Matlab scripts :

There you will find all the MATLAB scripts for:

1- Parameter extraction using HPPC and cycling data
2- ECM parameters identification and LUT generation
3- Validation process
4- SOC estimation using EK (UDDS)

1- Pulses exctraction :

Script : Run the script **'Pulse_extraction.m'**

Each pulses are extracted in charge and discharge and save is in [Working_repo '/' pulses], which is created via the code. The mat-files are ordered by temperature for 1 C-rate and contain charge and discharges pulses (HPPC).

Data used: 10-16-19_20.16 948_HPPC (from cycle 0)

2- ECM parameters extraction

Script: Run the MATLAB script **'Run_parameterestimation.m'**

Step1:
ECM parameters are identified using HPPC signals saved and explained in the first section (parameters extraction). The results of the identification are saved in the folder [Working_repo '/' pulses], which is created via the code. Several functions are used (ECM_Cost, ECM_ODE… To simulate the transient voltages from R1, R2, etc, as well as the root mean square for optimization. Step2:
LUT lookup table is generated for different SOC, Temp and C-rate breakpoints.
LUT is saved in the working repo as LookUpTables_HPPC.mat. This mat.-file is used for the validation process

Step3:

LUT is used to refined parameters for each SOC breakpoints. The experimental signal (WLTP) is filtered at given temperatures and C-rates respecting a certain tolerance. The corresponding LUT is saved as **LookUpTables.mat** The script 'Run_param_estimation_Meatech.m' should be run again to extract refined parameters and perform validation based on those results.

The code is ready but would need to be run again, I did not have time to have the results are simulations were long and time is short.

Data used: 11-04-19_18.28 1001_WLTP206c (from cycle 8)

3- ECM implementation and validation

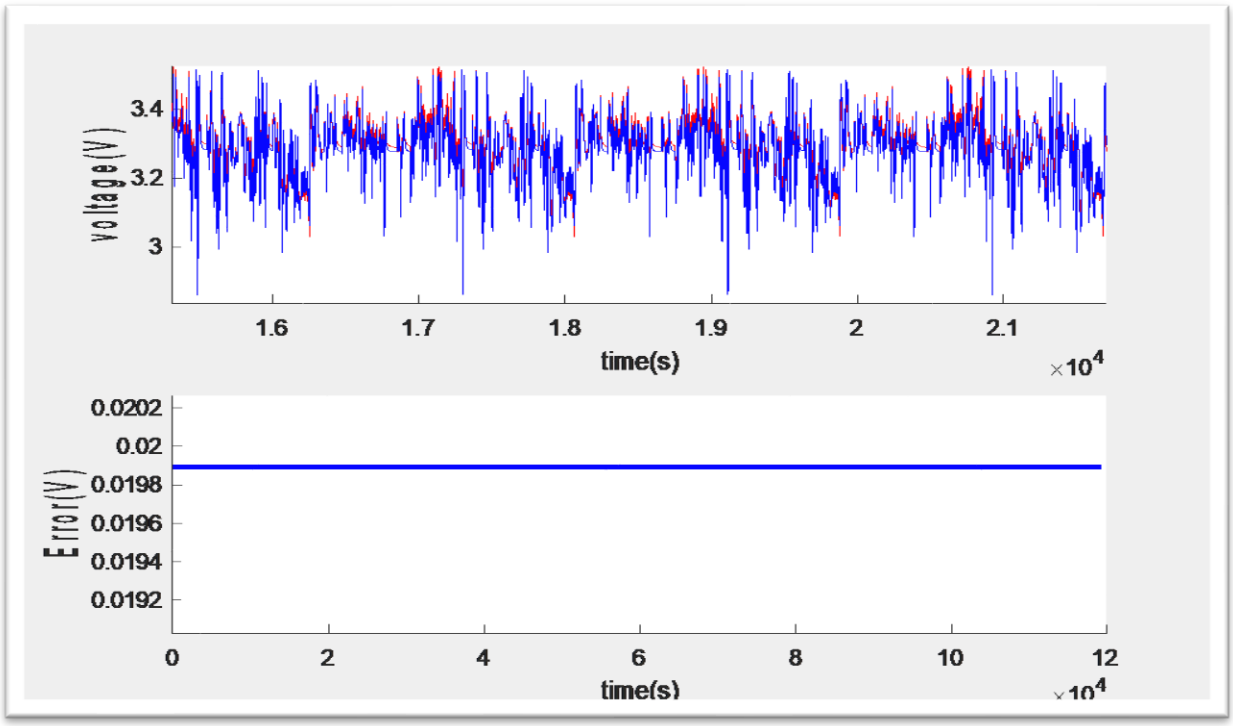
Script: Run the matlab script **'Script_validation.m'**

For the implementation, please refers to Simulink model 'ECM.slx'

The WLTP signal at cycle 16 is used as the experimental data for comparison.

Data used: '11-13-19_05.34 1023_WLTP206c.mat'(from cycle 16)

PLOTS

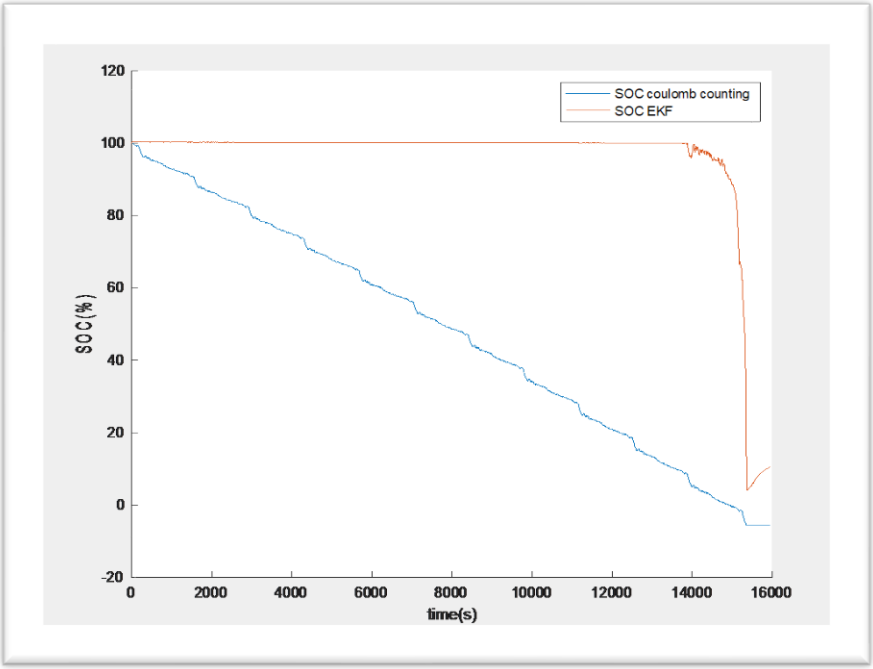


4- SOC estimation

Script: Run the MATLAB script 'SOC_EKF.m'

It was my first time implementing EKF. Even though my research helped me, I thinks there's an issue with the data (or I don't have the corresponding OCV). Thus results are not satisfactory. The UDDS signal starts at 4.2V (SOC 100), the OCV in the excel sheet starts around 3.5V, therefore the initialization of the EKF function at SOC_init= 100% gives a huge voltage gap. Also I'm using EKF-based estimation, the gradient dOCV/SOC will be low in the flat in the region 20-80. I could still play with noise and error covariance.

Plots-


SOC coulomb counting
SOC EKF
120
100
80
60
40
20
0
-20
SOC(%)
0
2000
4000
6000
8000
10000
12000
14000
16000
time(s)