

Last update: 14 May 2017

## CORRECTIONS TO

# Linear and Nonlinear Functional Analysis with Applications

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*Note:* The line of a running title is counted as line 0.

### Chapter 1

Page 39, line 1 in caption of Figure 1.18-2: delete “connected”

Page 40: Replace “Lipschitz-continuous” with “d $\Gamma$ -measurable”

Page 41, line 12: Replace “ $u, v$ ” with “ $f, g$ ”

### Chapter 2

Page 47, line –8: Insert “normed” after “infinite-dimensional”

Page 69, line –1: Replace “ $B(x; 1)$ ” with “ $B(x; \varepsilon)$ ”

Page 86, line –2: Insert “and  $A \in \mathcal{L}(X; Y)$ ” after “finite-dimensional”

Page 88, line –11: Replace “Problems 2.9-1 and 2.9-2” with “Question (1) in Problem 2.9-1”

### Chapter 3

Page 124, second line of the proof of Theorem 3.2-1: Insert “=  $\bar{X}$ ” after “ $\tilde{X}$ ” and replace “ $x$ ” with “ $\tilde{x}$ ”

Page 130, line 4 in proof of Theorem 3.2-1: Replace “ $(X, \|\cdot\|_1)$ ” with “ $X$ ”

Page 130, line 5 in proof of Theorem 3.2-1: Replace “ $\leq \|x^k - x^\ell\|$ ” with “ $= \|x^k - x^\ell\|_1$ ”

Page 131, line –13: Insert “for all  $x \in V(x_0)$ ,” after “Consequently,”

Page 139, line –3: Replace “ $\bar{a}_n$ ” with “ $a_n$ ”

Page 140, line 3: Replace “ $\bar{a}_i$ ” with “ $a_i$ ”

Page 141, line 1: Replace “ $\bar{a}_i$ ” with “ $a_i$ ”

Page 153, last line in Theorem 3.7-1: Replace “ $\|x_n - x\|$ ” with “ $d(x_n, x)$ ”

Page 153, line –3: Insert “since  $k < 1$ ” after “ $y = x$ ”

### Chapter 4

Page 174, line –17: Replace “ $y = 0$ ” with “ $x = 0$ ”

Page 175, line 10 in proof of Theorem 4.1-1: Replace “ $\bar{z}(y, x)$ ” with “ $\bar{z}(x, y)$ ”

Page 176, line 10: Insert “nonzero” after “for any”

Page 189, line 10: Insert “pointwise” after “that”

Page 193, line 3 in Theorem 4.4-1: Insert “real” after “ $m \times n$ ”

Page 208, line –2: Insert “if  $i \neq j$ ” after “ $k(j)$ ”

Page 210, line –9: Replace “ $\hat{g}(\theta)$ ” with “ $\tilde{g}(\theta)$ ”

Page 213, line 12: Insert “(Problem 4.8-6)” after “only the separable case”

Page 213, line 2 in statement of Theorem 4.9-1: Delete “separable”

Page 222, line –9: Insert “ $\|x_n\| = 1$  for all  $n \geq 1$  and” after “that”

Page 223, line –1: Insert “=” after “ $\|A_2\|$ ”

## Chapter 5

Page 236, line 2: Replace “ $n(x) \geq 1$ ” with “ $n(x) \geq 0$ ”

Page 248, in Theorem 5.4-3: Replace “ $\|A_n f\|$ ” with “ $\|A_n f - f\|$ ”

Page 252, lines -3 and -2: Replace “ $\sin\left(\frac{n+1}{2}\right)\varphi$ ” with “ $\sin\left(n + \frac{1}{2}\right)\varphi$ ”

Page 253, Figure 5.5-1: the function  $g_n^\varepsilon$  should be defined on the interval  $[-\pi, \pi]$  (instead of on the interval  $[0, 2\pi]$ ), with  $g_n^\varepsilon(\theta)$  for  $\theta \in [0, \pi]$  as shown on the figure, and with  $g_n^\varepsilon(\theta) := g_n^\varepsilon(-\theta)$  if  $\theta \in [-\pi, 0[$

Page 254, line 12: Replace “ $\sin\left(\frac{n+1}{2}\right)\varphi$ ” with “ $\sin\left(n + \frac{1}{2}\right)\varphi$ ”

Page 255, line 4: Replace “ $\sin\left(\frac{n+1}{2}\right)\varphi$ ” with “ $\sin\left(n + \frac{1}{2}\right)\varphi$ ”

Page 255, line -12: Insert “and  $A$  is *convex*” after “ $z_0 \in A$ ”

Page 259, lines 12–14: Replace the sentence “if a mapping ... in  $Y$ ” with “it is easy to construct simple examples of closed linear operators between normed vector spaces that are not continuous”

Page 262, line 5: Replace “ $\text{Dom } f$ ” with “ $Y$ ”

Page 289, line -15: Replace “1” with “ $2\pi$ ”

Page 301, line 4: Replace “all the” with “most”

## Chapter 6

Page 316: Replace the formula displayed on line -4 with the displayed formula: “for each multi-index  $\alpha$  with  $|\alpha| \geq 0$ ,  $\sup_{x \in K} |\partial^\alpha \varphi_k(x) - \partial^\alpha \varphi(x)| \rightarrow 0$  as  $k \rightarrow \infty$ ”

Page 322, line 1: Delete “ $i$ ” in “ $\|v - v_k i\|_{L^1(\mathbb{R})}$ ”

Page 322, line 3 in proof of Theorem 6.4-2: Insert a minus sign after “ $E_\varepsilon(x) :=$ ”

Page 324, line 9: Replace “ $[\Delta(\alpha + (1 - \alpha)E_k)]$ ” with “ $[\Delta(\alpha E_k + (1 - \alpha)E_k)]$ ”

Page 325, line -13 in the denominator: Replace “ $\delta_1^N$ ” with “ $\omega_N \delta_1^N$ ”

Page 325, line -3: Delete “loc” in “ $L_{\text{loc}}^1(U)$ ”

Page 328, line -8: Replace “ $N$ ” with “ $N + 1$ ” in “ $(L^p(\Omega))^N$ ”

Page 329, line 21: Replace “ $(\int_\Omega \sum_{|\alpha|=m} |\partial^\alpha v|^p dx)$ ” with “ $(\int_\Omega \sum_{|\alpha|=m} |\partial^\alpha v|^p dx)^{1/p}$ ”

Page 339, line 3: Replace “2.7” with “1.18”

Page 339, line 4: Replace “vector fields” with “functions”

Page 339, line 7: Replace “ $w_\ell$ ” with “ $w_j$ ”

Page 349, line 7: Replace “ $n$ ” with “ $N$ ”

Page 349, line 11: Replace “ $u$ ” with “ $v$ ”

Page 350, lines 13, 18, and 19: Replace “ $n$ ” with “ $N$ ”

Page 351, line 17: Replace “ $b$ ” with “ $c$ ”

Page 356, line 8: Replace “ $\|\Delta v\|_{0,\Omega}$ ” with “ $\|\Delta v\|_{0,\Omega}^2$ ”

Page 359, line -11: Delete “=”

Page 361, line 16: Replace “6.8-6” with “6.8-7”

Page 361, line -4: Replace “ $\Gamma$ ” with “ $\Omega$ ”

Page 362, line 2: Replace “6.8-2” with “6.8-3”

Page 373, line 14: Replace “ $Aw_k = w_k$ ” with “ $Aw_k = \lambda_k w_k$ ”

Page 373, line 15: Replace “ $v_\ell$ ” with “ $w_\ell$ ”

Page 373, line -14: Replace “To” with “We next”

Page 373, line -14: Replace “ $\sqrt{\alpha_k}$ ” with “ $\lambda_k^{-1/2}$ ”

Page 373, line -13: Insert “. To this end” after “ $(L^2(\Omega), \langle \cdot, \cdot \rangle)$ ”

Page 373, line -12: Replace “ $\sqrt{\alpha_k}$ ” with “ $\lambda_k^{-1/2}$ ”

Page 373, line -2: Insert “nonzero” after “for all”

Page 387, line 3: Replace “elliptic” with “coercive”

Page 393, line -5: Replace “ $L^2(\Omega)$ ” with “ $\mu \in L^2(\Omega)$ ”

Page 395, at the end of line 2: Delete “dx”

Page 397, line -8: Replace “ $\int_{\Omega} \mu_k \operatorname{div} \varphi \, dx$ ” with “ ${}_{H^{-1}(\Omega)} \langle \mu_k, \operatorname{div} \varphi \rangle_{H_0^1(\Omega)}$ ”

Page 397, line -6: Replace “ $\int_{\Omega} \mu \operatorname{div} \varphi \, dx$ ” with “ ${}_{H^{-1}(\Omega)} \langle \mu, \operatorname{div} \varphi \rangle_{H_0^1(\Omega)}$ ”

Page 397, line -4: Replace “identity mapping” with “canonical injection”

Page 397, line -1: Replace “Another” with “A direct, albeit delicate”

Page 399, line 19: Replace “second part; cf. Theorem 5.11-6” with “first part; cf. Theorem 5.11-5”

Page 401, line 15: Replace “ $\nu \sum_{i=1}^N {}_{H^{-1}(\Omega)} \langle -\Delta u_i$ ” with “ $\sum_{i=1}^N {}_{H^{-1}(\Omega)} \langle -\nu \Delta u_i$ ”

Page 403, line 6: Replace “adjoint” with “dual”

Page 405, line -7: Replace “identity mapping” with “canonical injection”.

Page 406, line 3: Replace

$$\| \mathbf{v} \|_{0,\Omega} \leq C_p (\| \mathbf{v} \|_{-1,\Omega}^p + \| \mathbf{e}(\mathbf{v}) \|_{-1,\Omega}^p)^{1,p}$$

with

$$\| \mathbf{v} \|_{1,p,\Omega} \leq C_p (\| \mathbf{v} \|_{0,p,\Omega}^p + \| \mathbf{e}(\mathbf{v}) \|_{0,p,\Omega}^p)^{1,p}$$

Page 411, Problem 6.15-4: Replace “in 1982” with “in 1962”

Page 420, Proof of Theorem 6.17-1, line 2: Replace “ $\boldsymbol{\pi} \in \mathcal{C}([0, 1]; \mathbb{R})$ ” with “ $\boldsymbol{\pi} \in \mathcal{C}([0, 1]; \mathbb{R}^N)$ ”

Page 420, line -4: Replace “ $\mathbb{R}$ ” with “ $\mathbb{R}^N$ ”

Page 421, lines 1 and 14: Replace “ $\mathbb{R}$ ” with “ $\mathbb{R}^N$ ”

Page 423, line -6: Replace “ $G_j(0, \lambda)$ ” with “ $G_j(1, \lambda)$ ”

Page 427, line 17: Replace “ $\pi$ ” with “ $\lambda$ ”

Page 432, line 8: Replace “ $\boldsymbol{\gamma}(t)$ ” with “ $\boldsymbol{\gamma}_x(t)$ ”

Page 438, line -1: Replace “ $\partial_j e_{ij}$ ” with “ $-\partial_j e_{ij}$ ”

Page 442, line -8: Replace “ $\mathbf{e} \cdot \mathbf{s}$ ” with “ $\mathbf{e} : \mathbf{s}$ ”

## Chapter 7

Page 455, line 11: Insert “ $\rightarrow Y$ ” before “is”

Page 459, line 11: Replace “ $f'(a)$ ” with “ $f'(a)h$ ”

Page 459, line 12: Replace “ $g'(b)$ ” with “ $g'(b)k$ ”

Page 468, line -6: Replace “ $\partial_1 f(a) - \partial_2 f(b)$ ” with “ $\partial_1 f(a) - \partial_1 f(b)$ ”

Page 470, line -5: Replace “ $f_m(x_0) - f_n(x_0)$ ” with “ $(f_m(x_0) - f_n(x_0))$ ”

Page 500, line 13: Replace “ $f'(x)$ ” with “ $f''(x)$ ”

Page 501, line 14: Replace “ $h$ ” with “ $s$ ”

Page 501, line 15: Replace “ $\zeta$ ” with “ $\xi$ ”

Page 501, line 16: Insert “ $\|\xi\|$ ” between “ $|t|$ ” and “ $\beta(t, \xi)$ ”

Page 502, line 19: Replace “ $k$ ” with “ $h$ ”

Page 504, line -1: Replace “ $(\alpha_1, \alpha_2, \dots, \alpha_m)$ ” with “ $(\alpha_1, \alpha_2, \dots, \alpha_n)$ ”

## Chapter 8

Page 580, line 12: Replace “ $\mathbf{g}^i(x)$ ” with “ $\mathbf{g}^j(x)$ ”

Page 593, line 2: Delete exponent “ $s$ ”

Page 593, line 3: Replace “ $\frac{n(n+1)}{2}$ ” with “ $n^2$ ”

Page 593, line 4: Replace “ $1 \leq k \leq \ell \leq n$ ” with “ $1 \leq k, \ell \leq n$ ”

Page 593, line -16: Replace “ $[\mathbf{g}_m(x)]^j$ . Then” with “ $w^m(x) [\mathbf{g}_m(x)]^j$ . Then (Theorem 8.3-1)”

Page 608, line 16: Replace “ $\mathbb{R}^n$ ” with “ $\mathbb{E}^n$ ”

Page 613, line 6: Insert “ $, n \geq 2,$ ” after “ $\mathbb{E}^n \rightarrow \mathbb{E}^n$ ”

Page 619, line 14: Replace twice “ $\mathbb{R}^3$ ” with “ $\mathbb{E}^3$ ”

Page 622, lines 22 and 23: Replace “ $\tilde{\omega}$ ” with “ $\omega$ ”

Page 623, line 15: Replace “ $\mathbb{R}^3$ ” with “ $\mathbb{E}^3$ ”

Page 624, line -8: Insert “simply connected” after “open”

Page 651, line 4: Delete “(” and “)”

Page 657, lines -11 and -10: Replace “This property is usually derived by assuming” with “Other crucial assumptions are”

## Chapter 9

Page 686, line 17: Replace “ $(\int_{\Omega} |\nabla \mathbf{v}|^p dx)^{1/p}$ ” with “ $(\int_{\Omega} |\nabla \mathbf{v}|^p dx)^{1/p}$ ”

Page 705, line 4: Replace “9.5-1” with “9.7-1”

Page 708, line -5: Replace “ $\psi$ ” with “ $\varphi$ ”

Page 716, at the end of line -7: Replace “the” with “any”

Page 719, line -11: Replace “.” with “ $\in$ ”

Page 719, line -7: Insert “ $dx$ ” after “ $\int$ ”

Page 723, line 5: Replace “of” with “from”

Page 731, line -2: Replace “ $\mathbf{a}$ ” with “ $\mathbf{b}$ ”

Page 737, line 5: Replace “ $<$ ” with “ $\leq$ ”

Page 737, line 6: Replace “ $\geq$ ” with “ $>$ ”

Page 744, line 3: Replace “ $\|A(v)\|$ ” with “ $\|A(v)\|_{V'}$ ”

Page 745, line -2: Insert “)” between “ $v$ ” and “,”

Page 750, line -7: Replace “ $1 \leq i \leq n$ ” with “ $1 \leq j \leq n$ ”

Page 751, lines -3, -5, -6, -9, and -12: Replace “ $f_{\eta}$ ” with “ $\tilde{f}_{\eta}$ ”

Page 755, line 9: Replace “(i)” with “(ii)”

Page 760, lines 2 and 3: Replace “ $V_j$ ” with “ $\tilde{V}_j$ ”

Page 765, line 6: Replace “det” with “deg”

Page 769, line -10: Replace the second “=” with “-”