ERRATA

for

Principles of Fourier Analysis

(August 1, 2013)

Notes:

text from the book is printed using this font (Times Roman)
Comments are printed using this font (Univers Condensed)
text to be added is underlined and in italics *like this*
text to be deleted has been "struck out" ~~like this~~
★ indicates a new addition to the list

(And, of course, beware of possible typos in this list of typos.)

ERRORS

Chapter 2 (Basic Terminology, Notation, and Conventions), page 8, displayed summation in the lower middle of the page: Replace $\sin(n\pi x)$ with $\sin(k\pi x)$.

Chapter 2 (Basic Terminology, Notation, and Conventions), page 11, line 6: rapid changes during ~~a~~ very brief periods .

Chapter 3 (Basic Analysis I: Continuity and Smoothness), page 21, line 18: by the ... cho~~o~~sen ...

Chapter 3 (Basic Analysis I: Continuity and Smoothness), page 25, 8th line after ***Higher Order Smoothness***: Replace $f^{(k-1)}$ with $f^{(k-2)}$.

Chapter 3 (Basic Analysis I: Continuity and Smoothness), page 26*, line 4 from bottom*: Sketch the graphs of $f(x)$ and ~~s~~ $f(x-\gamma)$ ...

Chapter 3 (Basic Analysis I: Continuity and Smoothness), page 27, 2nd line in paragraph 3: Replace $(\alpha-\gamma, \beta-\gamma)$ with $(\alpha+\gamma, \beta+\gamma)$.

Chapter 3 (Basic Analysis I: Continuity and Smoothness), page 28, first line: ~~As long as~~ *If* .

Chapter 3 (Basic Analysis I: Continuity and Smoothness), page 30, line 5: Replace B with $|B|$.

Chapter 3 (Basic Analysis I: Continuity and Smoothness), page 35, line 12:

Replace $\left[f(\delta_n) + \frac{1}{n} - f(\delta_n) - \frac{1}{n} \right]$

with $\left[f(\delta_n) + \frac{1}{n} - \left(f(\delta_n) - \frac{1}{n} \right) \right]$

Chapter 6 (Elementary Complex Analysis), page 66, displayed equation (6.21): Replace x_0 with z_0 .

Chapter 7 (Functions of Several Variables), page 88, line 6 in ***Exercise 7.6***: ~~Then~~ *Show that*

Chapter 8 (Heuristic Derivation of ...), page 99, bottom line:

Replace $g_k(t) = f_{k+1}(t) - f_k(t)$
with $g_k(t) = f_k(t) - f_{k-1}(t)$

Chapter 10 (... Sine and Cosine Series), page 124, bottom line, and page 125, line 4:

Replace $2\left(\frac{2}{k\pi}\right)^3\left[(-1)^k - 1\right] - \frac{2}{k\pi}$
with $2\left(\frac{2}{k\pi}\right)^3\left[(-1)^k - 1\right] - (-1)^k\frac{8}{k\pi}$

Chapter 10 (... Sine and Cosine Series), page 126, lines 5 and 9: Replace $\frac{16}{k\pi^2}$ with $\frac{16}{k^2\pi^2}$.

*Chapter 10 (... Sine and Cosine Series), page 128, line 2 and 3 in problem **10.7b***: $N = \cancel{0,}\ 1$

Chapter 11 (Inner Products, Norms, and Orthogonality), page 131, line 2:

Replace $= a^* \langle f \,|\, h \rangle + b^* \langle g \,|\, h \rangle$
with $= a^* \langle f \,|\, g \rangle + b^* \langle f \,|\, h \rangle$.

*Chapter 11 (Inner Products, Norms, and Orthogonality), page 134, text line 2 in **11.4***: is some orthogonal set of <u>*nonzero*</u> functions …

Chapter 11 (Inner Products, Norms, and Orthogonality), page 135, line 1: Let … be an orthogonal set of <u>*nonzero*</u> functions …

Chapter 11 (Inner Products, Norms, and Orthogonality), page 140, lines 4, 6, 9 and 13: First, replace every $\frac{p^2}{4}$ with $\frac{p}{2}$, then replace every remaining p^2 with p.

Chapter 12 (Complex Exponential Fourier Series), page 144, displayed equation (12.4): In the exponential in the last summation, replace ω_n with ω_k .

Chapter 12 (Complex Exponential Fourier Series), page 148, line 12: "Summing ... inte~~r~~ger N

Chapter 13 (Convergence and Fourier's Conjecture), page 154, 2nd line from bottom: In the first summation, replace $k = N$ with $k = -N$.

Chapter 13 (Convergence and Fourier's Conjecture), page 156, 2nd and 4th displayed equations from the bottom: Replace each $\lim_{t \to 0^{\pm}}$ with $\lim_{\tau \to 0^{\pm}}$.

Chapter 13 (Convergence and Fourier's Conjecture), page 167, line before equation (13.10): Recalling the ... equations (13.8) and ~~(13.8)~~ <u>*(13.9)*</u> are...

Chapter 13 (Convergence and Fourier's Conjecture), page 169, end of the displayed equalities at the bottom of the page: Replace $\le \|f\|\|g\|$ with $\le \frac{1}{p}\|f\|\|g\|$.

Chapter 13 (Convergence and Fourier's Conjecture), page 173, ***Exercises 13.6 e, f,*** *and* ***g:*** In the formulas for $h(t)$, $k(t)$, and $l(t)$, replace $f(t-4)$, $f(t-2)$, and $f(t-2)$ with $h(t-4)$, $k(t-2)$, and $l(t-2)$, respectively.

Chapter 13 (Convergence and Fourier's Conjecture), page 175, problem ***13.15****, equation (13.16b)*: Replace $\sum_{N=-\infty}^{\infty}$ with $\sum_{n=-\infty}^{\infty}$.

Chapter 14 (Convergence ...: The Proofs), page 177, sentence just after ***14.1 Basic Theorem ...***: Our ... same as theorem 13.1 on page ~~13.1~~ *154*).

Chapter 14 (Convergence ...: The Proofs), page 183, 2nd displayed equation: Replace $-i\sin\left(\frac{2\pi}{p}x\right)$ with $+i\sin\left(\frac{2\pi}{p}x\right)$.

Chapter 14 (Convergence ...: The Proofs), page 186, 3rd displayed equation: Replace $\frac{-x\cos(x)}{2\cos(x)}$ with $\frac{x}{2\cos(x)}$.

Chapter 15 (Derivatives and Integrals of Fourier Series), page 209, last line (displayed equation) in ***Theorem 15.13***: In the last summation, replace b_k with a_k.

Chapter 16 (Applications), page 215, last line of text: each of ... This gives us *a* bunch of ...

Chapter 16 (Applications), page 223, 2nd line from bottom: Multiply both integrals by 2 (the following line, however, is correct).

Chapter 16 (Applications), page 227,displayed formulas at top: Delete the π from the formula for ν_k.

Chapter 16 (Applications), page 241 ***Exercise 16.11,*** *line 4:* Replace the second $\left.\frac{\partial u}{\partial x}\right|_{(0,t)}$ with $\left.\frac{\partial u}{\partial x}\right|_{(L,t)}$.

Chapter 17 (Derivation of the Fourier Transform), page 246, formula (17.1): Replace $\Delta x \to 0$ with $\Delta x \to 0^+$.

Chapter 18 (Integrals on Infinite Intervals), page 271, displayed formula in problem 16: Replace $k\,\mathrm{rect}_{(k,k^{-2})}(x)$ with $2^k \mathrm{rect}_{(0,2^{-2k})}(x-k)$.

Chapter 19 (The Fourier Integral Transforms), page 276, last displayed equation in ***Exercise 19.3****:* Replace $\mathcal{F}$ with $\mathcal{F}_I$.

Chapter 19 (The Fourier Integral Transforms), page 276, end of last displayed equation on the page: Replace $= \mathcal{F}_I[\phi(y)]|_{-x}$ with $= \mathcal{F}_I[\phi(y)]|_x$.

Chapter 19 (The Fourier Integral Transforms), page 289, displayed equation in ***19.16b****:* Replace $\cdots = 2i\int_0^\infty \cdots$ with $\cdots = -2i\int_0^\infty \cdots$.

Chapter 19 (The Fourier Integral Transforms), page 281, line 7 from top: Delete the extra i in the exponent of the last integral.

Chapter 19 (The Fourier Integral Transforms), page 283, line 2 in ***Exercise 19.10****:* form (or ...) of a<u>n</u> absolutely ...

Chapter 21 (Elementary Identities), page 325, first displayed equation after ***Some Related Symmetries***: In the integral, replace dx with dy .

Chapter 21 (Elementary Identities), page 325–326, the displayed equations ***Some Related Symmetries***: Change the sign ($+$ or $-$) before each $\sin(2\pi xy)$.

Chapter 21 (Elementary Identities), page 328, third line in problem ***21.13***: Replace $\alpha > o$ with $\alpha > 0$.

Chapter 21 (Elementary Identities), page 328, last line in problem ***21.16 b***: Replace $\alpha = 2i$ with $\gamma = 2i$.

Chapter 22 (Differentiation), page 348, problem 5h: Replace $\mathcal{F}$ with $\mathcal{F}^{-1}$.

Chapter 22 (Differentiation), page 349, problem 7a: Taking <u>*the*</u> Fourier transform ....

Chapter 23 (Gaussian Functions), page 356, midpage, statement #2: The translation of $g(x)$ by any complex number ~~number~~ a , ...

Chapter 23 (Gaussian Functions), page 363, line 8: The line should be

$$\mathrm{Im}[I_1] \;=\; -\sqrt{\frac{\pi}{|\lambda|}}\,\sin\Big(\frac{1}{2}\theta\Big) \quad \text{and} \qquad \mathrm{Im}[I_2] \;=\; \sqrt{\frac{\pi}{|\lambda|}}\,\sin\Big(\frac{1}{2}\theta\Big) \quad .$$

Chapter 24 (Convolutions), page 375, line 2 after Alternate Definitions: often define convolution by ~~as~~

Chapter 24 (Convolutions), page 375, 2nd to last line in Alternate Definitions: may depend ... using the ~~the~~ Laplace ... transform

Chapter 25 (Correlation, ...), page 399, line 3 (displayed eqn): Replace this line with:

$$f\bigstar\eta(t) \;=\; \int_{-\infty}^{\infty} f^*(s)\,\eta(s+t)\,ds \;=\; \alpha\,\eta_0$$

Chapter 25 (Correlation, ...), page 399, line 5 (displayed eqn): Replace this line with:

$$\alpha \;=\; \int_{-\infty}^{\infty} f^*(s)\,ds \quad .$$

Chapter 25 (Correlation, ...), page 399, lines 11 and 12 (displayed eqns): In the integrals, replace each g with f .

Chapter 25 (Correlation, ...), page 399, lines 14 (displayed eqn): The last term should be $\alpha\,\eta_0$, not $2\alpha\,\eta_0$.

Chapter 25 (Correlation, ...), page 400, 2nd and 3rd line after ***Exercise 25.4***: In each line, replace $|\mathbf{u}|\,|\mathbf{v}|$ with $\|\mathbf{u}\|\,\|\mathbf{v}\|$.

Chapter 25 (Correlation, ...), page 401, displayed equation (25.9): Replace $\left|\int_{-\infty}^{\infty} f(x)g(x)\,dx\right|$ with $\left|\int_{-\infty}^{\infty} f(x)g^*(x)\,dx\right|$.

Chapter 26 (Identity Sequences), page 421, ***Figure 26.1***: In the figure, replace $\epsilon = 1,\ \epsilon = 2,$ and $\epsilon = 4$ with $\epsilon = \frac{1}{2},\ \epsilon = \frac{1}{4},$ and $\epsilon = \frac{1}{8}$, respectively.

Chapter 27 (Generalizing the Classical Theory), page 438, ***Figure 27.1***: In the figure, replace $\epsilon = 1,$ $\epsilon = 2,$ and $\epsilon = 4$ with $\epsilon = \frac{1}{2},\ \epsilon = \frac{1}{4},$ and $\epsilon = \frac{1}{8}$, respectively.

Chapter 28 (Systems), page 468, line 9 from bottom: Observe ... can be viewed as ~~as~~ a system with

Chapter 28 (Systems), page 469, 1st line in section ***28.2***: As noted, ... of a LSI system~~s~~ to be ...

Chapter 28 (Systems), page 473, 2nd line from bottom in the displayed equation: In the integral, replace the $\text{step}(t)$ with $\text{step}(s)$.

Chapter 30 (A Starting Point for the Generalized Theory), page 500, last displayed equation: In the exponential, replace x_0 with x .

Chapter 31 (Gaussian Test Functions), page 513, line 17 (displayed eqn): Replace $e^{-(x-\xi)^2}$ with $e^{-\gamma(x-\zeta)^2}$.

Chapter 31 (Gaussian Test Functions), page 516, line 14 (displayed eqn): Replace $(f^*)^*$ with $(f^*)^* = f$

Chapter 32 (Generalized Functions), page 552, ***Exercise 23 g, h and i***: Replace x with $|x|$ under the square roots.

Chapter 33 (Sequences and Series ...), page 572, line 8 in problem ***33.8*** *(displayed eqn)*: Replace the lower limit $k = M$ with $k = -M$

Chapter 33 (Sequences and Series ...), page 573, line 4 in problem ***33.10 a*** *(displayed eqn)*: Replace the lower limit $ky = -\infty$ with $k = -\infty$.

Chapter 33 (Sequences and Series ...), page 573, problem ***33.10 b iii***: Replace g with h .

Chapter 34 (Basic Transform, ...), page 578, ***Example 34.4****, last line*: Replace $\mathcal{F}^{-1}$ with $\mathcal{F}$.

Chapter 35 (Generalized Products, ... Integrals), page 623, ***Example 35.3****, 2nd line in equation (35.1)*: Replace the first $\text{sinc}(\pi k)\,\delta_k(x)$ with $\text{sinc}(\pi x)\,\delta_k(x)$.

Chapter 35 (Generalized Products, ... Integrals), page 623, ***Example 35.3****, 2nd displayed equation from the bottom*: Delete the first $\text{sinc}(\pi k) =$.

Chapter 35 (Generalized Products, ... Integrals), page 634, 1st displayed pair of equations on the page: In the 2nd equation, replace $\lim_{\epsilon \to \infty}$ with $\lim_{\gamma \to \infty}$.

Chapter 37 (Solving Simple Equations), page 679: Add period to footnote.

Chapter 36 (Periodic Functions and Regular Arrays), page 640, line 8 from bottom: ing that ~~that~~ it does, ...

Chapter 38 (Periodic Functions and Regular Arrays), page 649, 1st displayed formula after ***A Possible Difficulty ...***: The exponential in the integral should be $e^{-i2\pi\omega_k t}$.

*Chapter 36 (Periodic Functions and Regular Arrays), page 659, first displayed equation in **Exercise 36.9***: Replace $\left\langle\, f(x-p)\,,\,\phi(x)\,\right\rangle$ with $\left\langle\, f(x-p)\,,\,\phi(x)\,\right\rangle = \left\langle\, f(x)\,,\,\phi(x)\,\right\rangle$.

Chapter 39 (Sampling ... Discrete Fourier Transform), page 712, 4th displayed equation (the one for f_3): Replace $-$ with $=$.

Chapter 39 (Sampling ... Discrete Fourier Transform), page 715, 1st displayed equation: Replace f_{k+N} with $\widehat{f}_{\,k+N}$.

Chapter 39 (Sampling ... Discrete Fourier Transform), page 726, equations (39.18) and (39.19: Add the obviously missing "1" to $n = 0,\ 2,\ 3,\ \ldots$ and $k = 0,\ 2,\ 3,\ \ldots$.

Chapter 39 (Sampling ... Discrete Fourier Transform), page 733, 1st displayed equation, equation (39.22): Replace $n = 0,\ \pm 1,\ \ldots$ with $k = 0,\ \pm 1,\ \ldots$.

Chapter 39 (Sampling ... Discrete Fourier Transform), page 735, 3rd displayed equation: That formula for correlation should be $\dfrac{1}{\sqrt{N}}\displaystyle\sum_{j=0}^{N-1} x^*_{j-k}\,y_j$.

Chapter 39 (Sampling ... Discrete Fourier Transform), page 737, 3rd and 2nd displayed equations from the bottom: In the equation for u_{M-1} replace u_{2N-2} with v_{2M-2} , and in the equation for w_{M-1} replace u_{2N-1} with v_{2M-1} .

Chapter 39 (Sampling ... Discrete Fourier Transform), page 739, 1st displayed equation: The terms are missing in the middle summation. They should be $e^{-i\frac{2\pi}{M}nj}v_{3j+1}$.

Chapter 39 (Sampling ... Discrete Fourier Transform), page 739, line right after the formula for V_0: which only requires ~~$N+1$~~ $\underline{N-1}$ "adds" ... .

Chapter 39 (Sampling ... Discrete Fourier Transform), page 740, footnote: numbers we derive ... will give ~~a~~ slightly inflated measures ... .

Chapter 39 (Sampling ... Discrete Fourier Transform), page 744, 4th displayed equation (the one just after Thus, for $N > 4,$): This should be identified as "equation" (39.33), so add (39.33) to the far righthand side.

Chapter 39 (Sampling ... Discrete Fourier Transform), page 747, last line: of K to get $\underline{a}$ discrete transform~~s~~ that requires ... .

*Chapter 39 (Sampling ... Discrete Fourier Transform), page 748, last line in exercise **39.34b***: which we ... inequality ~~(39.6)~~ *(39.33)*.

ANSWERS, page 760, answers to problems 6e and 7b of chapter 9: Replace $\dfrac{4}{k^2\pi^k}$ with $\dfrac{4}{k^2\pi^2}$.

ANSWERS, page 761, answer to problem 6e of chapter 13: Answer should be: $1\,,\ 1,\ 0\,,\ -1\,,\ -1$.

ANSWERS, page 761, answer to problem 6c of chapter 15: Answer should be:

$$\sum_{\substack{k=-\infty\\ k\neq 0}}^{\infty} \frac{i}{k\pi}\left[(-1)^k\ -\ 1\right]e^{ik\pi t}$$

ANSWERS, page 761, answer to problem 6d of chapter 15: Answer should be:

$$\text{oddsaw}' \;=\; 1\,,\;\; FS[\text{oddsaw}'] \;=\; 1$$

ANSWERS, page 762, answers to problems 14a of chapter 16: It shourld be

$$\sum_{k=1}^{\infty}[A_k\cos(\nu_k t) \;+\; B_k\sin(\nu_k t)]\,e^{-\beta t}\sin\left(\frac{k\pi}{L}x\right)$$

where the A_k's and B_k's are arbitrary constants and $\nu_k \;=\; \frac{1}{L}\sqrt{(kc\pi)^2 \;-\; (\beta L)^2}$.

ANSWERS, page 763, answer to problem 11o of chapter 21: Answer should be

$$\frac{1}{2}\left[(3+i2\pi(\omega+1))^{-1} \;+\; (3+i2\pi(\omega-1))^{-1}\right]$$

ANSWERS, page 763, answer to problem 13c of chapter 21: Answer should be

$$\frac{2\pi}{3}e^{(1+3i)8\pi(\omega-3)/3}\text{step}(3-\omega)$$

ANSWERS, page 763, answer to problem 4i of chapter 22: Answer should be

$$\frac{1}{2}\pi^{-3}\omega^{-3}\Big[\big(2\,\pi^2\omega^2-1\big)\sin(2\pi\omega) \;+\; 2\pi\omega\cos(2\pi\omega)\Big]$$

ANSWERS, page 764, answer to problem 8i of chapter 23: Replace $\left[1-\frac{2\pi^2}{\gamma}\,\omega\right]$ with $\left[1-\frac{2\pi^2}{\gamma}\,\omega^2\right]$.

ANSWERS, page 764, answer to problem 15aii of chapter 24: Replace all ω's with x's .

ANSWERS, page 765, answer to problem 20a of chapter 24: Answer should be

$$\frac{1}{4}\Big[e^{4(t-1)} - e^{4(t+1)}\Big]\text{step}(-1-t) \;+\; \frac{1}{4}\Big[e^{4(t-1)} - 1\Big]\text{pulse}_1(t)$$

ANSWERS, page 769, answer to problems 33 of chapter 39: Answer should be: $3N^2$ (includes index arithmetic) .

ANSWERS, page 769, answer to problems 34b of chapter 39: Answer should be: $9N\log_2 N \;+\; N$.