ERRATA
STURM-LIOUVILLE THEORY & ITS APPLICATIONS

Page 26, line 8 to 9 (counted from above) should read: ..., and the convergence properties of such series as the geometric series $\sum x^n$ and the p-series $\sum 1/n^p$ (see [1] or [3]).

Page 29, Exercise 1.40. Replace $|x| < n$ by $|x| \leq n$.

Page 30, Exercise 1.48, first line should read: Use the result of Exercise 1.47 and Taylor's theorem [1] to obtain ...

Page 36, Exercise 1.52. Replace $\langle f_n, g\rangle \xrightarrow{\mathcal{L}^2} \langle f, g\rangle$ by $\langle f_n, g\rangle \rightarrow \langle f, g\rangle$.

Page 40, Exercise 1.62. The (displayed) definitions of φ_n and ψ_n should appear as follows:

$$\varphi_n(x) = \begin{cases} f_n(x), & x \in [0, l] \\ f_n(-x), & x \in [-l, 0), \end{cases}$$

$$\psi_n(x) = \begin{cases} f_n(x), & x \in [0, l] \\ -f_n(-x), & x \in [-l, 0). \end{cases}$$

Page 54, Exercise 2.9: Remove the hint.

Page 56, line -8 (counted from below), should read: In order to extend these results to the operator L, ...

Page 61, line -8, should read: as shown by the sequence (α_n) in Figure 2.2, where α_n approaches $(n - \frac{1}{2})$ asymptotically as $n \to \infty$.

Page 62, lines -7 and -6 should read: ..., where c is a constant, which we can take to be 1. ρ is then a C^2 function which is strictly positive on I. It reduces to 1 when $q = p'$, that is, when L is formally self-adjoint.

Page 66, Exercise 2.20. The first line should read: Determine the positive eigenvalues and eigenfunctions of $u'' + \lambda u = 0$ on $(0, l)$.

Page 71, lines 6 to 8, should read: $\cdots$ therefore vanishes at $x = a$ and $x = b$, hence

$$\langle -Lv, v\rangle = \int_a^b [p(x)\,|v'(x)|^2 - r(x)\,|u(x)|^2]dx \geq \ell\,\|v\|^2\,.$$

But this is contradicted by the inequality $\cdots$

Page 84, line 17 should read: ... by Example 3.1 in the next chapter, where each nonzero eigenvalue has two linearly independent eigenfunctions. Of course there cannot be more than two linearly independent eigenfunctions since the differential equation is of second order. This would seem to imply that periodic boundary conditions are less restrictive than separated boundary conditions.

For most real values of λ, however, the boundary conditions are already too restrictive to admit *any* eigenfunctions. This is the case when λ is not an eigenvalue.

Page 84, Remark 3 should be deleted.

Page 101, Exercise 3.2. The last line should read: uniformly convergent on $[-\pi, \pi]$? Why?

Page 106, In the representation of $D_n(\alpha)$ (above Figure 3.4), replace $\alpha \neq 0, 2\pi, \cdots$ by $\alpha \neq 0, \pm 2\pi, \cdots$ and replace $\alpha = 0, 2\pi, \cdots$ by $\alpha = 0, \pm 2\pi, \cdots$.

Page 115, Exercise 3.15 (a,b,e, and f). Change the inequalities on x to $-\pi < x \leq \pi$, $-1 < x \leq 1$, $-2 < x \leq 2$, $-l < x \leq l$, respectively.

Page 117, Exercise 3.26. In the first line, replace $f(x) = x^{1/3}$ by $f(x) = |x|^{1/2}$. In the fourth line, replace $x \in (-\pi, \pi)$ by $x \in [-\pi, \pi]$ and $(-\pi, \pi)$ by $[-\pi, \pi]$.

Page 127, Exercise 3.36, the second line should read:

$$u_{xx} + u_{yy} = 0, \quad 0 < x < \pi, \ 0 < y < \pi.$$

Page 139, line -10. Replace $\mathbb{N}_0$ by $\mathbb{N}$.

Page 140, Exercise 4.10, third line. Replace $\mathbb{R}^3$ by $\mathbb{R}^2$.

Page 143, lines 1 and 3. Replace $\|H_n\|^2$ by $\|H_n\|^2_{e^{-x^2}}$.

Page 146, line -8. Replace $\|L_n\|^2$, $\langle L_n, L_n\rangle$, and $\langle x^n, L_n\rangle$, respectively, by $\|L_n\|^2_{e^{-x}}$, $\langle L_n, L_n\rangle_{e^{-x}}$, and $\langle x^n, L_n\rangle_{e^{-x}}$.

Page 147, Exercise 4.21. Part (a), first and third lines: replace x^{k+r} by x^k and $\dfrac{2(k+r-\lambda)}{(k+r+2)(k+r+1)}$ by $\dfrac{2(k-\lambda)}{(k+2)(k+1)}$. Part (b) should read: Show that the solution of Hermite's equation is given by $u(x) = c_0 u_0(x) + c_1 u_1(x)$, where

$$\begin{aligned} u_0(x) &= 1 - \frac{2\lambda}{2!}x^2 + \frac{2^2\lambda(\lambda-2)}{4!}x^4 - \cdots, \\ u_1(x) &= x - \frac{2(\lambda-1)}{3!}x^3 + \frac{2^2(\lambda-1)(\lambda-3)}{5!}x^5 - \cdots. \end{aligned}$$

Part (c) should read: What happens when λ is a nonnegative integer?

Page 148, Exercise 4.26. Replace $e^{x/2}$ by $e^{-x/2}$.

Page 167, Exercise 5.15, second line should read: ... that, for all $n = 2, 3, 4, ...$,

Page 170, Exercise 5.24 should read: Prove that $I_\nu(x) \neq 0$ for any $x > 0$, $\nu > -1$, and that ...

Page 173, Exercise 5.26. In the fourth line replace $J_n^{(k)}$ by $J_n^{(k)}(x)$.

Page 192, Exercise 6.6. In the fourth line replace $\xi > a$ by $\xi \geq a$.

Page 239, lines 1 and 2 should read: if either f or g is (piecewise) continuous, and (piecewise) smooth if either function is (piecewise) smooth and the other is (piecewise) continuous (Exercise 7.16).

Page 241, Exercise 7.8. Part (f) should read: $y' + 2y = x[H(x) - H(x-1)]$, $y(0) = 0$. Part (g) should read:

$$y' + y = \begin{cases} \sin x, & 0 < x < \pi \\ -2\sin x, & x > \pi \end{cases}, \quad y(0) = 0.$$

Exercise 7.9. Part (d): Replace $\cot^{-1}(s+1)$ by $\operatorname{arccot}(s+1)$. Exercise 7.10: Delete equation in fourth line, and replace $\tan^{-1}$ by arctan in fifth line.

Page 242, Exercise 7.16. Parts (a) and (b) should be replaced by:
(a) $f * g$ is continuous if either f or g is continuous.
(b) $f * g$ is smooth if either f or g is smooth and the other is continuous.
(c) What can be said about $f * g$ if the continuity and smoothness conditions in (a) and (b) are piecewise?

Page 245. Replace solution 1.4 by: Assume that $\{x_1, \cdots, x_n\}$ and $\{y_1, \cdots, y_m\}$ are bases of the same vector space with $n \neq m$ and show that this leads to a contradiction. If $m > n$, express each y_i, $0 \leq i \leq n$, as a linear combination of $x_1, \cdots, x_n$. The resulting system of n linear equations can be solved uniquely for each x_i, $0 \leq i \leq n$, as a linear combination of y_i, $0 \leq i \leq n$ (why?). Since each vector $y_{n+1}, ..., y_m$ is also a linear combination of $x_1, \cdots, x_n$ (and hence of $y_1, \cdots, y_n$), this contradicts the linear independence of $\{y_1, \cdots, y_m\}$. Similarly, If $m < n$ then $\{x_1, ..., x_n\}$ is linearly dependent. Hence $m = n$.

Page 246, Exercise 1.42, part (b): Replace $x \neq -1$ by $(-1, 1)$.

Page 247. Exercise 2.3: replace $|x| < 1$ by $x \in \mathbb{R}$. Exercise 2.13: replace $\mathbb{Z}$ by $\mathbb{N}_0$. Exercise 2.17, part (a) should read: (a) $e^{\pm\sqrt{\lambda}x}$ when $\lambda \in \mathbb{C}\backslash\{0\}$ and $\{1, x\}$ when $\lambda = 0$. Exercise 2.21: replace the dot after e^{2x} by a comma.
Page 248, Exercise 3.15, part (a): Replace $(-1)^{n+1}$ by $(-1)^n$.

Page 251, Exercise 4.23: Replace ∞ by n.

Page 254, Exercise 5.41: Close the square bracket $[\cdots]$.

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