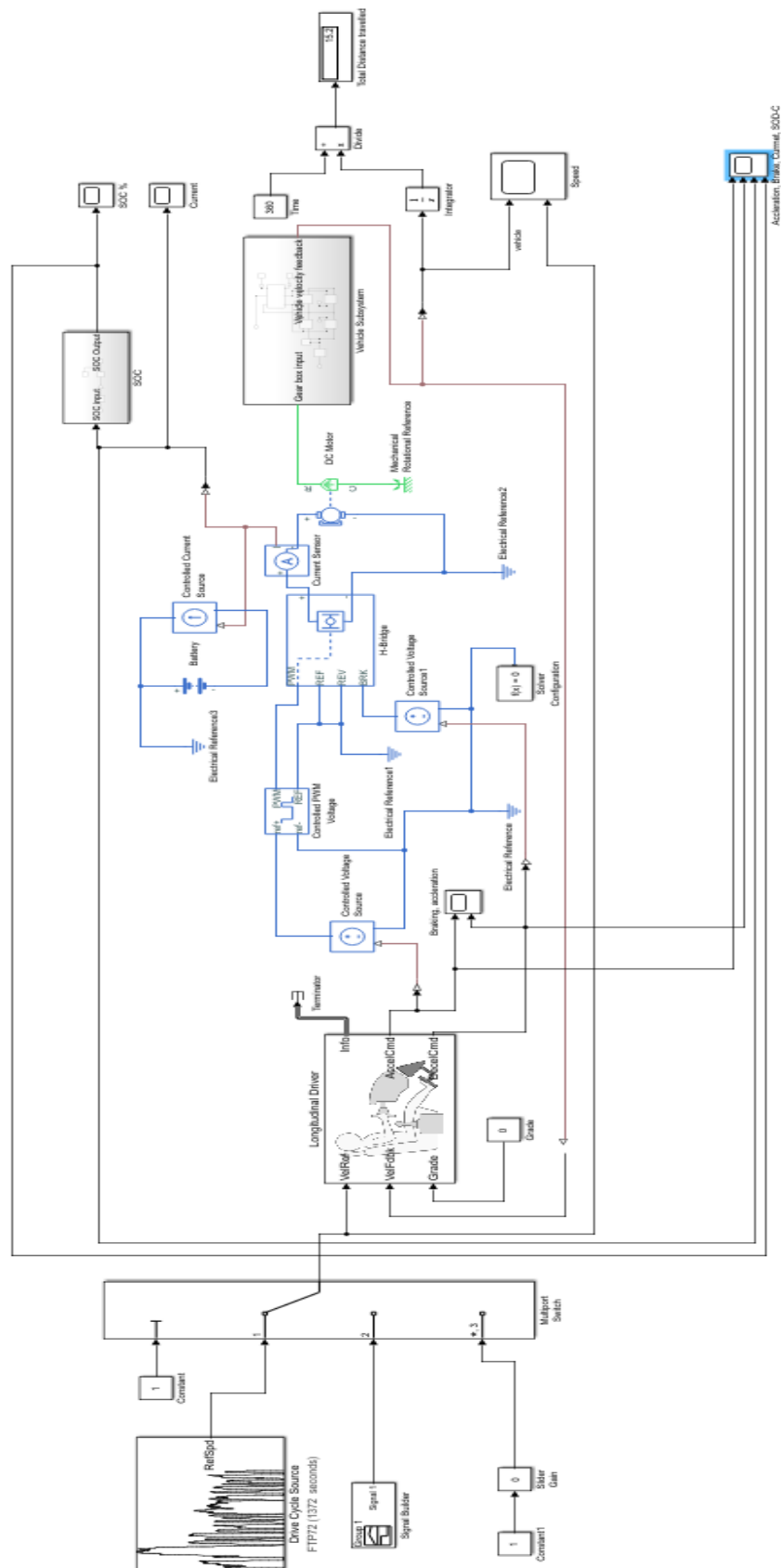# Simulation Result of EV

Figure : MATLAB Simulation of Electric Vehicle System

The simulations are run for various drive cycles and the results are in the following table.

Simulation Time - It is the time for which the simulation is run. Each drive cycle has its own time duration which needs to be updated in simulation time, each time the drive cycle is changed.

Speed Trace - It is a plot of the reference speed from the drive cycle and the feedback speed from the vehicle body.

SOC (%) - It is the state of charge of the battery which decreases when the vehicle accelerated and slightly increases when the vehicle decelerates.

Distance Travelled - It is the total distance travelled by the vehicle following a particular drive cycle and its duration.

Table: Different Drive Cycle

|	Case 1	Case 2	Case 3	Case 4
Drive Cycle, Simulation Time (sec)	FTP75, 2474	US06,600	Artemis Motorway 150kmph, 1068	World Harmonized Vehicle Cycle, 900
Vehicle body weight (kg), Frontal area (m2), Rolling resistance	800, 3, 0.015	800, 3, 0.015	800, 3, 0.015	800, 3, 0.015
Battery Nominal Voltage (V)	300	300	400	200
DC Motor Rated load (kW), Rated DC supply voltage (V)	60, 300	75, 200	85, 350	60, 150
H-Brigde Output voltage amplitude	300	200	350	150
SOC at end of drive cycle (Initial SOC 100%)	96	94	93	97
Top speed reached? kWh per km	Yes	No	No	Yes

Case1: FTP75
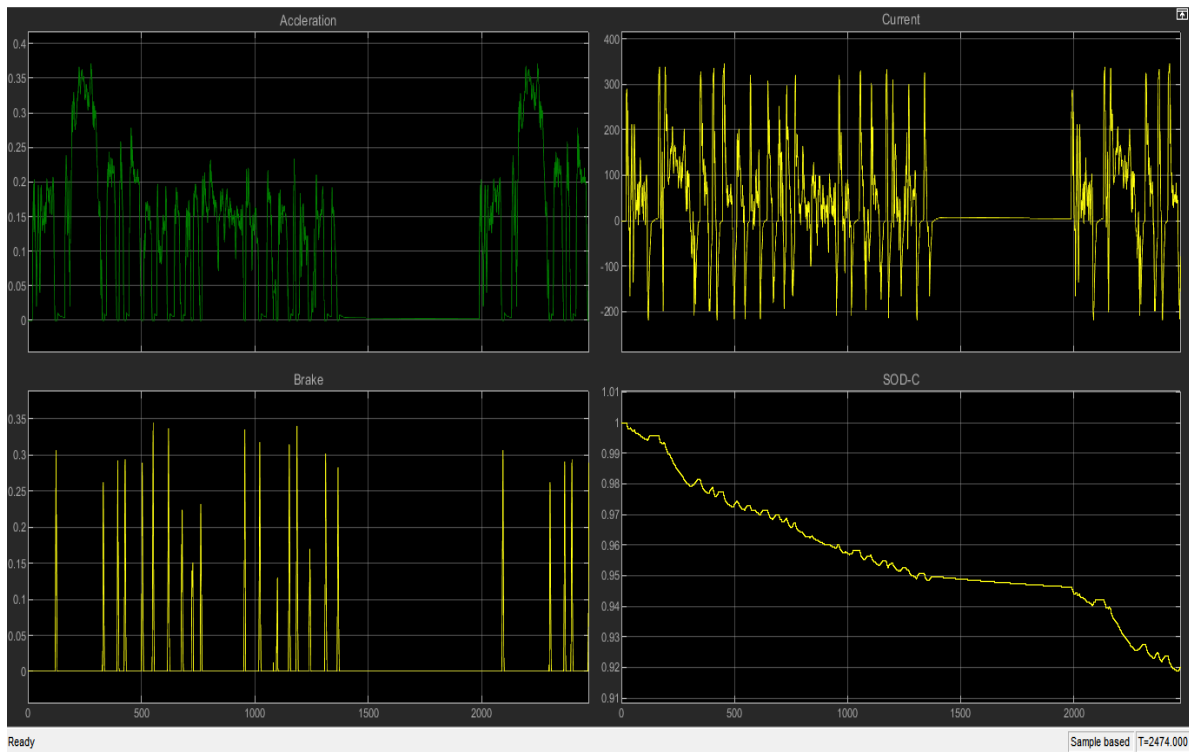
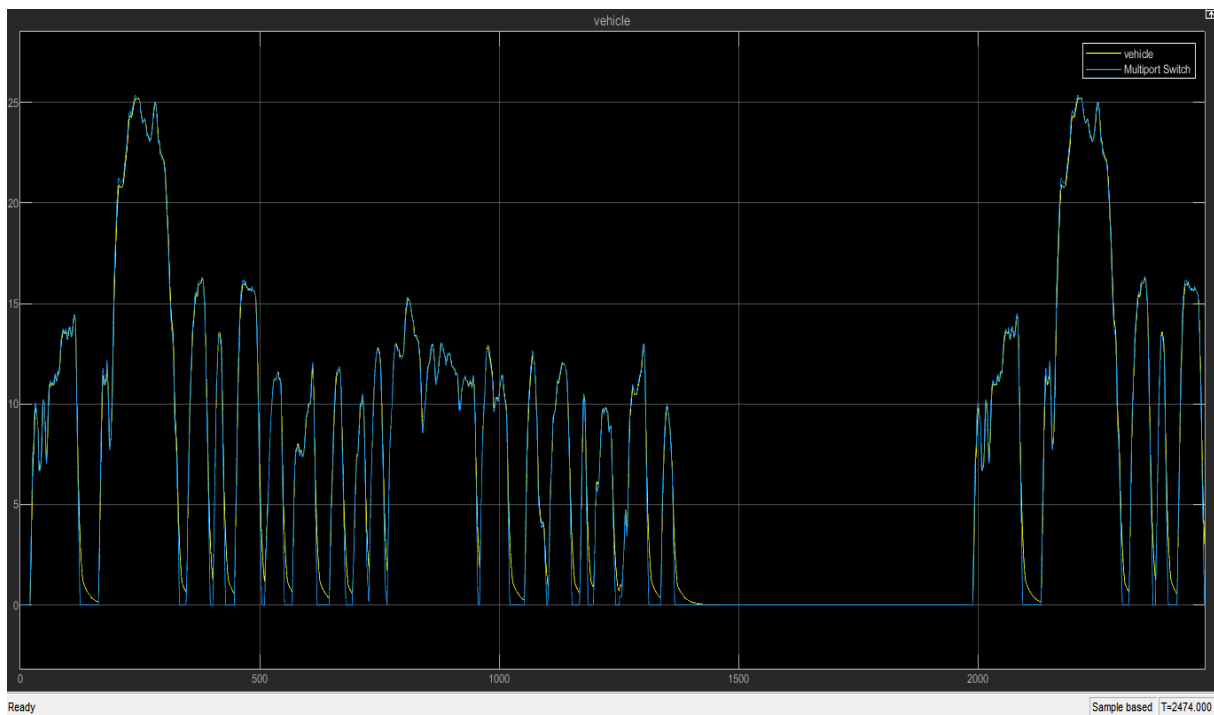Fig. 6.1: Acceleration, Brake, Current, Sod-c of Ftp75

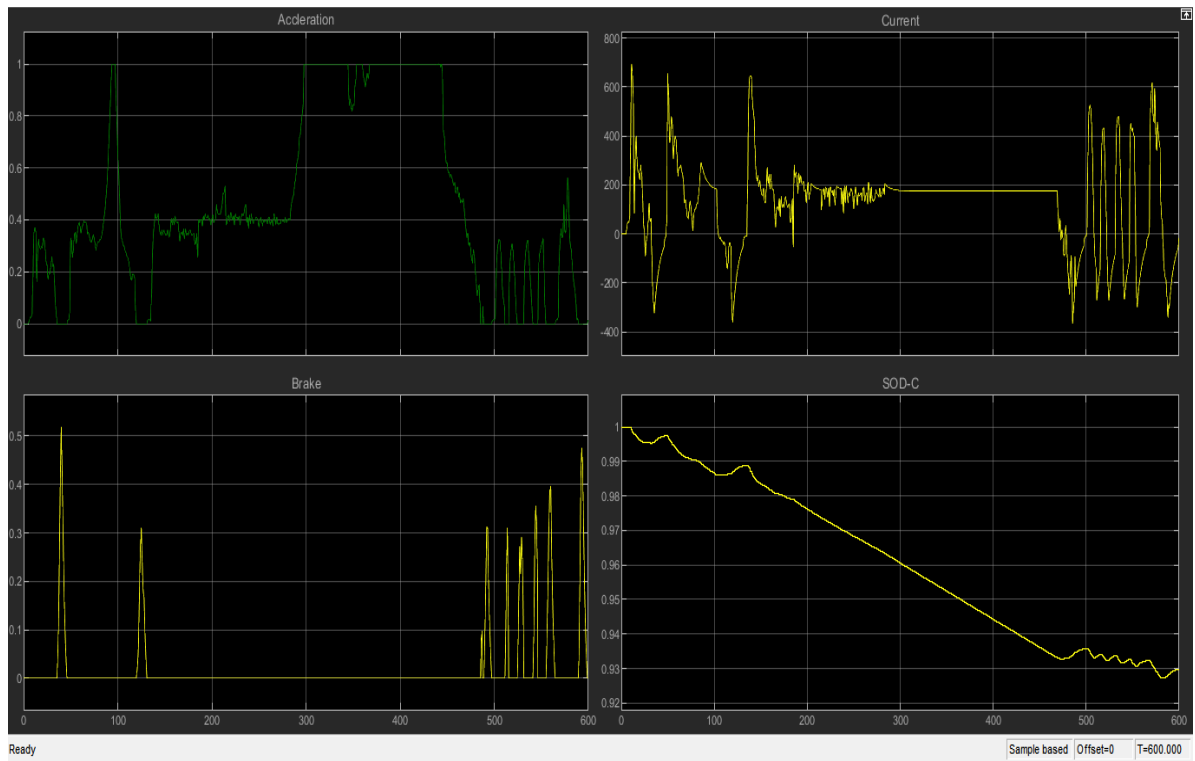Fig. 6.2: Reference with Vehicle of Ftp75

Case2: US06

Fig. 6.3: Acceleration, Brake, Current, Sod-c of Us06
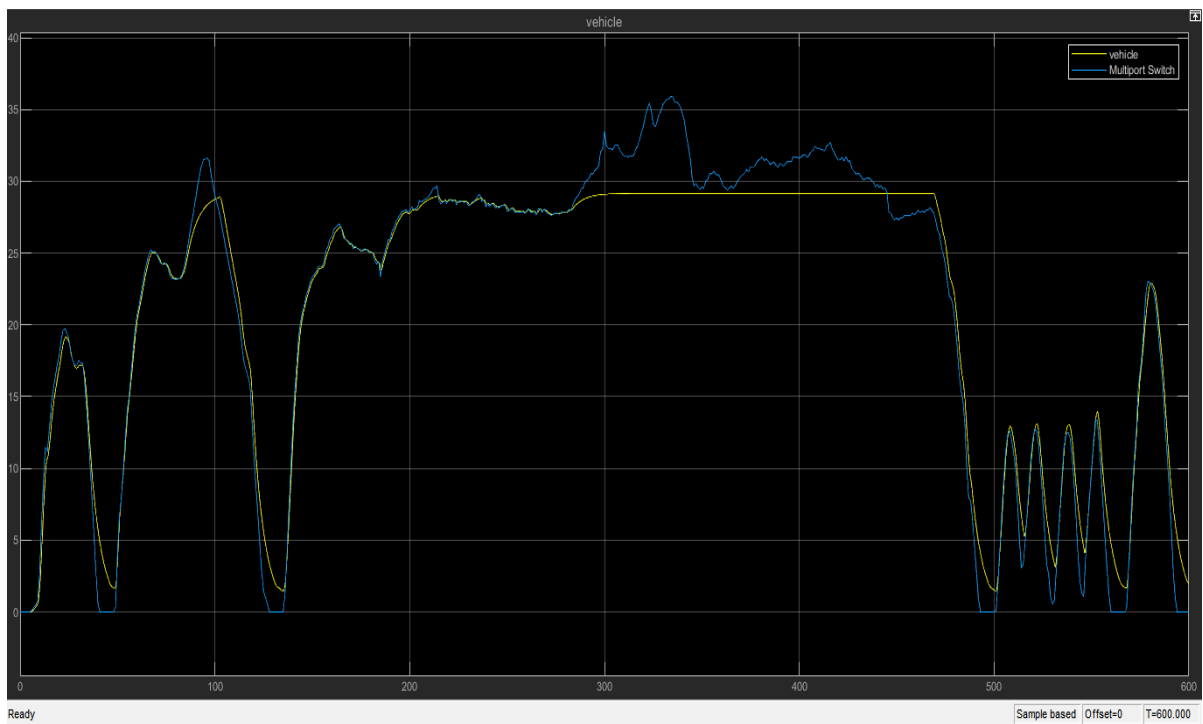

Fig. 6.4: Reference with Vehicle of Us06
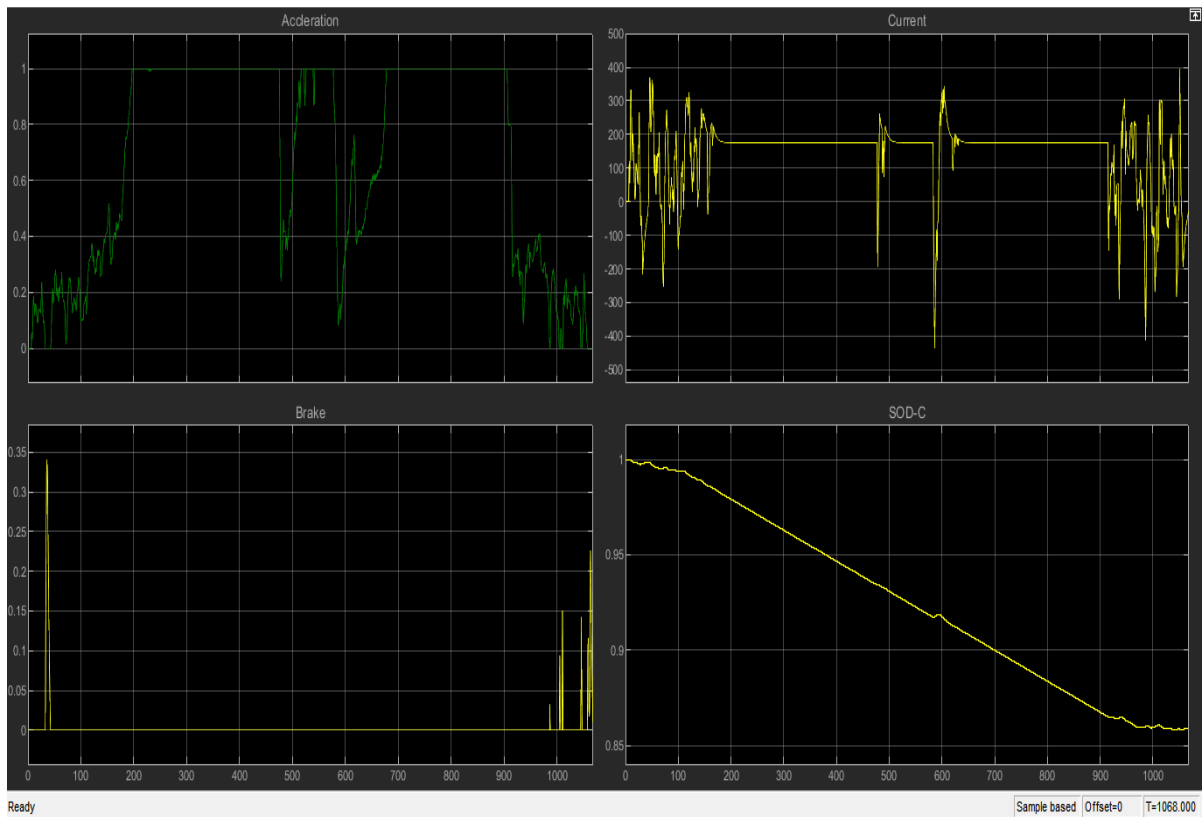
Case3: Artemis Motorway 150kmph

Fig. 6.5: Acceleration, Brake, Current, Sod-c of Artemis Motoway 150
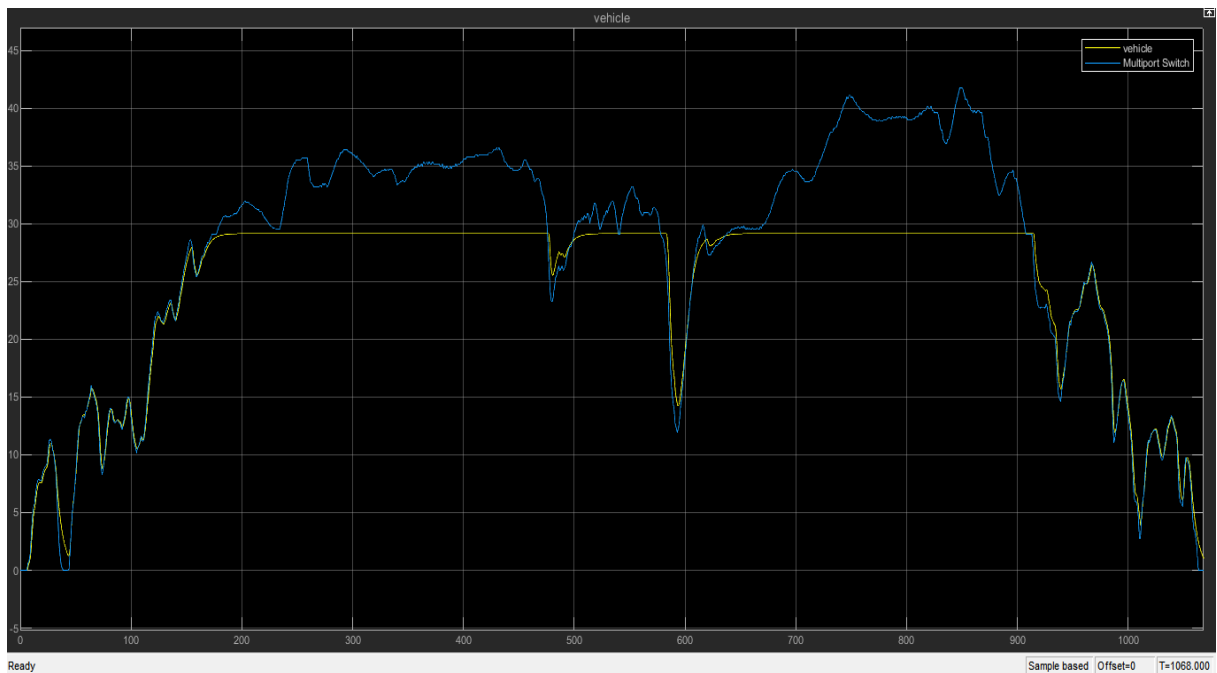

Fig. 6.6: Reference with Vehicle of Artemis Motoway 150
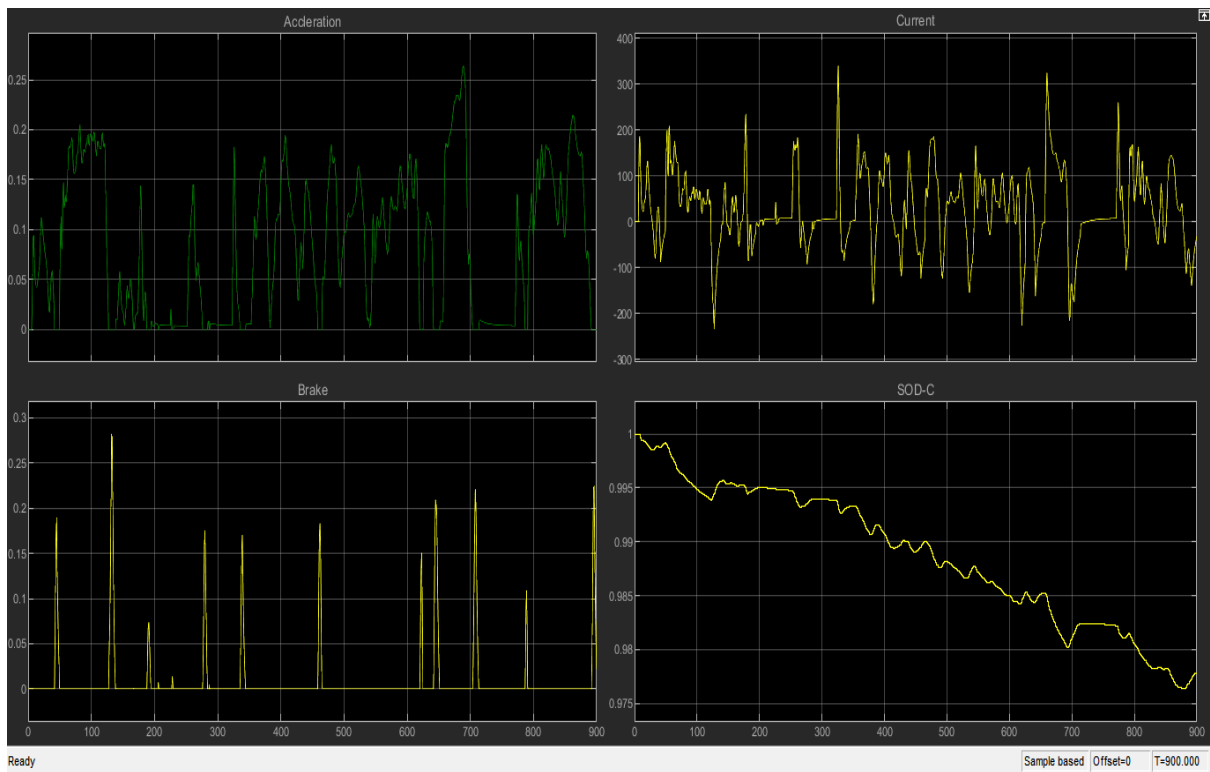
Case4: World Harmonized Vehicle Cycle

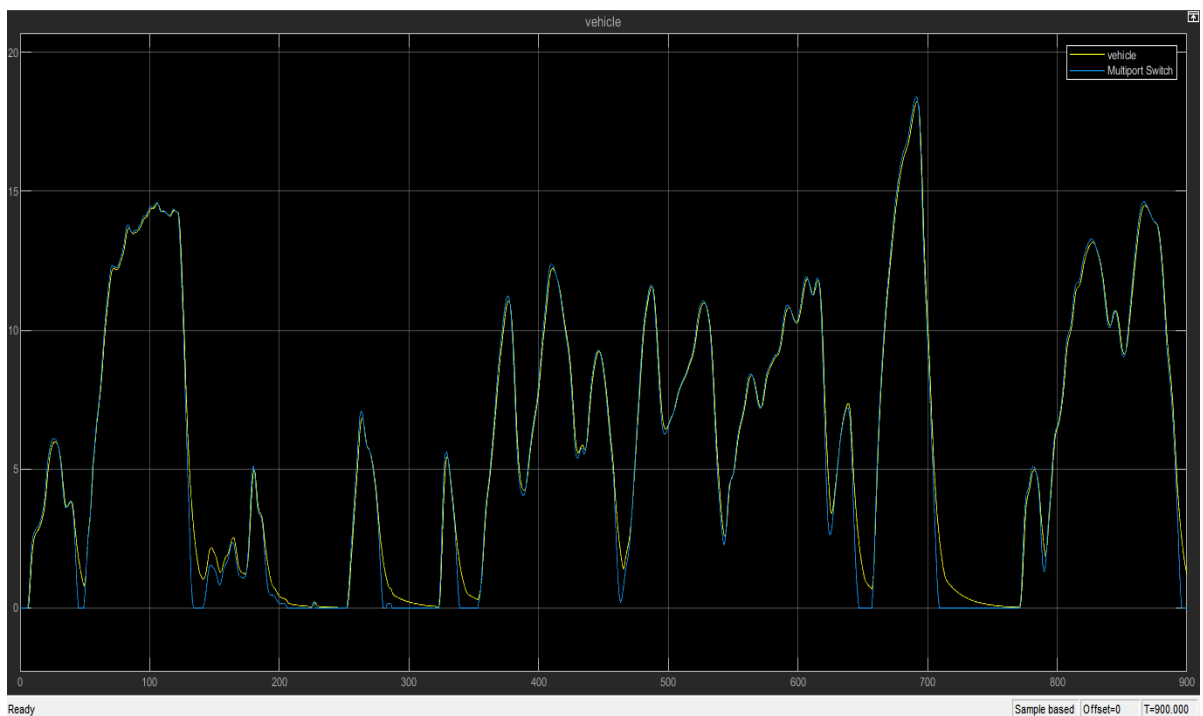Fig. 6.7: Acceleration, Brake, Current, Sod-c of Whvc

Fig. 6.8: Reference with Vehicle of Whvc

Conclusion

In the speed trace plots for all the drive cycles which are observed in this study, the feedback speed plot and the reference speed plot overlap each other almost completely but there are regions where both the speeds are different. It is when the vehicle is decelerating. The reference speed plot falls sharply but the feedback speed does not. This is due to the inertia of the vehicle body. As the inertia of the vehicle body is higher, it takes a longer duration for it to decelerate. That is why the overlapping is not 100%. The battery's state of charge for each drive cycle can be visualized from the SOC plot. As long as the vehicle is accelerating the SOC is decreasing but as soon as the deceleration starts, the SOC plot goes slightly up. This is because the battery is being charged, due to regenerative braking during deceleration.