

Self-assessment of understanding and exercises

- 1 Consider a TTC model with the following parameters:

```
E = 3.7;      % [V]
Rs = 0.02;    % [Ohm]
R1 = 0.08;    % [Ohm]
C1 = 9000;    % [F]
R2 = 0.001;   % [Ohm]
C2 = 2000;    % [F]
```

Simulate (in Matlab, my advise, but if you are familiar with other tools that's ok too) the battery terminal voltage v following a step variation of the current from 0 A to +5 A.

- 2 Same as above, but, this time, with a step variation of the current from 0 A to -5 A.
- 3 What does it mean, in practice, to have a positive current vs. a negative current? And what's the impact on the battery terminal voltage?
- 4 Try dropping the faster state from the state-space model (ie, $R2/C2$, .. why is that the slower state). With reference to the circuit of the TTC, dropping the faster state means removing one of the two RC branches. Compare the results against point 1 and try to reason on the implications of 1 state vs 2 states.
- 5 If you compare the model you have simulated above with the considerations we did on the cell internal voltage vs. SOC, what could one add to the model to make it better in that respect?

I assume that the knowledge on how to simulate a step response of a state-space model (in Matlab) is available from courses on numerical simulations. If not, let me know so that I can help.