Semi-implicit estimation of a battery model based on the SIHD method – Preliminary results –

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Semi-implicit estimation of a battery model

The semi-implicit estimation has been tested on a simple battery voltage model (Thevenin-type, see e.g. Plett, 2015), described as follows :

$$\dot{\mathrm{SoC}} = -\frac{I}{Q_{\mathrm{nom}}} \qquad (I \text{ is the known (noisy) input current})$$

$$\dot{V}_{RC1} = -\frac{V_{RC1}}{R_1 C_1} + \frac{I}{C_1}$$

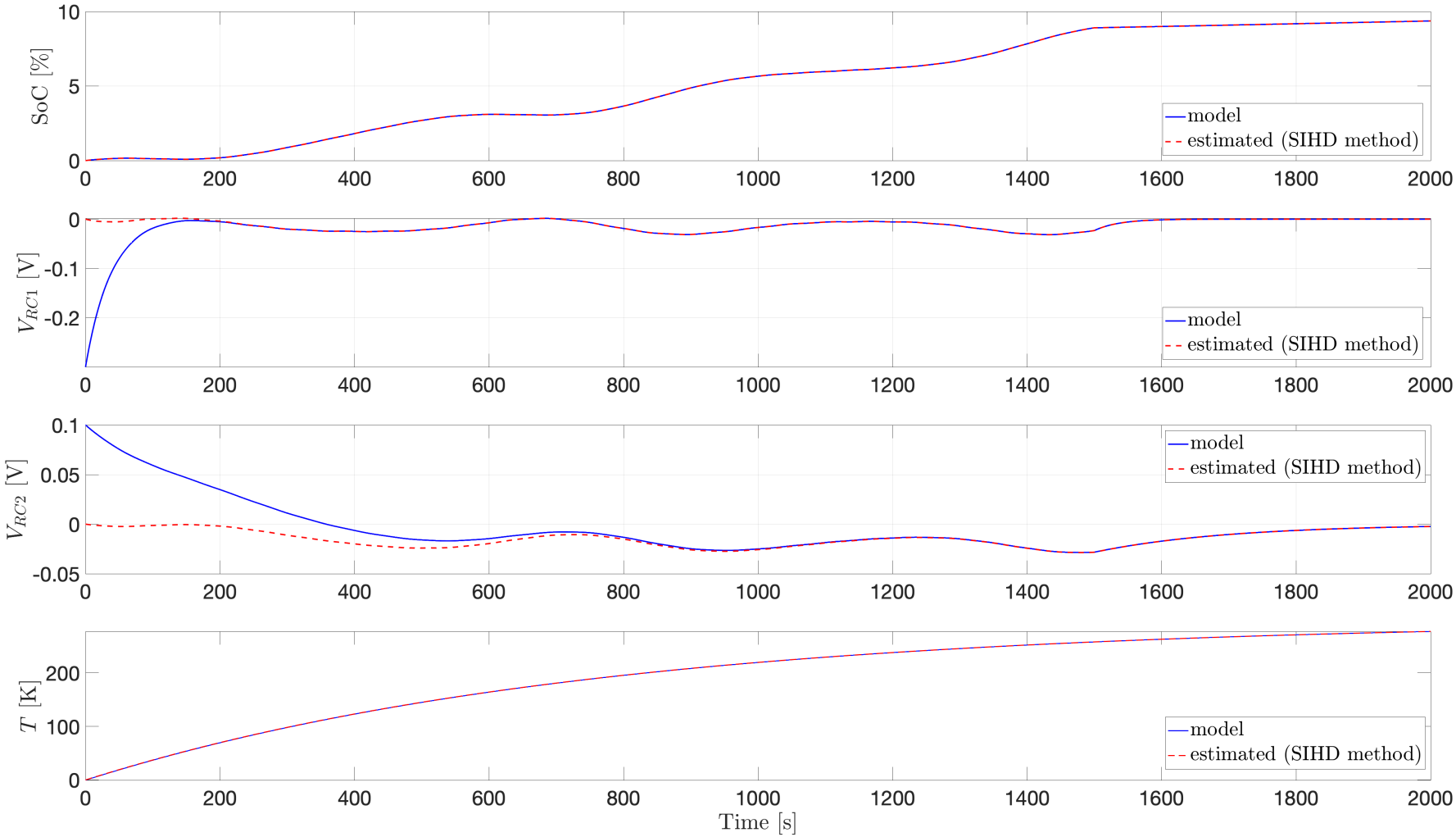
$$\dot{V}_{RC2} = -\frac{V_{RC2}}{R_2 C_2} + \frac{I}{C_2}$$

$$\dot{T} = \frac{I^2(R_s + R_1 + R_2) - (T - T_{\mathrm{amb}})/R_{\mathrm{th}}}{C_{\mathrm{th}}}$$

$$V_t = V_{\mathrm{OCV}}(\mathrm{SoC}) - R_s I - V_{RC1} - V_{RC2}$$

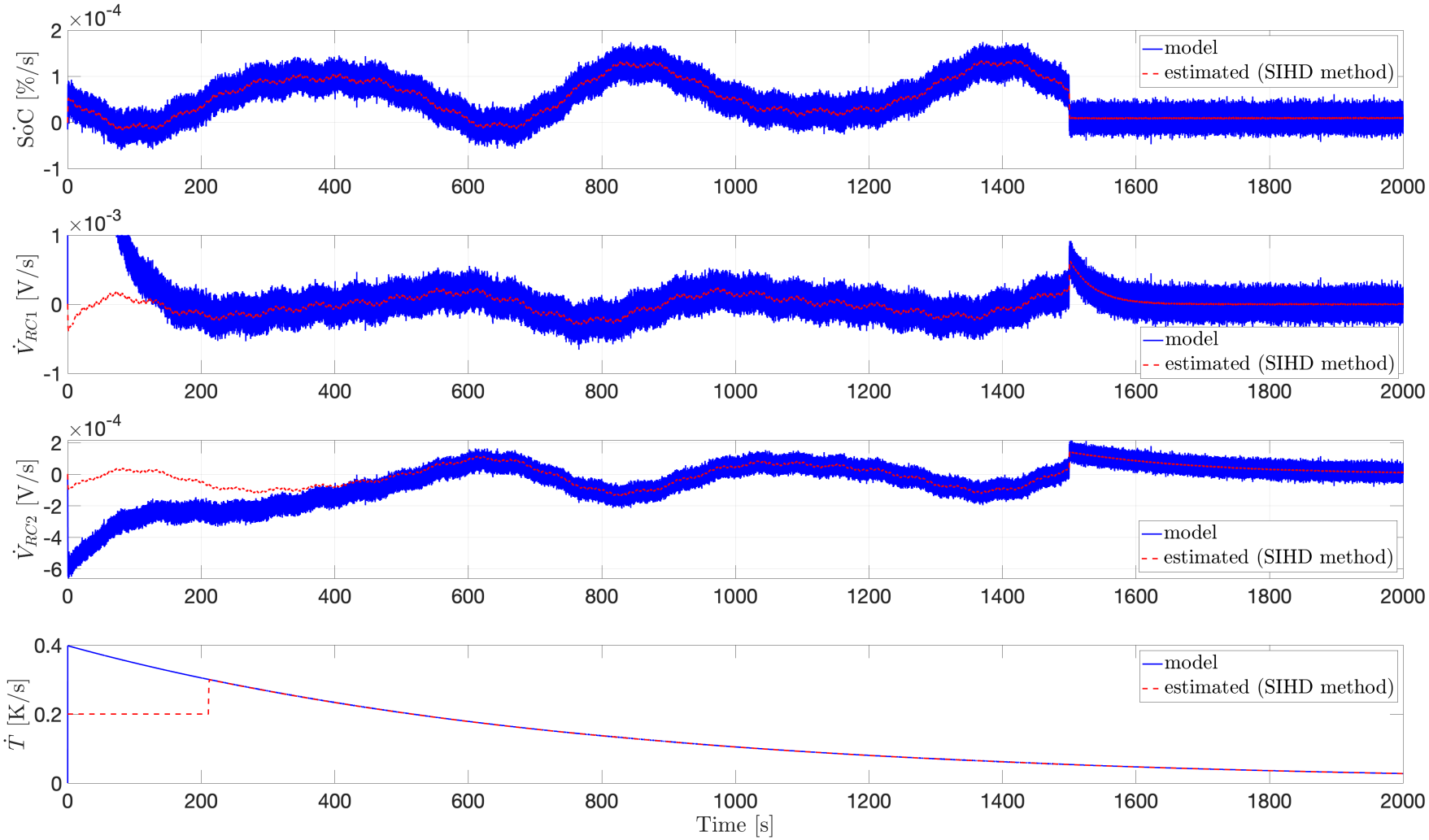
The estimation of the states is performed using the Semi-Implicit Homogeneous Differentiator (SIHD)
[Michel et al., Springer, 2025, in press]

Simulations (1/2)



Estimated states — Good tracking performance under noisy input current.

Simulations (2/2)



Estimated time-derivatives of the states.