International Workshop on Supercapacitors and Energy Storage
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Supercapacitor sizing for starting and peak-shaving applications

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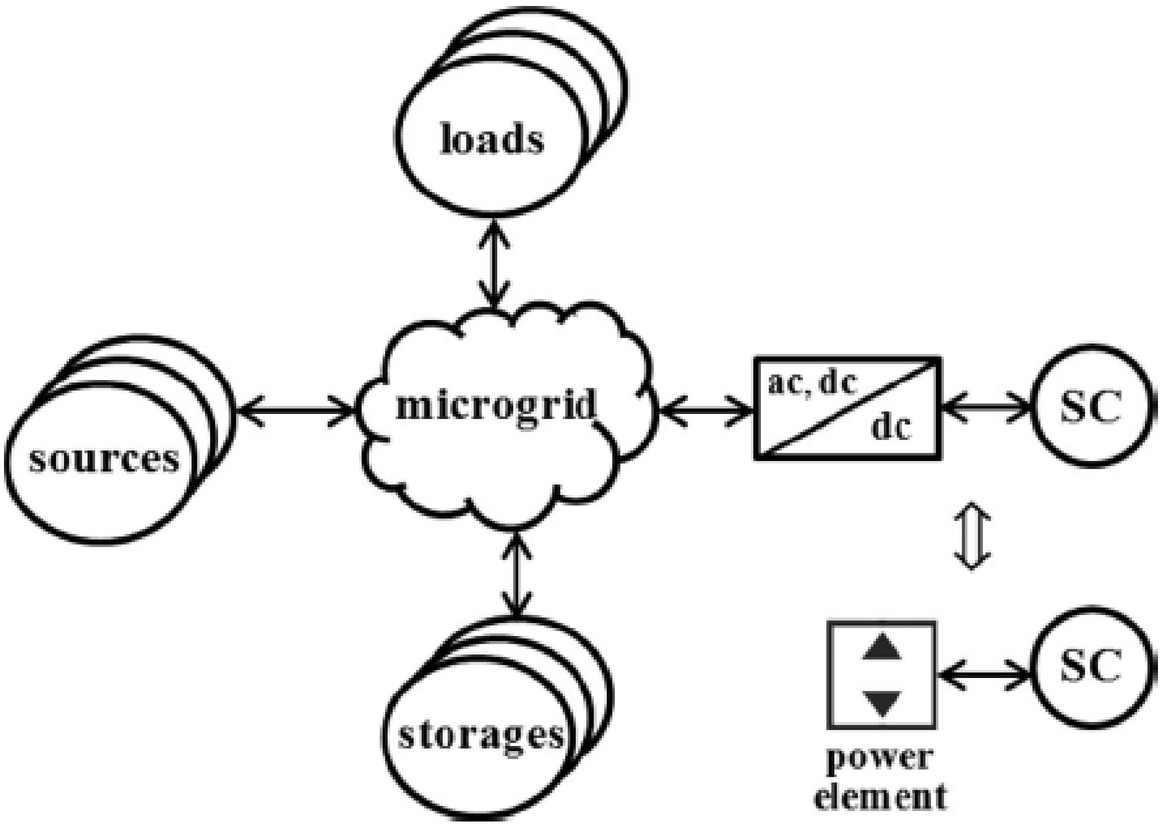
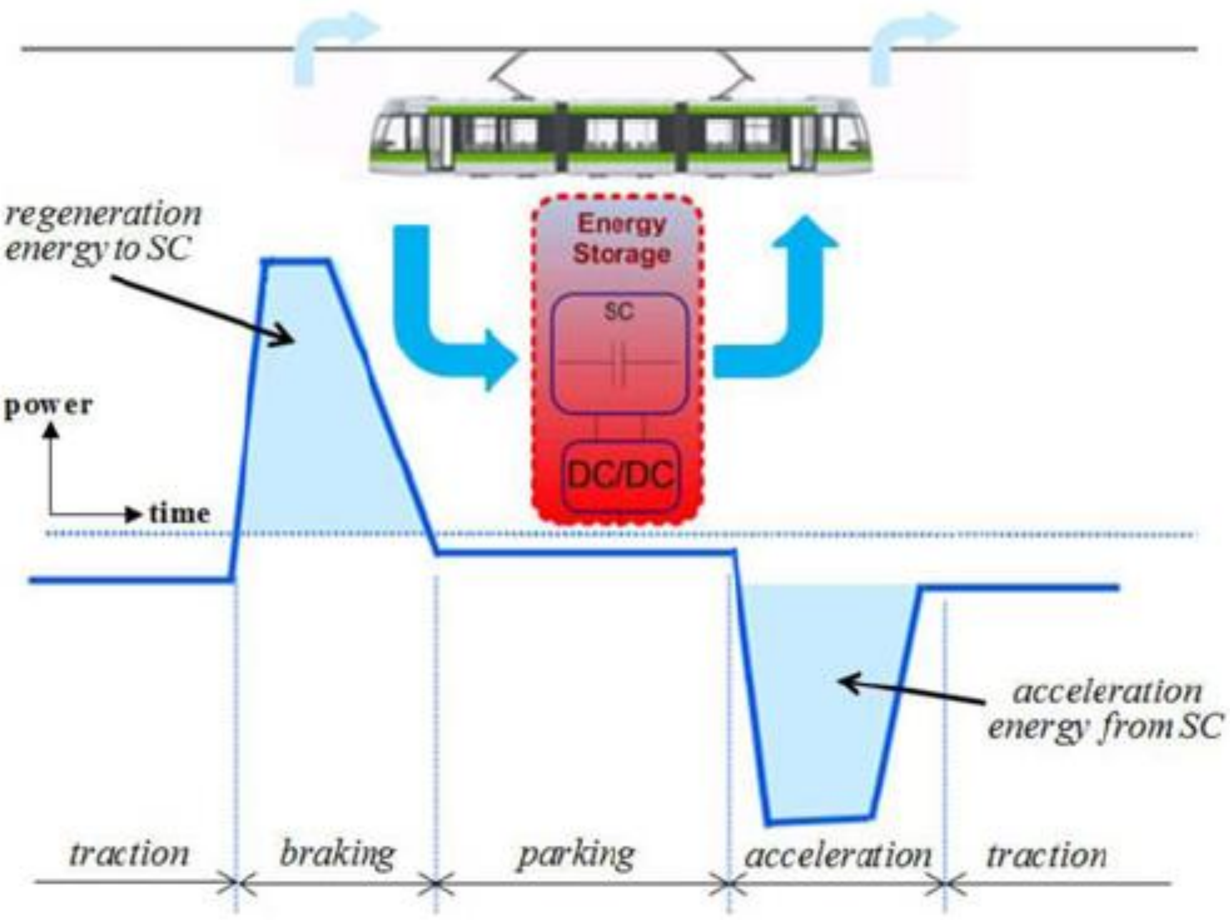
Supercapacitor sizing for starting and peak-shaving applications



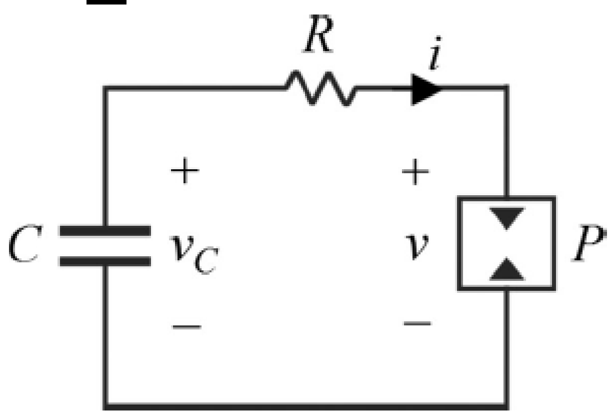
SC connected to a microgrid via power electronics converter.

Supercapacitor sizing for starting and peak-shaving applications

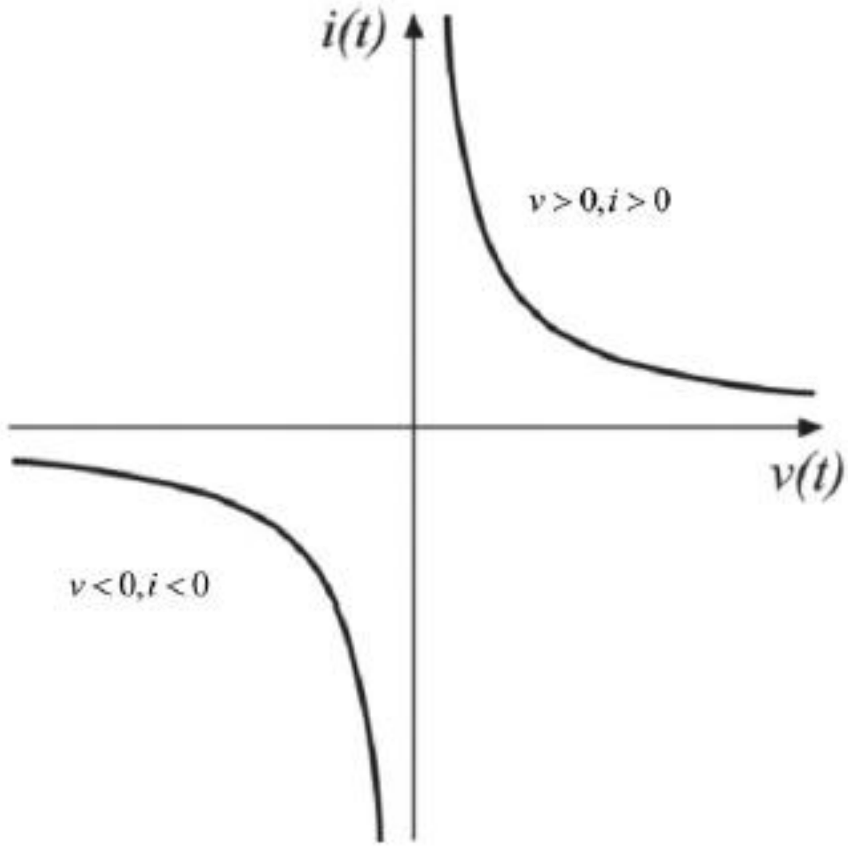


Power flow in an electric train with SC energy storage.

Supercapacitor sizing for starting and peak-shaving applications

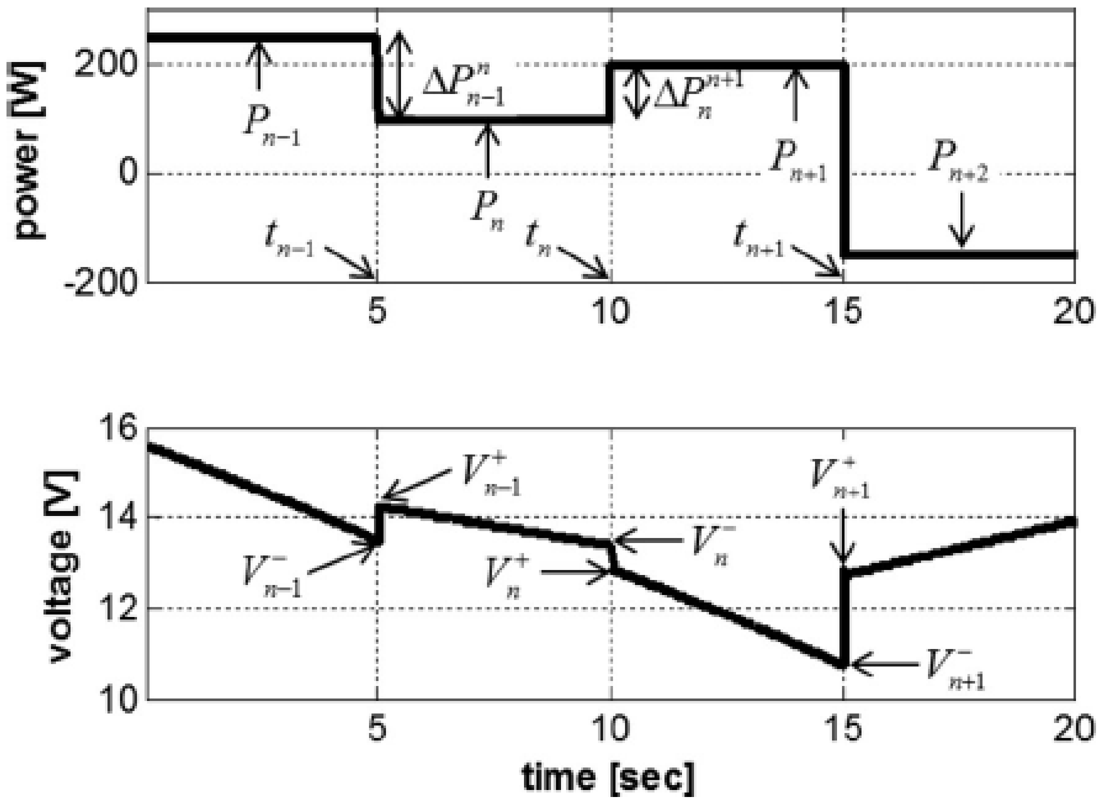


SC connected to a constant power element.



Constant power element $I-V$ curves.

Supercapacitor sizing for starting and peak-shaving applications

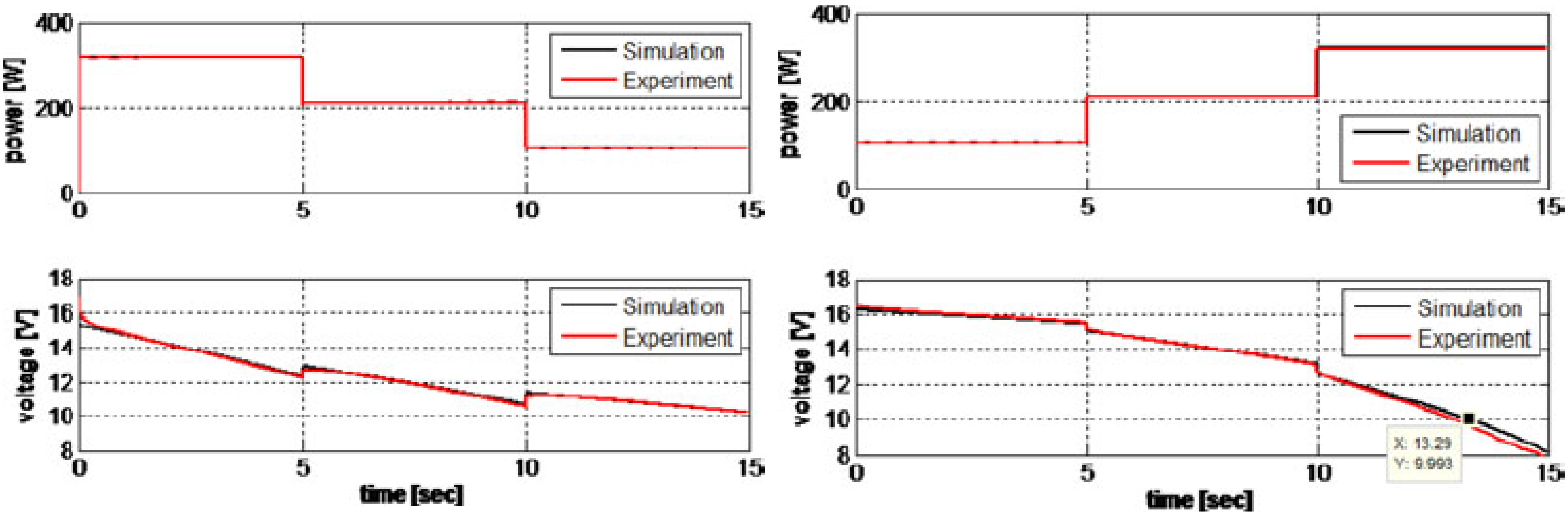


$$v(t) = \left(-RP_{n+1}W\{f(t)\}\right)^{-0.5}, \qquad t_n < t < t_{n+1}$$

$$f(t) = -(RP_{n+1})^{-1} e^{(2P_{n+1}t + 2CRP_{n+1}\ln V_n^{+} - C(V_n^{+})^2)/CRP_{n+1}}$$

Supercapacitor sizing for starting and peak-shaving applications

$$\rho(p) = \begin{cases} P_1, T_1 \\ P_2, T_2 \\ \vdots \\ P_N, T_N \end{cases}$$



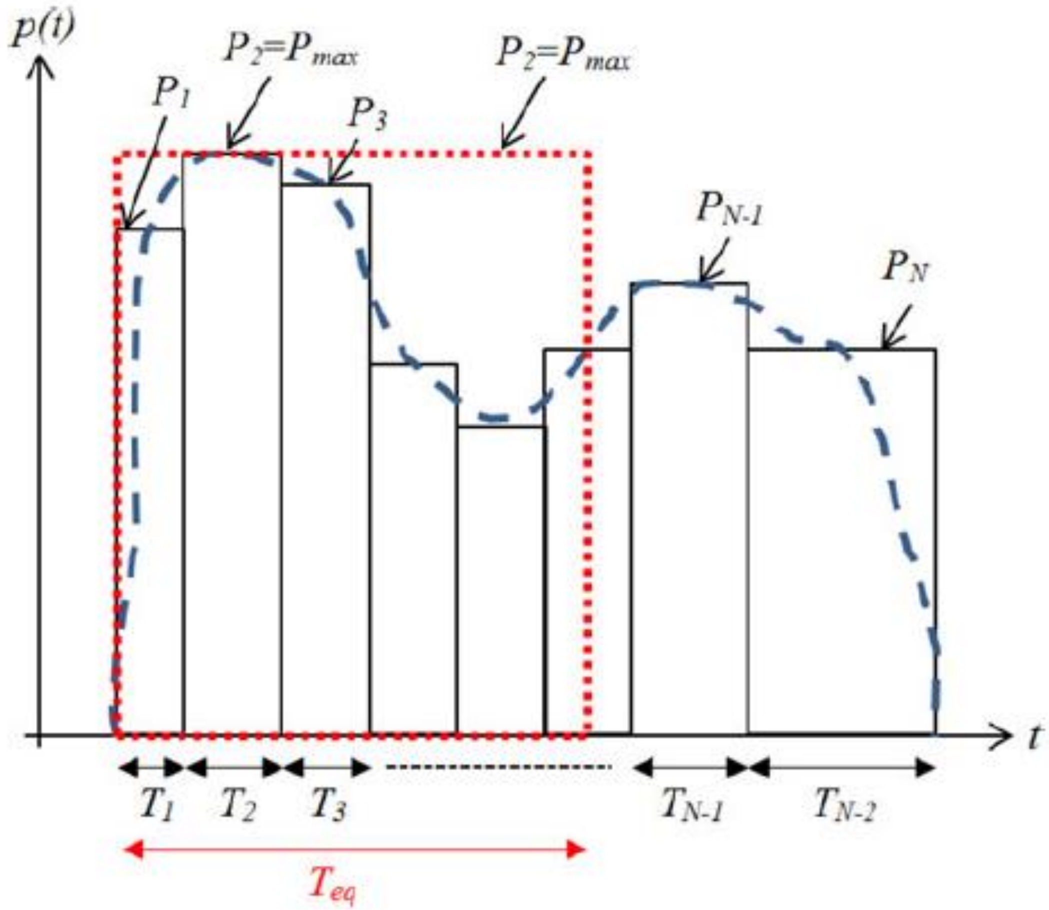
Supercapacitor sizing for starting and peak-shaving applications

$$\rho(p) = \begin{cases} P_1, T_1 \\ P_2, T_2 \\ \vdots \\ P_N, T_N \end{cases}$$

$$E_t = \sum_{k=1}^{N} P_k T_k .$$

$$T_{\mathrm{eq}} = \frac{E_t}{P_{\max}} = \frac{\sum_k P_k T_k}{\max_k P_k} .$$

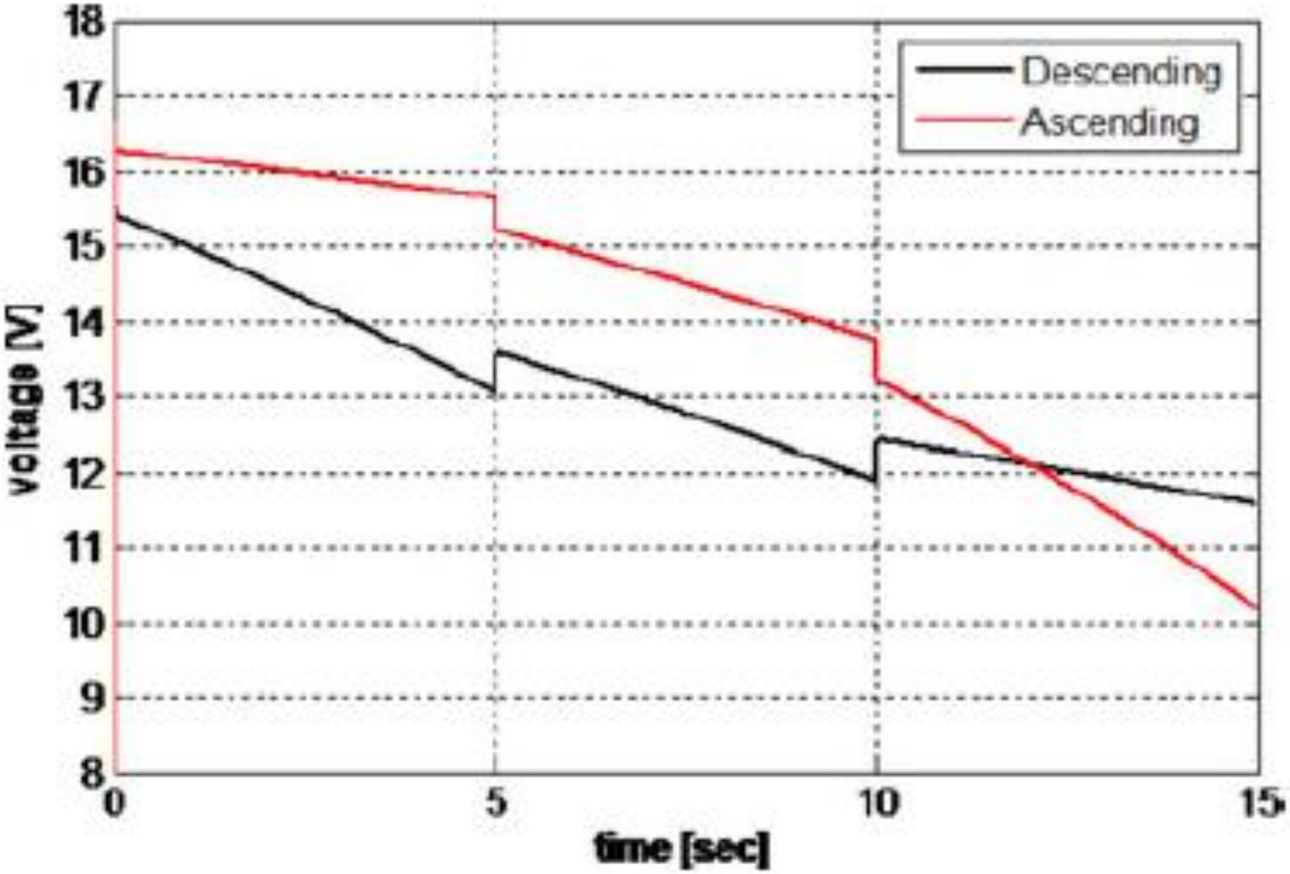
Supercapacitor sizing for starting and peak-shaving applications



$$(-RP_{n+1}W\{f(T_{\mathrm{eq}})\})^{-0.5} < V_{\min}$$

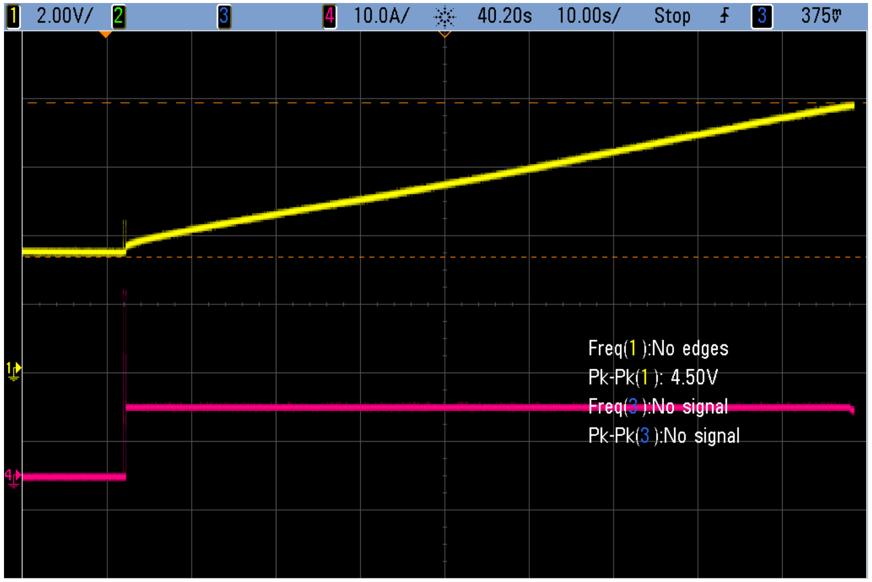
$$f(T_{\mathrm{eq}}) = -(RP_{\max})^{-1}\, e^{(2P_{\max}T_{\mathrm{eq}} + 2CRP_{\max}\ln V_0^{+} - C(V_0^{+})^2)/CRP_{\max}}.$$

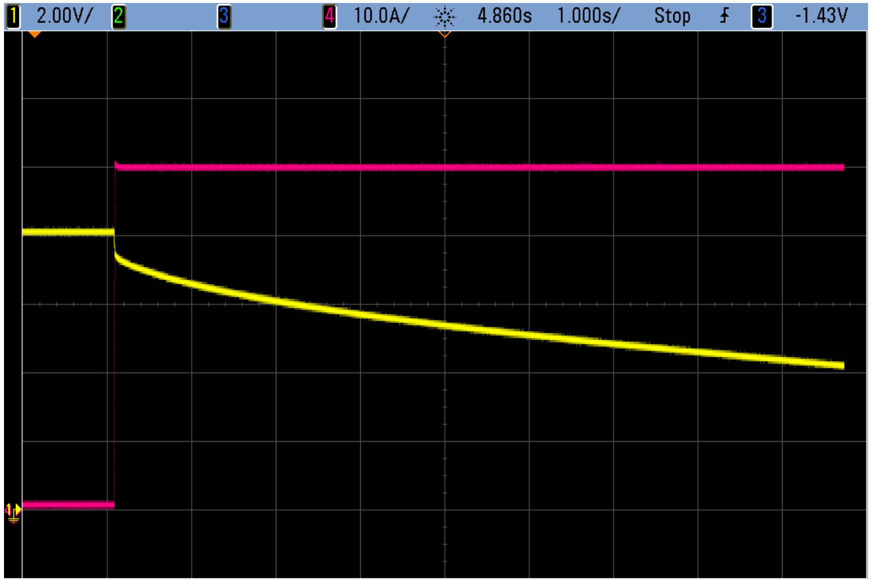
Supercapacitor sizing for starting and peak-shaving applications



Supercapacitor sizing for starting and peak-shaving applications

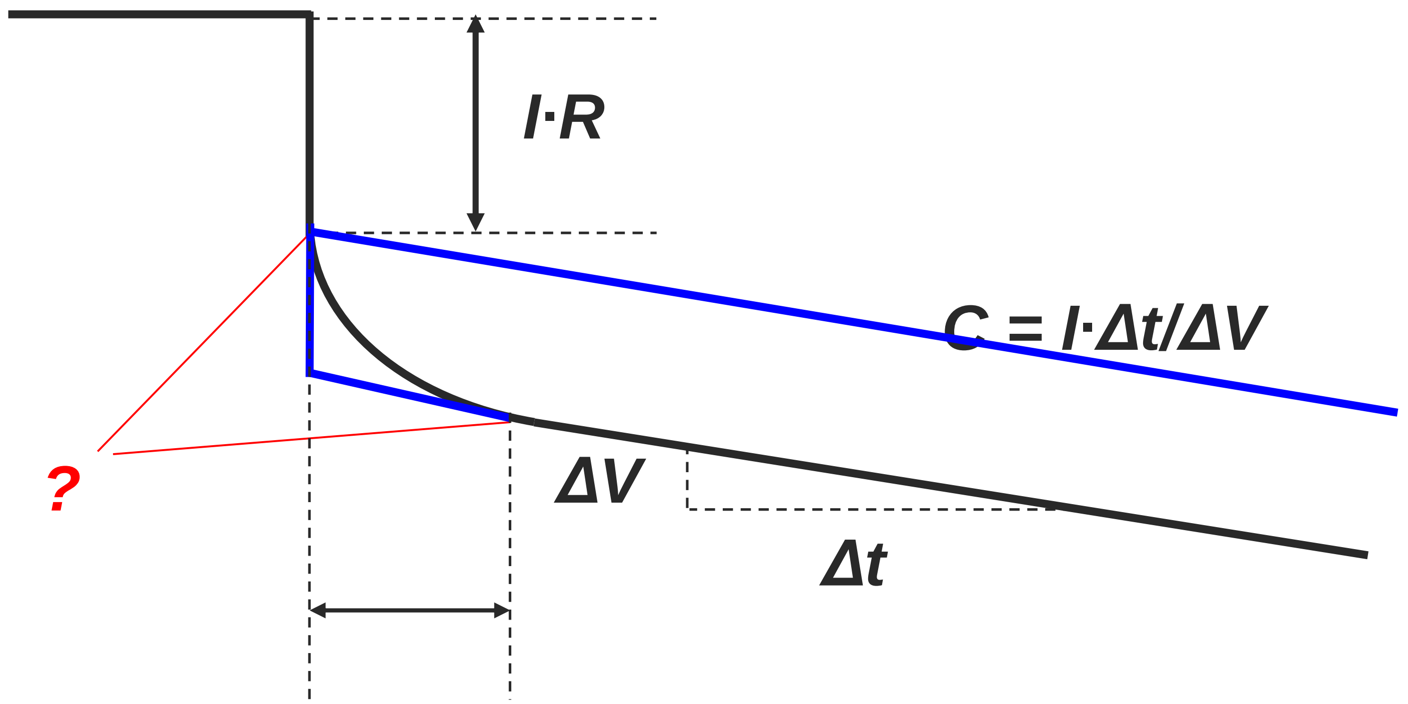
Some issues regarding R and C …





Supercapacitor sizing for starting and peak-shaving applications

Discharge behavior



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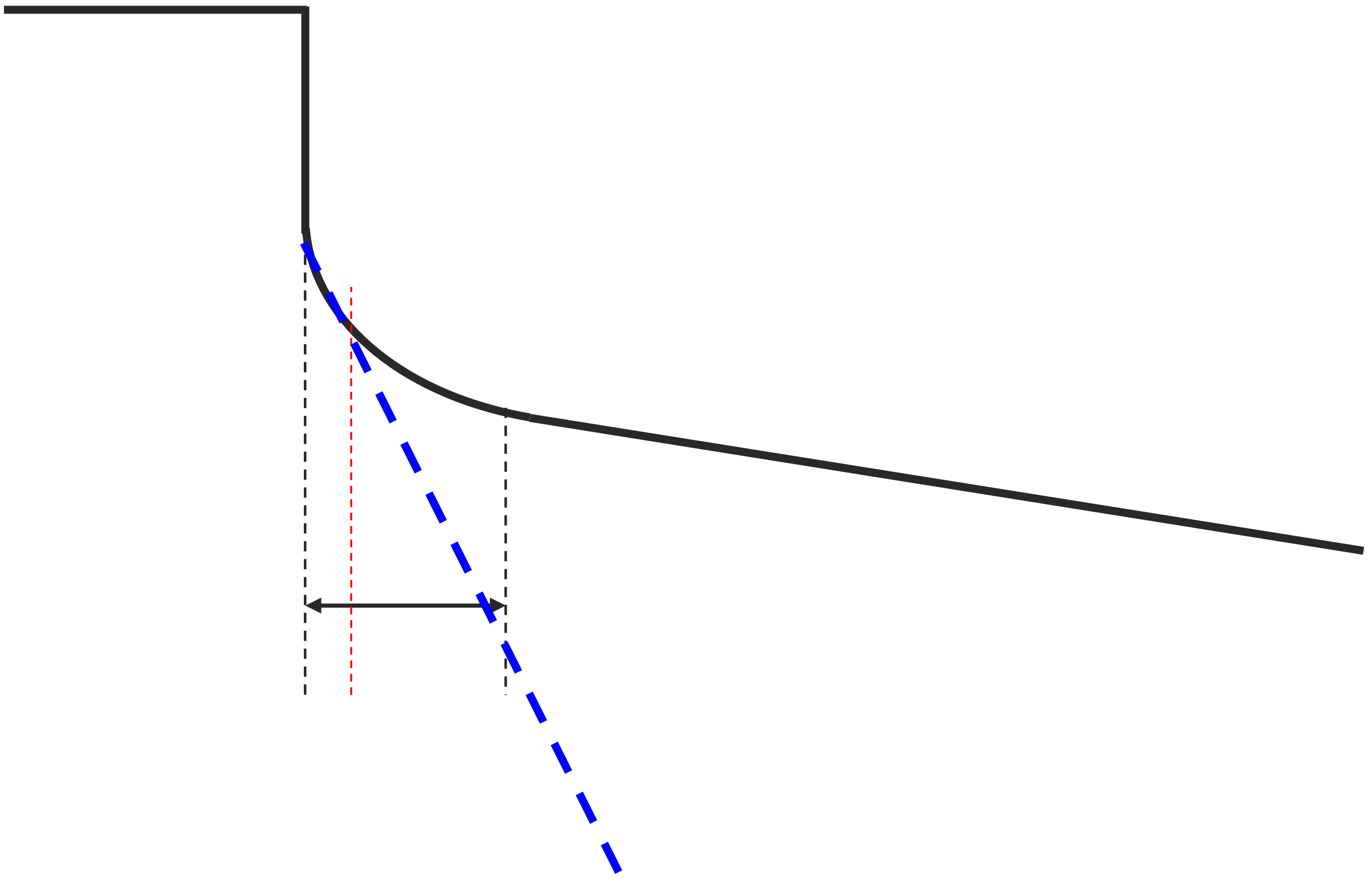
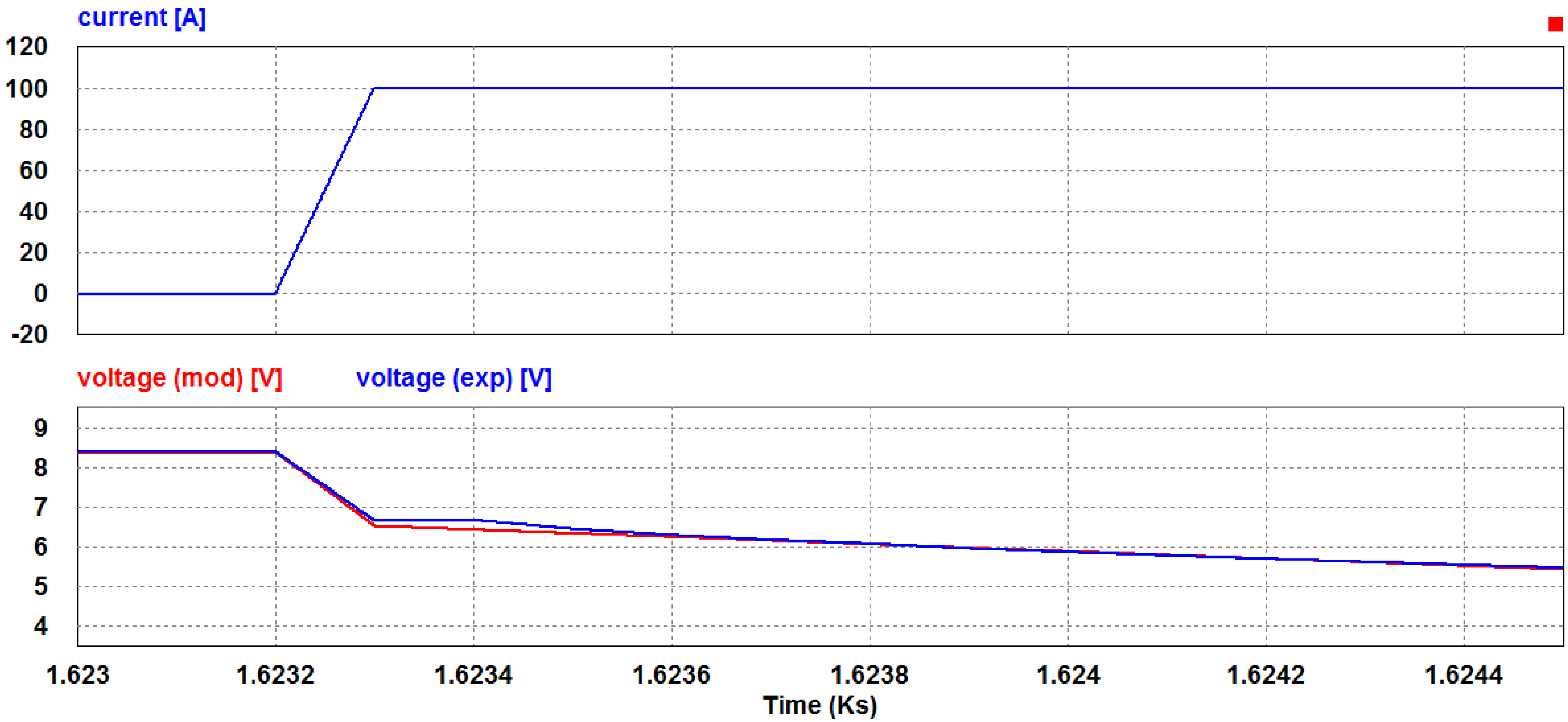
Discharge behavior



Supercapacitor sizing for starting and peak-shaving applications

C = 200F, R = 16mOhm



$C_{d,25}$ = 110F, $R_{d,25}$ = 18mOhm

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