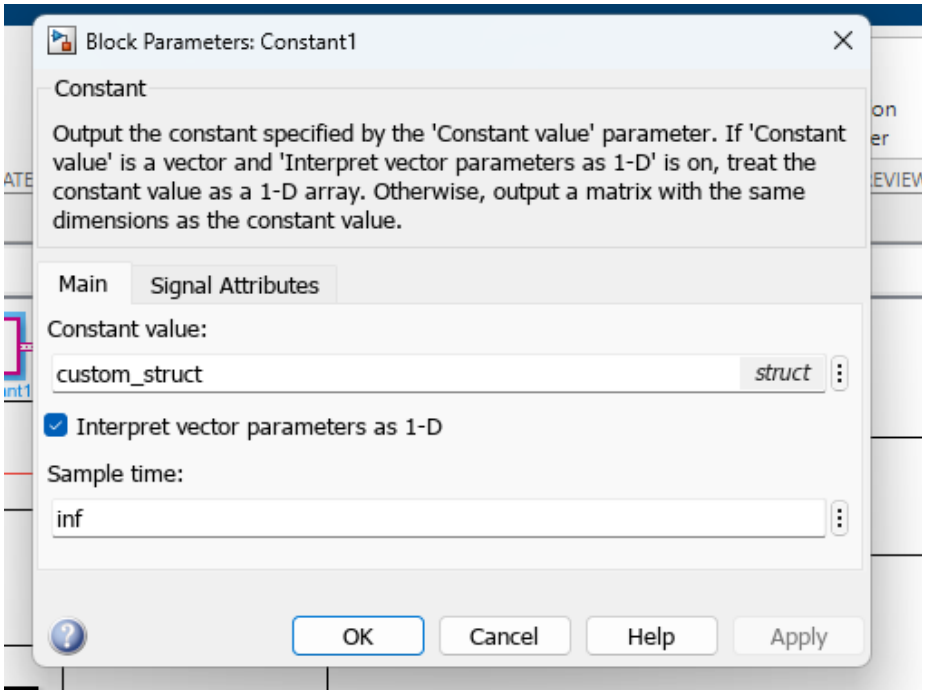


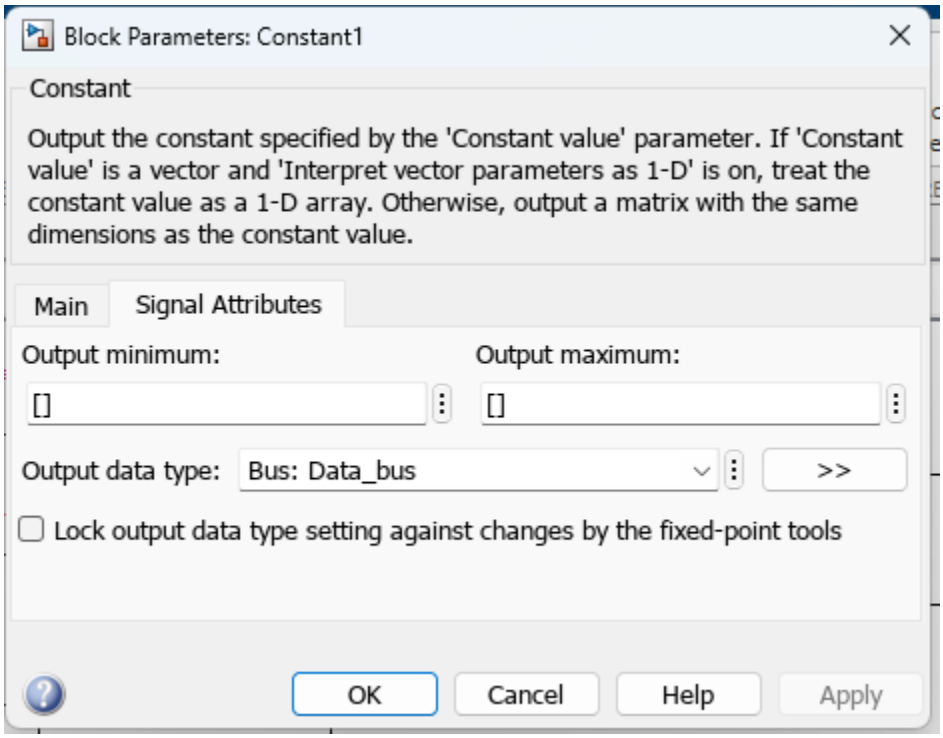
8. Run the global_init.m file in matlab to load the necessary data in Simulink.

- Execute the global_init.m file to load the required data into Simulink.

9. Create a constant block. Select the struct variable “custom_struct” in the main option of the block. Under attributes, select the “Bus:Data_bus” as the output data type.

- Create a constant block, choose "custom_struct" in the main options, and set the output data type to "Bus:Data_bus" under attributes.





10. **Delete the connection between WhlTrqCmdFrnt coming out of the “Hamiltonian computation and minimization block” to the “Convert Whl to EMtrq Vector block” and the “WhlEMTrqCmdFrnt" Tag. Attach it to a terminator block. Do the same for WhlTrqCmdRear.**

- Disconnect WhlTrqCmdFrnt and WhlTrqCmdRear from the "Hamiltonian computation and minimization block" and connect them to terminator blocks.

11. Start making the connections.

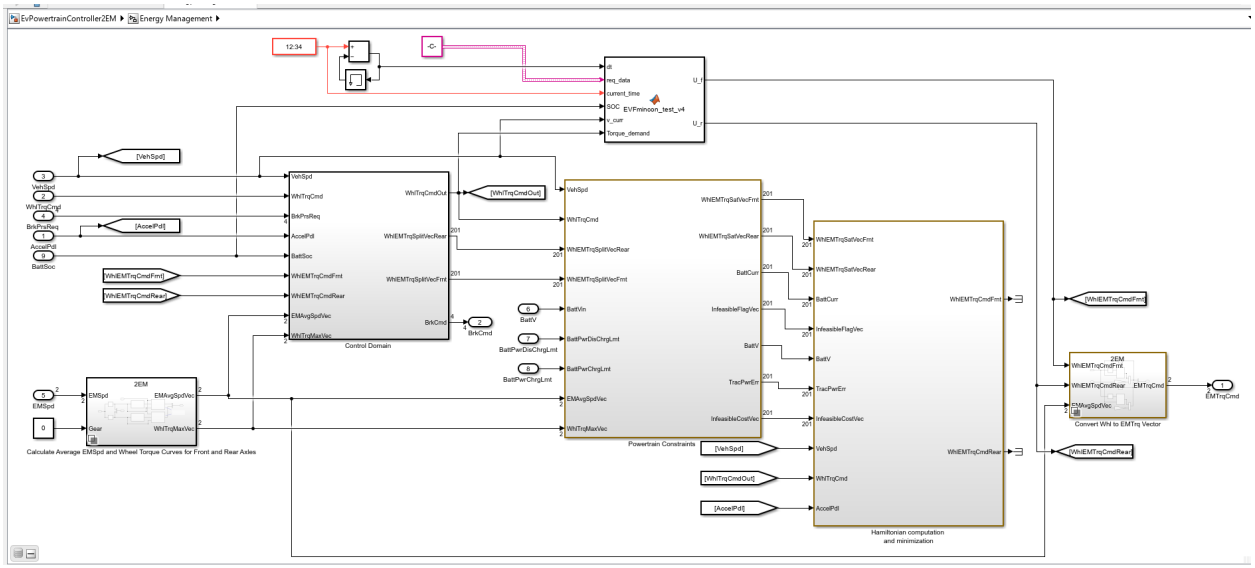
- Connect a branch from the output block of the subtract block to the input parameter “dt” of the NMPC controller block.
- Connect a branch from the main digital clock to the current_time input port of the NMPC function.
- Connect the constant block to the req_data block of NMPC.
- Connect the SOC to BattSoc (indicated by signal 9).
- Connect v_curr to the “VehSpd” signal.
- Connect Torque_demand to “WhlTrqCmdOut”.

12. Attach the outputs of the NMPC block U_f and U_r to WhlEMTrqCmdFrnt and WhlEMTrqCmdRear in the “Convert Whl to EMtrq Vector" block and tags.

- Establish connections between the NMPC block outputs (U_f and U_r) and the corresponding inputs in the “Convert Whl to EMtrq Vector " block, ensuring proper tagging.

13. Once done, the subsystem should look similar to this.

- Verify that the subsystem matches the provided configuration.



14. **Move back to the ConfiguredVirtualVehicleModel and press run.**

- Return to the ConfiguredVirtualVehicleModel and initiate the simulation by clicking on the run button.

By following these steps, you should be able to successfully run the NMPC energy optimization for the electric vehicle model in Matlab.