Exercise 9: Laplace transform

1. Python

a. An equivalent circuit model for a lithium-ion battery can be used to simulate its behaviour during charging and discharging. Assume, that you have an equivalent circuit model with two RC elements. The resistance, capacitance, and OCV values depend on the SOC of the battery. This dependence is shown in the file “parameter_2RC.csv”.

   Utilizing these parameters, write a program in python that performs a CC/CV cycle on the battery using the ECM. Assume that during the CC step, the battery is charged by a current of 15 A. During the CV step, the voltage of the battery is maintained at 4.2V. Also consider that the capacity of the battery is 31 Ah.

   Useful function for this question includes: *interp1d, fsolve, solve_ivp*, etc.

b. Now consider the second order RC circuit used to model the lithium-ion battery. Find the transfer function of an RC circuit with two elements using Laplace transform. Utilize the capabilities of the SciPy library to plot the step response of the function, considering that the input is the current and the output is the terminal voltage. How do you handle the SOC dependence of the circuit parameters?

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