January 10, 2019

# Errata and Supplements to "Nonsmooth Mechanics and Convex Optimization" (CRC Press, 2011)

- Page 8, (1.3):
  $\forall x \in \mathcal{K} \quad \to \quad x \in \mathcal{K}$
- Page 17, proof of Fact 1.3.15:
  $A \bullet B = A^{1/2} B A^{1/2} \quad \to \quad A \bullet B = \mathrm{tr}(A^{1/2} B A^{1/2})$
- Page 23, proof of Fact 1.4.6:

  From (1.18) and the equality in (1.20), we obtain

  $$x_0 = \|\boldsymbol{x}_1\|, \quad s_0 = \|\boldsymbol{s}_1\|. \tag{1.21}$$

  The equality in (1.19) holds if and only if either

  $$\begin{cases} \boldsymbol{x}_1 = \boldsymbol{0}; \\ \boldsymbol{s}_1 = \boldsymbol{0}; \\ \boldsymbol{x}_1 \neq \boldsymbol{0},\ \boldsymbol{s}_1 \neq \boldsymbol{0}, \text{ and } \boldsymbol{x}_1 = -\alpha \boldsymbol{s}_1 \ (\alpha > 0) \end{cases} \tag{1.22}$$

  is satisfied.[16] Thus we see that (a) holds if and only if (1.21) and (1.22) are satisfied. but the latter condition is equivalent to (c).

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  The equality in (1.19) holds if and only if either

  $$\begin{cases} \boldsymbol{x}_1 = \boldsymbol{0}; \\ \boldsymbol{s}_1 = \boldsymbol{0}; \\ \boldsymbol{x}_1 \neq \boldsymbol{0},\ \boldsymbol{s}_1 \neq \boldsymbol{0}, \text{ and } \boldsymbol{x}_1 = -\alpha \boldsymbol{s}_1 \ (\alpha > 0) \end{cases} \tag{1.21}$$

  is satisfied.[16] With reference to (1.18) and the equality in (1.20), we obtain $x_0 = 0$ if $\boldsymbol{x}_1 = \boldsymbol{0}$ and $s_0 = 0$ if $\boldsymbol{s}_1 = \boldsymbol{0}$. Furthermore, in the final case of (1.21) we obtain

  $$x_0 = \|\boldsymbol{x}_1\|, \quad s_0 = \|\boldsymbol{s}_1\|. \tag{1.21}$$

  From this observation we conclude that (a) is equivalent to (c).

- Page 54, the 1st line of section 2.2.4:
  "We here establish the optimality conditions for (P) and (P*). We assume that $\varPhi$ is a closed proper convex function."

- Page 59, Definition 2.2.13:
  $L : \mathbb{V} \times \mathbb{Y}^* \to \mathbb{R} \cup \{+\infty\} \qquad \to \qquad L : \mathbb{V} \times \mathbb{Y}^* \to \mathbb{R} \cup \{-\infty\}$

- Page 62, eq. (2.44):

$$\varPhi(\boldsymbol{x}; \boldsymbol{\lambda}, \boldsymbol{\nu}) = \begin{cases} f_0(x) & \text{if } f_j(x) + z_j \leq 0 \quad (j = 1, \dots, m), \\ & \qquad h_l(x) + \nu_l = 0 \quad (l = 1, \dots, k), \\ +\infty & \text{otherwise}, \end{cases}$$

$$\downarrow$$

$$\varPhi(\boldsymbol{x}; \boldsymbol{\lambda}, \boldsymbol{\nu}) = \begin{cases} f_0(x) & \text{if } f_j(x) + \lambda_j \leq 0 \quad (j = 1, \dots, m), \\ & \qquad h_l(x) + \nu_l = 0 \quad (l = 1, \dots, k), \\ +\infty & \text{otherwise}, \end{cases}$$

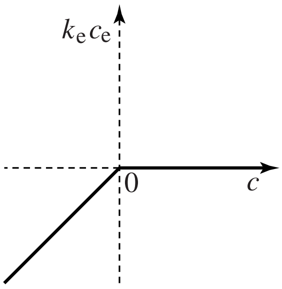
- Page 62, eq. (2.45):

$$= \begin{cases} f_0(\boldsymbol{x}) + \sum_{j=1}^{m} \lambda_j^* g_j(\boldsymbol{x}) + \sum_{l=1}^{k} \nu_l^* h_l(\boldsymbol{x}) & \text{if } \boldsymbol{\lambda}^* \geq \boldsymbol{0}, \\ -\infty & \text{otherwise.} \end{cases}$$

$$\downarrow$$

$$= \begin{cases} f_0(\boldsymbol{x}) + \sum_{j=1}^{m} \lambda_j^* f_j(\boldsymbol{x}) + \sum_{l=1}^{k} \nu_l^* h_l(\boldsymbol{x}) & \text{if } \boldsymbol{\lambda}^* \geq \boldsymbol{0}, \\ -\infty & \text{otherwise.} \end{cases}$$

- Page 107, Figure 4.4(a):

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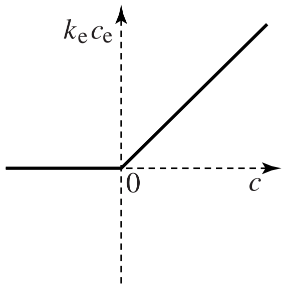


- Page 257, (9.6):

$$\omega_1(\boldsymbol{\varepsilon}_{\mathrm{w}}) > 0, \quad \omega_2(\boldsymbol{\varepsilon}_{\mathrm{w}}) > 0, \tag{9.6a}$$

$$\omega_1(\boldsymbol{\varepsilon}_{\mathrm{w}}) > 0, \quad \omega_2(\boldsymbol{\varepsilon}_{\mathrm{w}}) = 0, \tag{9.6b}$$

$$\omega_1(\boldsymbol{\varepsilon}_{\mathrm{w}}) = 0, \quad \omega_2(\boldsymbol{\varepsilon}_{\mathrm{w}}) = 0 \tag{9.6c}$$

$$\downarrow$$

$$\lambda_1(\boldsymbol{\sigma}) > 0, \quad \lambda_2(\boldsymbol{\sigma}) > 0, \tag{9.6a}$$

$$\lambda_1(\boldsymbol{\sigma}) > 0, \quad \lambda_2(\boldsymbol{\sigma}) = 0, \tag{9.6b}$$

$$\lambda_1(\boldsymbol{\sigma}) = 0, \quad \lambda_2(\boldsymbol{\sigma}) = 0 \tag{9.6c}$$

- Page 277, (9.72):
  $\langle z^*, \mathit{\Lambda} \rangle \qquad \to \qquad \langle z^*, \mathit{\Lambda} x \rangle$
- Page 313, 2 lines below (10.3b):
  $\boldsymbol{r}(r_{\mathrm{n}}, \boldsymbol{r}_{\mathrm{t}}) \qquad \to \qquad \boldsymbol{r} = (\boldsymbol{r}_{\mathrm{t}}, r_{\mathrm{n}})$
- Page 327, (10.35):

$$\begin{cases} \Delta u_{\mathrm{t}} > 0 & \Rightarrow \quad r_{\mathrm{t}} \leq 0, \\ \Delta u_{\mathrm{t}} < 0 & \Rightarrow \quad r_{\mathrm{n}} \geq 0. \end{cases}$$

$$\downarrow$$

$$\begin{cases} \Delta u_{\mathrm{t}} > 0 & \Rightarrow \quad r_{\mathrm{t}} \leq 0, \\ \Delta u_{\mathrm{t}} < 0 & \Rightarrow \quad r_{\mathrm{t}} \geq 0. \end{cases}$$

- Page 340, 6 lines below (10.81):

$$0 \leq \alpha \langle \boldsymbol{x} - \bar{\boldsymbol{y}}, \boldsymbol{y} - \bar{\boldsymbol{y}} \rangle + \alpha^2 \|\boldsymbol{y} - \bar{\boldsymbol{y}}\|^2.$$

$$\downarrow$$

$$0 \leq 2\alpha \langle \boldsymbol{x} - \bar{\boldsymbol{y}}, \boldsymbol{y} - \bar{\boldsymbol{y}} \rangle + \alpha^2 \|\boldsymbol{y} - \bar{\boldsymbol{y}}\|^2.$$

- Page 358, footnote 5:

$$f(\boldsymbol{\sigma}) = \|\operatorname{dev}(\boldsymbol{\sigma})\| = \left[\left(\boldsymbol{\sigma} - \tfrac{1}{3}\operatorname{tr}(\boldsymbol{\sigma})\right) : \left(\boldsymbol{\sigma} - \tfrac{1}{3}\operatorname{tr}(\boldsymbol{\sigma})\right)\right]^{1/2} = \left[\boldsymbol{\sigma} : \boldsymbol{\sigma} - \tfrac{1}{3}(\boldsymbol{I} : \boldsymbol{\sigma})^2\right]^{1/2},$$

$$\downarrow$$

$$f(\boldsymbol{\sigma}) = \|\operatorname{dev}(\boldsymbol{\sigma})\| = \left[\left(\boldsymbol{\sigma} - \tfrac{1}{3}\operatorname{tr}(\boldsymbol{\sigma}\boldsymbol{I})\right) : \left(\boldsymbol{\sigma} - \tfrac{1}{3}\operatorname{tr}(\boldsymbol{\sigma}\boldsymbol{I})\right)\right]^{1/2} = \left[\boldsymbol{\sigma} : \boldsymbol{\sigma} - \tfrac{1}{3}(\boldsymbol{I} : \boldsymbol{\sigma})^2\right]^{1/2},$$