Tutorial AMPL

Mixed-Integer Nonlinear Programming

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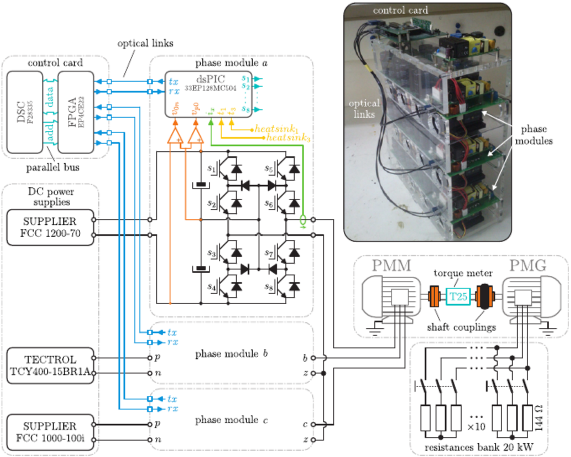
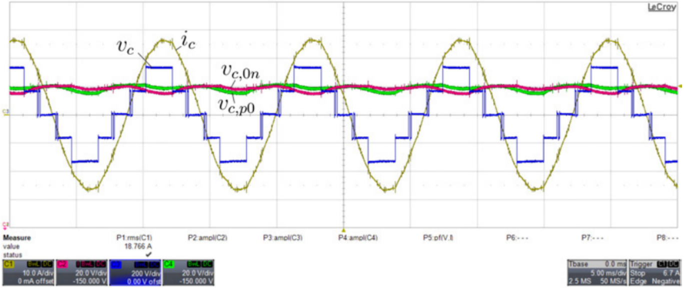
CC-ACC Converters

Modeling and optimization of switching policies for CC-AC converters.

CC-ACC Converters



CC-ACC Converters



Trigonometric Relations

- First, we use trigonometric relations rather than angles:

$$\sin(\alpha + \beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta$$
$$\cos(\alpha + \beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta$$

- We introduce the following variables:

$$y_{k,h} = \sin(h\gamma_k)$$
$$x_{k,h} = \cos(h\gamma_k)$$

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Trigonometric Relations

$$-1 \leq x_{k,h}, y_{k,h} \leq 1, \forall h \tag{1a}$$

$$x_{k,1}^2 + y_{k,1}^2 = 1 \tag{1b}$$

$$\begin{cases} y_{k,2} = 2x_{k,1}y_{k,1} \\ x_{k,2} = x_{k,1}^2 - y_{k,1}^2 = 1 - 2y_{k,1}^2 \end{cases} \tag{1c}$$

$$\begin{cases} y_{k,4} = 2x_{k,2}y_{k,2} \\ x_{k,4} = x_{k,2}^2 - y_{k,2}^2 \end{cases} \tag{1d}$$

$$\begin{cases} y_{k,5} = y_{k,4}x_{k,1} + x_{k,4}y_{k,1} \\ x_{k,5} = x_{k,4}x_{k,1} - y_{k,4}y_{k,1} \end{cases} \tag{1e}$$

Trigonometric Relations

$$\begin{cases} y_{k,h} = y_{k,h-2}x_{k,2} + x_{k,h-2}y_{k,2} \\ x_{k,h} = x_{k,h-2}x_{k,2} - y_{k,h-2}y_{k,2} \end{cases}, h = 6n+1, n \geq 1 \qquad (2a)$$

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MINLP Model

$$\min \sum_{h=6n\pm 1}^{H} \frac{4}{\pi^2 h^4} \left(\sum_{k=1}^{K} y_{k,h} \right)^2$$

$$\text{s.t.}: \text{Eqs. } (1)-(2),\ \forall k$$

$$x_{k,1} \geq 0,\ \forall k$$

$$\frac{4}{\pi} \sum_{k=1}^{K} y_{k,1} = M$$

$$\left\{ \begin{array}{l} y_{k,1} \leq \delta_k \\ \delta_k - 1 \leq y_{k,1} \end{array} \right. ,\forall k$$

$$\text{s.t.}: \delta_k \in \{0,1\}, \forall k$$

$$z_1 = (2\delta_1 - 1)$$

$$z_k = z_{k-1} + 2(\delta_{k-1} - 1),\ \forall k \geq 2$$

$$0 \leq z_k \leq \left\lfloor \frac{L-1}{2} \right\rfloor,\ \forall k$$

$$y_{k,1}^2 \geq y_{k+1,1}^2,\ k = 1, \ldots, K-1$$

where M is a given parameter.

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AMPL Tutorial

- Thank you for attending this lecture!!!