Errata for *Introduction to Statistical Signal Processing*
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Thanks to Ian Lee, Michael Gutmann, Frédéric Vrins, André Isidio de Melo, Philippe Bonnet, and to the champion typo finder, Ron Aloysius.

p. 49: The summations in (2.42)-(2.43) should run from $k = 0$ to $n - 1$, not from $k = 1$ to n as stated because the pmf is uniform on $\{0, 1, \ldots, n-1\}$ and not on $\{1, 2, \ldots, n\}$. As a result the sum in (2.42) should evaluate to $(n - 1)/2$ and not $(n + 1)/2$ and the sum in (2.43) should evaluate to $(2n - 1)(n - 1)/6$ and not $(n + 1)(2n + 1)/6$.

p. 51: Eq. (2.49) should be

$$m^{(2)} = \sum_{k=1}^{\infty} k^2 p(1-p)^{k-1} = p\left(\frac{2}{p^3} - \frac{1}{p^2}\right)$$

and not

$$m^{(2)} = \sum_{k=1}^{\infty} k^2 p(1-p)^{k-1} = p\left(\frac{2}{p^3} + \frac{1}{p^2}\right)$$

Eq. (2.50) should be

$$\sigma^2 = \frac{1-p}{p^2}$$

and not

$$\sigma^2 = \frac{2}{p^2}$$

p. 61: In (2.68) m should be $m^{(2)}$.

(2.74) is missing a π, it should be

$$\int_{-\infty}^{\infty} \frac{1}{\sqrt{2\pi\sigma^2}} e^{-(x-m)^2/2\sigma^2}\, dx = 1$$

and not

$$\int_{-\infty}^{\infty} \frac{1}{\sqrt{2\sigma^2}} e^{-(x-m)^2/2\sigma^2}\, dx = 1$$

p. 62 As on the previous page πs are missing. (2.75) should be

$$\int_{-\infty}^{\infty} \frac{1}{\sqrt{2\pi\sigma^2}} x e^{-(x-m)^2/2\sigma^2}\, dx = m$$

and not

$$\int_{-\infty}^{\infty} \frac{1}{\sqrt{2\sigma^2}} x e^{-(x-m)^2/2\sigma^2}\, dx = m$$

and (2.76) should be

$$\int_{-\infty}^{\infty} \frac{1}{\sqrt{2\pi\sigma^2}} (x-m)^2 e^{-(x-m)^2/2\sigma^2}\, dx = \sigma^2$$

and not

$$\int_{-\infty}^{\infty} \frac{1}{\sqrt{2\sigma^2}} (x-m)^2 e^{-(x-m)^2/2\sigma^2}\, dx = \sigma^2$$

p. 63 Second line of (2.82):

$$\int_{-\infty}^{(\alpha-m)/\sigma} \frac{1}{\sqrt{2\pi}} e^{-u^2/2}\, dx$$

should be

$$\int_{-\infty}^{(\alpha-m)/\sigma} \frac{1}{\sqrt{2\pi}} e^{-u^2/2}\, du$$

(the differential should be du)

p. 68: $E(g) = \lambda \sum_{x\in F} g(x)p(x) + (1-\lambda) \int_{x\in F} g(x)f(x)\, dx$ should be $E(g) = \lambda \sum_{x\in \Omega} g(x)p(x) + (1-\lambda) \int_{x\in \Omega} g(x)f(x)\, dx$

p. 75. In Problem 14 the comment "In words: if the probability of the symmetric difference of two events is small, then the two events must have approximately the same probability." belongs with Problem 2.15, not with 2.13.

p. 94 In caption of Figure 3.1 $\Pr(f \in F) = P(\{\omega : \omega \in F\}) = P(f^{-1}(F))$ should be $\Pr(f \in F) = P(\{\omega : f(\omega) \in F\}) = P(f^{-1}(F))$

p. 125:

$$P(X^{-1}(F_1) \cap Y^{-1}(F_2) = P(X^{-1}(F_1)) \cap Y^{-1}(F_2)).$$

should be

$$P(X^{-1}(F_1) \cap Y^{-1}(F_2) = P(X^{-1}(F_1))P(Y^{-1}(F_2)).$$

p. 131 Eq. (3.55) should be

$$\Lambda = \begin{bmatrix} \sigma_X^2 & \rho\sigma_X\sigma_Y \\ \rho\sigma_X\sigma_Y & \sigma_Y^2 \end{bmatrix},$$

not

$$\Lambda = \begin{bmatrix} \sigma_X^2 & \rho\sigma_X\sigma_Y \\ \rho\sigma_X\sigma_Y & \sigma_Y \end{bmatrix}$$

The second line of (3.58) should be

$$\frac{1}{2\pi\sqrt{\det\Lambda}} e^{-\frac{1}{2}(x-m_X,y-m_Y)\Lambda^{-1}(x-m_X,y-m_Y)^t}$$

and not

$$\frac{1}{\sqrt{2\pi\det\Lambda}} e^{-\frac{1}{2}(x-m_X,y-m_Y)\Lambda^{-1}(x-m_X,y-m_Y)^t}$$

p. 132 Second line, the mean should be $m_{Y|X} \triangleq m_Y + \rho(\sigma_Y/\sigma_X)(x - m_X)$ and not $m_{Y|X} \triangleq y - m_Y + \rho(\sigma_Y/\sigma_X)(x - m_X)$

The final line of (3.62) should be

$$f_{X_0}(x_0) \prod_{l=1}^{n-1} f_{X_l|X_0,\ldots,X_{l-1}}(x_l|x_0,\ldots,x_{l-1})$$

and not

$$f_{X_0}(x_0) \prod_{l=1}^{k-1} f_{X_l|X_0,\ldots,X_{l-1}}(x_l|x_0,\ldots,x_{l-1})$$

(The upper limit of the sum should be n not k)

p. 144 Eq. (3.99) should be

$$P_e = \frac{1}{2}\left(1 - \Phi\left(\frac{0.5}{\sigma_W}\right) + \Phi\left(-\frac{0.5}{\sigma_W}\right)\right) = \Phi\left(-\frac{1}{2\sigma_W}\right).$$

and not

$$P_e = \frac{1}{2}\left(1 - \Phi\left((\frac{0.5}{\sigma_W}\right) + \Phi\left(-\frac{0.5}{\sigma_W}\right)\right) = \Phi\left(\frac{1}{2\sigma_W}\right).$$

(remove extra left paren and add minus sign).

p. 145 Just above Section 3.12, $f_{X|Y}(x|y) = f_{Y|X}(y|x)f_Y(y)/f_X(x)$ should be $f_{X|Y}(x|y) = f_{Y|X}(y|x)f_X(x)/f_Y(y)$

p. 138, equation above (3.82):

$$\exp\left(-\frac{1}{2}(\frac{\alpha-m}{\sigma^2})^2\right).$$

should be

$$\exp\left(-\frac{1}{2}(\frac{\alpha-m}{\sigma})^2\right).$$

p. 149 In line equation following (3.115) should be $M_X(ju) = \mathcal{F}_{-u/2\pi}(f_X) = \mathcal{L}_{-ju}(f_X)$, that is, the subscript of $\mathcal{L}$ needs a minus sign.

p. 150 Penultimate line of (3.120) should be

$$\left\{\int_{-\infty}^{\infty}\frac{1}{(2\pi\sigma^2)^{1/2}}e^{-(x-(m+ju\sigma^2))^2/2\sigma^2}\,dx\right\}e^{jum-u^2\sigma^2/2}$$

and not

$$\left\{\int_{-\infty}^{\infty}\frac{1}{(2\pi\sigma^2)^{1/2}}e^{-(x-(m+ju\sigma^2))^2/2\sigma^2}\,dx\right\}e^{jum-y^2\sigma^2/2}$$

(the y^2 should be u^2

p. 162 Eq. (3.139)

$$\begin{aligned}&p_{Y_n|Y_{n-1},\ldots,Y_1}(y_n|y_{n-1},\ldots,y_1)\\ &\quad= \Pr(Y_n = y_n|Y_l = y_l; l = 1,\ldots,y_{n-1})\\ &\quad= \Pr(X_n = y_n - y_{n-1}|Y_l = y_l; l = 1,\ldots,y_{n-1})\\ &\quad= \Pr(X_n = y_n - y_{n-1}|X_1 = y_1, X_i = y_i - y_{i-1};\ i = 2,3,\ldots,n-1),\end{aligned}$$

should read

$$\begin{aligned}&p_{Y_n|Y_{n-1},\ldots,Y_1}(y_n|y_{n-1},\ldots,y_1)\\ &\quad= \Pr(Y_n = y_n|Y_l = y_l; l = 1,\ldots,y_{n-1})\\ &\quad= \Pr(X_n = y_n - y_{n-1}|Y_l = y_l; l = 1,\ldots,n-1)\\ &\quad= \Pr(X_n = y_n - y_{n-1}|X_1 = y_1, X_i = y_i - y_{i-1};\ i = 2,3,\ldots,n-1),\end{aligned}$$

that is, the final index in the penultimate line is $n-1$ and not y_{n-1}.

p. 165 The sentence "The discrete time, continuous alphabet case of summing iid random variables is handled in virtually the same manner as the discrete time case, with conditional pdfs replacing conditional pmfs."

should read

"The discrete time, continuous alphabet case of summing iid random variables is handled in virtually the same manner as the discrete time, discrete alphabet case, with conditional pdfs replacing conditional pmfs."

Eq. (3.149)

$$f_{Y_1,\ldots,Y_n}(y_1,\ldots,y_n) = \prod_{l=1}^{k-1} f_{Y_l|Y_1,\ldots,Y_{l-1}}(y_l|y_1,\ldots,y_{l-1}).$$

should read

$$f_{Y_1,\ldots,Y_n}(y_1,\ldots,y_n) = \prod_{l=1}^{n} f_{Y_l|Y_1,\ldots,Y_{l-1}}(y_l|y_1,\ldots,y_{l-1}).$$

That is, the upper limit of the product should be n.

Eq. (3.152)

$$f_{Y_1,\ldots,Y_n}(y_1,\ldots,y_{n-1}) = \prod_{i=1}^{n} f_X(y_i - y_{i-1})$$

should read

$$f_{Y_1,\ldots,Y_n}(y_1,\ldots,y_n) = \prod_{i=1}^{n} f_X(y_i - y_{i-1})$$

that is, the final index on the left is n, not $n-1$.

p. 168 Problem 1:

$X(r) = |r|^2$ should be $X(r) = r^2$

$Y(r) = r^{1/2}$ should be $Y(r) = |r|^{1/2}$

p. 176, problem 43, last line. B_t should be β_t.

p. 184 Eighth line following (4.1), $r_n^{(n)}$ should be $r_a^{(n)}$.

p. 185 Eq. (4.4)

$$E(X) = \sum_{x\in A} a p_X(x)$$

should be

$$E(X) = \sum_{x\in A} x p_X(x)$$

p. 208 Note that if we take $g(x) = x$ and $h(x,y) = 1$, this general form reduces to the previous form.

should be

Note that if we take $g(x) = 1$ and $h(x, y) = y$, this general form reduces to the previous form.

p. 210:

$$
\begin{aligned}
f_{Y|X}(y|x) &= \frac{f_{XY}(x,y)}{f_Y(y)} \\
&= \frac{\exp\left(-(1/2)((x-m_X)^t \ (y-m_Y)^t)K_U^{-1}\begin{pmatrix} x-m_X \\ y-m_Y \end{pmatrix}\right)}{\sqrt{(2\pi)^{(k+m)}\det K_U}} \\
&\quad \times \frac{\sqrt{(2\pi)^k \det K_X}}{\exp\left(-(x-m_X)^t K_X^{-1}(x-m_X)/2\right)} \\
&= \frac{1}{\sqrt{(2\pi)^m \det K_X / \det K_U}} \\
&\quad \times \exp\left(-(1/2)((x-m_X)^t \ (y-m_Y)^t)K_U^{-1}\begin{pmatrix} x-m_X \\ y-m_Y \end{pmatrix}\right. \\
&\qquad \left. + (x-m_X)^t K_X^{-1}(x-m_X)\right)
\end{aligned}
$$

should be

$$
\begin{aligned}
f_{Y|X}(y|x) &= \frac{f_{XY}(x,y)}{f_X(x)} \\
&= \frac{\exp\left(-(1/2)((x-m_X)^t \ (y-m_Y)^t)K_U^{-1}\begin{pmatrix} x-m_X \\ y-m_Y \end{pmatrix}\right)}{\sqrt{(2\pi)^{(k+m)}\det K_U}} \\
&\quad \times \frac{\sqrt{(2\pi)^k \det K_X}}{\exp\left(-(x-m_X)^t K_X^{-1}(x-m_X)/2\right)} \\
&= \frac{1}{\sqrt{(2\pi)^m \det K_U / \det K_X}} \\
&\quad \times \exp\left(-(1/2)((x-m_X)^t \ (y-m_Y)^t)K_U^{-1}\begin{pmatrix} x-m_X \\ y-m_Y \end{pmatrix}\right. \\
&\qquad \left. + (1/2)(x-m_X)^t K_X^{-1}(x-m_X)\right)
\end{aligned}
$$

Last line: $N = k$ should be $N = n$.

p. 213 In the first displayed equation following "A direct proof of this result,"

$$\begin{aligned} E[(Y - g(X))^2] &= E[(Y - E(Y|X) + E(Y|X) - g(X))^2] \\ &= E[(Y - E(Y|X))^2] \\ &\quad -2E[(Y - E(Y|X))(E(Y|X) - g(X))] \\ &\quad +E[(E(Y|X) - g(X))^2]. \end{aligned}$$

should be

$$\begin{aligned} E[(Y - g(X))^2] &= E[(Y - E(Y|X) + E(Y|X) - g(X))^2] \\ &= E[(Y - E(Y|X))^2] \\ &\quad +2E[(Y - E(Y|X))(E(Y|X) - g(X))] \\ &\quad +E[(E(Y|X) - g(X))^2]. \end{aligned}$$

that is, the sign in front of the 2 on the penultimate line should be positive.

p. 215 Second line from the bottom of the page, $K_{(X,Y)} = E[((X^t, Y^t) - (m_X^t - m_Y^t))^t((X^t, Y^t) - (m_X^t - m_Y^t))]$ should be $K_{(X,Y)} = E[((X^t, Y^t) - (m_X^t, m_Y^t))^t((X^t, Y^t) - (m_X^t, m_Y^t))]$, that is, the minus signs separating the means should be commas.

p. 216 Top line, $K_{YX} = E[(Y - m_Y)(Y - m_Y)^t]$ should be $K_{YX} = E[(Y - m_Y)(X - m_X)^t]$

p. 218, four lines above (2.64) and one line below (4.64) $b = E(Y) + AE(X)$ should be $b = E(Y) - AE(X)$

Eq. (4.64)

$$\begin{aligned} \mathrm{MSE}(A, b) &= \mathrm{Tr}\left((Y - AX - b)(Y - AX - b)^t\right) \\ &\geq \mathrm{Tr}(K_Y - K_{YX}K_X^{-1}K_{XY}) \end{aligned}$$

$$\begin{aligned} \mathrm{MSE}(A, b) &= E\left[\mathrm{Tr}\left((Y - AX - b)(Y - AX - b)^t\right)\right] \\ &\geq \mathrm{Tr}(K_Y - K_{YX}K_X^{-1}K_{XY}) \end{aligned}$$

p. 219 Top of the page.

$$\begin{aligned} \mathrm{MMSE}(A, b) &= \mathrm{Tr}\left((Y - AX - b)(Y - AX - b)^t\right) \\ &= \mathrm{Tr}\,((Y - m_Y + A(X - m_X) - b + m_Y + Am_X) \\ &\qquad \times (Y - m_Y + A(X - m_X) - b + m_Y + Am_X)^t\big) \\ &= \mathrm{Tr}\left(K_Y - AK_{XY} - K_{YX}A^t + AK_XA^t\right) \\ &\qquad + (b - m_Y - Am_X)^t(b - m_Y - Am_X) \end{aligned}$$

should be

$$\begin{aligned}\text{MMSE}(A,b) &= E\left[\text{Tr}\left((Y-AX-b)(Y-AX-b)^t\right)\right] \\ &= E\left[\text{Tr}\left((Y-m_Y-A(X-m_X)-b+m_Y-Am_X)\right.\right. \\ &\qquad \times \left.\left.(Y-m_Y-A(X-m_X)-b+m_Y-Am_X)^t\right)\right] \\ &= \text{Tr}\left(K_Y-AK_{XY}-K_{YX}A^t+AK_XA^t\right) \\ &\qquad +(b-m_Y+Am_X)^t(b-m_Y+Am_X)\end{aligned}$$

(4.65)

$$b = m_Y + Am_X.$$

should be

$$b = m_Y - Am_X.$$

In Theorem 4.6, $K_{YX} = E[(Y-m_Y)(Y-m_Y)^t]$ should be $K_{YX} = E[(Y-m_Y)(X-m_X)^t]$.

p. 220, first line, $b = E(Y) + AE(X)$ should be $b = E(Y) - AE(X)$

p. 242. In proof of Lemma 4.4, final equation on page:

$$\begin{aligned}&F_{Y_n}(y) - F_Y(y+\epsilon) \\ &\qquad = \Pr(Y \le y+\epsilon \text{ and } Y_n > y) - \Pr(Y_n \le y \text{ and } Y > y+\epsilon) \\ &\qquad \le \Pr(Y \le y+\epsilon \text{ and } Y_n > y) \\ &\qquad \le \Pr(|Y-Y_n| \ge \epsilon).\end{aligned}$$

should be

$$\begin{aligned}&F_{Y_n}(y) - F_Y(y+\epsilon) \\ &\qquad = \Pr(Y_n \le y \text{ and } Y > y+\epsilon) - \Pr(Y \le y+\epsilon \text{ and } Y_n > y) \\ &\qquad \le \Pr(Y_n \le y \text{ and } Y > y+\epsilon) \\ &\qquad \le \Pr(|Y-Y_n| \ge \epsilon).\end{aligned}$$

p. 261, Problem 19. This problem considers some useful properties of autocorrelation or covariance function.

should be

This problem considers some useful properties of autocorrelation or covariance functions for real-valued random processes.

$E(X_t^2 = R_X(t,t) = R_X(0,0)$ should be $E(X_t^2) = R_X(t,t) = R_X(0,0)$ (a right paren is missing)

p. 262, problem21:
Given two random processes $\{X_t;\, t \in \mathcal{T}\}$ and $\{X_t;\, t \in \mathcal{T}\}$
should read
Given two random processes $\{X_t;\, t \in \mathcal{T}\}$ and $\{Y_t;\, t \in \mathcal{T}\}$
p. 267, Problem 4.37, the upper case G_k should be lower case g_k.
p. 273, Problem 4.57(c), $E[X^n]$ should be $E[X^N]$.
p. 289, the $K_Y(k,j)$E should read

$$\sigma^2 r^{|k-j|}\frac{1-r^{2(\min(k,j)+1)}}{1-r^2}.$$

p. 300 In several formulas the index k should be n:

$$\mathcal{R}_X(k) =< X_n X^*_{n-k} >= \lim_{N\to\infty}\frac{1}{N}\sum_{k=0}^{N-1} X_n X^*_{n-k}$$

should be

$$\mathcal{R}_X(k) =< X_n X^*_{n-k} >= \lim_{N\to\infty}\frac{1}{N}\sum_{n=0}^{N-1} X_n X^*_{n-k}$$

$$\mathcal{R}_X(k) = \lim_{N\to\infty}\frac{1}{N}\sum_{k=0}^{N-1} X_n(\omega) X^*_{n-k}(\omega),$$

should be

$$\mathcal{R}_X(k) = \lim_{N\to\infty}\frac{1}{N}\sum_{n=0}^{N-1} X_n(\omega) X^*_{n-k}(\omega),$$

$$\mathcal{P}_X = \mathcal{R}_X(0) = \lim_{N\to\infty}\frac{1}{N}\sum_{k=0}^{N-1} |X_n|^2,$$

should be

$$\mathcal{P}_X = \mathcal{R}_X(0) = \lim_{N\to\infty}\frac{1}{N}\sum_{n=0}^{N-1} |X_n|^2,$$

p. 303, the last line in the top equation should read

$$\lim_{N\to\infty}\sum_{k=-(N-1)}^{N-1}(1-\frac{|k|}{N})R_X(k)e^{-i2\pi fk}$$

and not

$$\lim_{N\to\infty}\frac{1}{N}\sum_{k=-(N-1)}^{N-1}(1-\frac{|k|}{N})R_X(k)e^{-i2\pi fk}$$

that is, the extra $1/N$ should be removed.

p. 308 In Lemma 5.1, item 3, Eq. (5.6.2),

$$E(|X|)\le\|X\|.$$

should be

$$|E(X)|\le\|X\|.$$

p. 309 Continuing the corrections of p. 308: in the proof of item 3 of the lemma,

$$E(|X|)=E(|X\times 1|)\le\|X\|\times\|1\|=\|X\|.$$

should be

$$|E(X)|=|E(X\times 1)|\le\|X\|\times\|1\|=\|X\|.$$

A related error in the proof of item 5 is the presence of a superfluous line in the sequence of inequalities. In particular,

$$\begin{aligned}
|E[X_nY_m^*-XY^*]| &= |E[X_nY_m^*-XY_m^*+XY_m^*-XY^*]|\\
&= |E[(X_n-X)Y_m^*]+E[X(Y_m-Y)^*]|\\
&\le |E[(X_n-X)Y_m^*]|+|E[X(Y_m-Y)^*]|\\
&\le E[|(X_n-X)Y_m^*|]+E[|X(Y_m-Y)^*|]\\
&\le \|X_n-X\|\times\|Y_m\|+\|X\|\times\|Y_m-Y\|\\
&= \|X_n-X\|\times\|Y_m-Y+Y\|+\|X\|\times\|Y_m-Y\|\\
&\le \|X_n-X\|\times(\|Y_m-Y\|+\|Y\|)+\|X\|\times\|Y_m-Y\|
\end{aligned}$$

should be

$$\begin{aligned}
|E[X_nY_m^*-XY^*]| &= |E[X_nY_m^*-XY_m^*+XY_m^*-XY^*]|\\
&= |E[(X_n-X)Y_m^*]+E[X(Y_m-Y)^*]|\\
&\le |E[(X_n-X)Y_m^*]|+|E[X(Y_m-Y)^*]|\\
&\le \|X_n-X\|\times\|Y_m\|+\|X\|\times\|Y_m-Y\|\\
&= \|X_n-X\|\times\|Y_m-Y+Y\|+\|X\|\times\|Y_m-Y\|\\
&\le \|X_n-X\|\times(\|Y_m-Y\|+\|Y\|)+\|X\|\times\|Y_m-Y\|
\end{aligned}$$

p. 324: Replace

$$\sum_{n=-\infty}^{\infty} \frac{1}{2W} x\left(\frac{n}{2W}\right) \frac{\sin(\pi(t-nT)/T)}{\pi(t-nT)/T}$$

by

$$\sum_{n=-\infty}^{\infty} x\left(nT\right) \frac{\sin(\pi(t-nT)/T)}{\pi(t-nT)/T}$$

p. 325: Replace (5.101)

$$R_X(t-\tau) = \sum_{n=-\infty}^{\infty} R_X\left(\frac{n}{2W} - \tau\right) \frac{\sin(\pi(t-nT)/T)}{\pi(t-nT)/T}.$$

by

$$R_X(t-\tau) = \sum_{n=-\infty}^{\infty} R_X\left(nT - \tau\right) \frac{\sin(\pi(t-nT)/T)}{\pi(t-nT)/T}.$$

p. 326: Replace the first equation

$$R_X(0) = \sum_{n=-\infty}^{\infty} R_X\left(\frac{n}{2W} - t\right) \frac{\sin(\pi(t-nT)/T)}{\pi(t-nT)/T}.$$

by

$$R_X(0) = \sum_{n=-\infty}^{\infty} R_X\left(nT - t\right) \frac{\sin(\pi(t-nT)/T)}{\pi(t-nT)/T}.$$

Replace the penultimate equation in the proof

$$\begin{aligned} &\sum\sum\nolimits_{n,m:n-m=k} \frac{\sin(\pi(t-nT)/T)}{\pi(t-nT)/T} \frac{\sin(\pi(t-mT)/T)}{\pi(t-mT)/T} \\ &= \sum_{n=-\infty}^{\infty} \frac{\sin(\pi(t-nT)/T)}{\pi(t-nT)/T} \frac{\sin(\pi(\frac{t}{T}-(n-k)))}{\pi(\frac{t}{T}-(n-k))} = \frac{\sin(\pi(\frac{t}{T}-k))}{\pi(\frac{t}{T}-k)}, \end{aligned}$$

by

$$\begin{aligned} &\sum\sum\nolimits_{n,m:n-m=k} \frac{\sin(\pi(t-nT)/T)}{\pi(t-nT)/T} \frac{\sin(\pi(t-mT)/T)}{\pi(t-mT)/T} \\ &= \sum_{n=-\infty}^{\infty} \frac{\sin(\pi(t-nT)/T)}{\pi(t-nT)/T} \frac{\sin(\pi(t+kT-nT)/T)}{\pi(t+kT-nT)/T} = \frac{\sin(\pi k)}{\pi k}, \end{aligned}$$

Replace the final equation in the proof (just above section 5.8.7)

$$\lim_{N\to\infty}\sum_{n=-N}^{N}\sum_{m=-N}^{N} R_X((n-m)T)\frac{\sin(\pi(t-nT)/T)}{\pi(t-nT)/T}\frac{\sin(\pi(t-mT)/T)}{\pi(t-mT)/T}$$
$$=\sum_{-\infty}^{\infty} R_X(k)\frac{\sin(\pi(\frac{t}{T}-k))}{\pi(\frac{t}{T}-k)} = R_X(0)$$

by

$$\lim_{N\to\infty}\sum_{n=-N}^{N}\sum_{m=-N}^{N} R_X((n-m)T)\frac{\sin(\pi(t-nT)/T)}{\pi(t-nT)/T}\frac{\sin(\pi(t-mT)/T)}{\pi(t-mT)/T}$$
$$=\sum_{-\infty}^{\infty} R_X(k)\frac{\sin(\pi k)}{\pi k} = R_X(0)$$

p. 327 In the equations for $R_{X_N}(t,s)$, the s several times is incorrectly replaced by t and in the equation preceeding (5.107), the subscript n should be m. These are fixed by replacing

$$\begin{aligned} R_{X_N}(t,s) &= E[X_N(t)X_N^*(s)] = E\left[\sum_{n=1}^{N} X_n\phi_n(t)\sum_{m=1}^{N} X_m^*\phi_m^*(t)\right] \\ &= \sum_{n=1}^{N}\sum_{m=1}^{N} E[X_nX_m^*]\phi_n(t)\phi_m^*(t)] = \sum_{n=1}^{N}\lambda_N\phi_n(t)\phi_n^*(t) \end{aligned}$$

so that

$$R_X(t,s) = \lim_{N\to\infty} R_{X_N}(t,s) = \sum_{n=1}^{\infty}\lambda_n\phi_n(t)\phi_n^*(t).$$

Multiplying by a ϕ-function and integrating then yields

$$\begin{aligned} \int_a^b R_X(t,s)\phi_m(s)\,ds &= \sum_{n=1}^{\infty}\lambda_n\phi_n(t)\int_a^b \phi_m(s)\phi_n^*(s)\,ds \\ &= \lambda_n\phi_n(t). \end{aligned}$$

by

$$
\begin{aligned}
R_{X_N}(t,s) &= E[X_N(t)X_N^*(s)] = E\left[\sum_{n=1}^{N} X_n\phi_n(t)\sum_{m=1}^{N} X_m^*\phi_m^*(s)\right] \\
&= \sum_{n=1}^{N}\sum_{m=1}^{N} E[X_nX_m^*]\phi_n(t)\phi_m^*(s)] = \sum_{n=1}^{N}\lambda_N\phi_n(t)\phi_n^*(s)
\end{aligned}
$$

so that

$$
R_X(t,s) = \lim_{N\to\infty} R_{X_N}(t,s) = \sum_{n=1}^{\infty}\lambda_n\phi_n(t)\phi_n^*(s).
$$

Multiplying by a ϕ-function and integrating then yields

$$
\begin{aligned}
\int_a^b R_X(t,s)\phi_m(s)\,ds &= \sum_{n=1}^{\infty}\lambda_n\phi_n(t)\int_a^b \phi_m(s)\phi_n^*(s)\,ds \\
&= \lambda_m\phi_m(t).
\end{aligned}
$$

p. 328 In the middle of the page,

$$
\begin{aligned}
\lambda_n\int_a^b \phi_m^*(t)\phi_n(t)\,dt &= \int_a^b\int_a^b \phi_m^*(t)R_X(t,s)\phi_n(s)\,ds\,dt \\
&= \int_a^b \phi_n(s)\left(\int_a^b R_X(t,s)\phi_m^*(t)\right) ds \\
&= \int_a^b \phi_n(s)\left(\int_a^b R_X(s,t)\phi_m(t)\right)^* ds \\
&= \lambda_m^*\int_a^b \phi_n(t)\phi_m^*(t)\,dt
\end{aligned}
$$

so that

$$
(\lambda_n - \lambda_m^*)\int_a^b \phi_n(t)\phi_m^*(t)\,dt = 0.
$$

should be

$$
\begin{aligned}
\lambda_n \int_a^b \phi_m^*(t)\phi_n(t)\,dt &= \int_a^b \int_a^b \phi_m^*(t) R_X(t,s)\phi_n(s)\,ds\,dt \\
&= \int_a^b \phi_n(s) \left(\int_a^b R_X(t,s)\phi_m^*(t) dt \right) ds \\
&= \int_a^b \phi_n(s) \left(\int_a^b R_X(s,t)\phi_m(t) dt \right)^* ds \\
&= \lambda_m^* \int_a^b \phi_n(s)\phi_m^*(s)\,ds
\end{aligned}
$$

so that replacing the dummy variable s by t yields

$$
(\lambda_n - \lambda_m^*) \int_a^b \phi_n(t)\phi_m^*(t)\,dt = 0.
$$

p. 329 In the first equation, first line, a complex conjugate is missing:

$$
E[X_n X_m^*] = E\left[\left(\int_a^b X(t)\phi_n^*(t)\,dt \right) \left(\int_a^b X(s)\phi_m(s)\,ds \right) \right]
$$

should be

$$
E[X_n X_m^*] = E\left[\left(\int_a^b X(t)\phi_n^*(t)\,dt \right) \left(\int_a^b X^*(s)\phi_m(s)\,ds \right) \right]
$$

In the last equation on the page a λ_n is missing,

$$
\sum_{n=1}^N \phi_n^*(t) \int_a^b R_X(t,s)\phi_n(s)\,ds = \sum_{n=1}^N \phi_n^*(t)\phi_n^*(t).
$$

should read

$$
\sum_{n=1}^N \phi_n^*(t) \int_a^b R_X(t,s)\phi_n(s)\,ds = \sum_{n=1}^N \lambda_n \phi_n^*(t)\phi_n^*(t).
$$

p. 330: The missing λ_n of p. 329 carries to this page. The first equation

$$
E[X_N(t)X(t)^*] = \sum_{n=1}^N \phi_n^*(t)\phi_n^*(t),
$$

should be

$$E[X_N(t)X(t)^*] = \sum_{n=1}^{N} \lambda_n \phi_n^*(t)\phi_n^*(t),$$

Near the middle of the page, change
If R_X has a Fourier series expansion

$$R_X(\tau) = \sum_{n=-\infty}^{\infty} b_n e^{j2\pi nt/T}$$

to
If R_X has a Fourier series expansion

$$R_X(\tau) = \sum_{n=-\infty}^{\infty} b_n e^{j2\pi n\tau/T}$$

and just below it change
then the integral equation to be solved for the Karhunen–Loeve expansion is

$$\lambda\phi(t) \;=\; \int_0^T \sum_{n=-\infty}^{\infty} b_n e^{j2\pi nt/T}\phi(s)\,ds = \sum_{n=-\infty}^{\infty} b_n \int_0^T e^{j2\pi n(t-s)/T}\phi(s)\,ds.$$

to
then the integral equation (5.107) to be solved for the Karhunen–Loeve expansion is

$$\lambda\phi(t) \;=\; \int_0^T \sum_{n=-\infty}^{\infty} b_n e^{j2\pi n(t-s)/T}\phi(s)\,ds = \sum_{n=-\infty}^{\infty} b_n \int_0^T e^{j2\pi n(t-s)/T}\phi(s)\,ds.$$

The subscripts in the text and equation at the bottom of the page need repair, as do the related subscripts at the top of p. 331. Change Guessing a solution $\phi_n(t) = c_n e^{j2\pi nt/T}$ where c_n is a normalizing constant, then

$$\begin{aligned}\int_0^T c_n e^{j2\pi nt/T} c_m * e^{-j2\pi mt/T}\,dt &= c_n c_m^* \int_0^t e^{j2\pi(n-m)t/T}\,dt \\ &= |c_n|^2 T\delta_{N-M}\end{aligned}$$

so that $c_n = 1/\sqrt{T}$. Then with

$$\phi_n(t) = \frac{e^{j2\pi nt/T}}{\sqrt{T}}$$

the integral equation becomes

$$
\begin{aligned}
\lambda \frac{e^{j2\pi nt/T}}{\sqrt{T}} &= \sum_{n=-\infty}^{\infty} b_n \int_0^T e^{j2\pi n(t-s)/T} \frac{e^{j2\pi ns/T}}{\sqrt{T}}\, ds \\
&= \sum_{n=-\infty}^{\infty} b_n \frac{e^{j2\pi nt/T}}{\sqrt{T}} \int_0^T e^{\frac{j2\pi(m-n)s}{T}}\, ds \\
&= b_m T \frac{e^{j2\pi nt/T}}{\sqrt{T}} = bmT\phi_m(t),
\end{aligned}
$$

which we already knew was a solution from the development for Fourier series.

to

Guessing a solution $\phi_m(t) = c_n e^{j2\pi mt/T}$ where c_m is a normalizing constant, then

$$
\begin{aligned}
\int_0^T c_n e^{j2\pi nt/T} c_m^* e^{-j2\pi mt/T}\, dt &= c_n c_m^* \int_0^t e^{j2\pi(n-m)t/T}\, dt \\
&= |c_n|^2 T \delta_{n-m}
\end{aligned}
$$

so that $c_n = 1/\sqrt{T}$. Then with

$$
\phi_m(t) = \frac{e^{j2\pi mt/T}}{\sqrt{T}}
$$

the integral equation becomes

$$
\begin{aligned}
\lambda \frac{e^{j2\pi mt/T}}{\sqrt{T}} &= \sum_{n=-\infty}^{\infty} b_n \int_0^T e^{j2\pi n(t-s)/T} \frac{e^{j2\pi ms/T}}{\sqrt{T}}\, ds \\
&= \sum_{n=-\infty}^{\infty} b_n \frac{e^{j2\pi nt/T}}{\sqrt{T}} \int_0^T e^{\frac{j2\pi(m-n)s}{T}}\, ds \\
&= b_m T \frac{e^{j2\pi mt/T}}{\sqrt{T}} = b_m T\phi_m(t),
\end{aligned}
$$

which we already knew was a solution from the development for Fourier series.

p. 408, Problem 28 Find the power spectral densities $S_X(f)$ and $S_Y(f)$? should be

Find the power spectral densities $S_X(f)$ and $S_Y(f)$.

p. 435, Problem A.23 (b) has a typo and as a result the integral blows up. It should be replaced by

$$\int_0^\infty dx e^{-x} \int_0^x dy e^{-y}.$$

p. 439 (B.7) should be

$$\sum_{k=0}^\infty k^2 q^{k-1} = \frac{2q}{(1-q)^3} + \frac{1}{(1-q)^2}$$

instead of

$$\sum_{k=0}^\infty k^2 q^{k-1} = \frac{2}{(1-q)^3} + \frac{1}{(1-q)^2}$$

The second line of the next equation should be

$$\frac{1}{q}\sum_{k=0}^\infty k^2 q^{k-1} - \frac{1}{q}\sum_{k=0}^\infty k q^{k-1} = \frac{1}{q}\sum_{k=0}^\infty k^2 q^{k-1} - \frac{1}{(1-q)^2 q}$$

instead of

$$\frac{1}{q}\sum_{k=0}^\infty k^2 q^{k-1} - \frac{1}{q}\sum_{k=0}^\infty k q^{k-1} = \frac{1}{q}\sum_{k=0}^\infty k^2 q^{k-1} - \frac{1}{(1-q)^2}$$

The final equation of the proof should be

$$\sum_{k=0}^\infty k^2 q^{k-1} = \frac{2q}{(1-q)^3} + \frac{1}{(1-q)^2},$$

instead of

$$\sum_{k=0}^\infty k^2 q^{k-1} = \frac{2}{(1-q)^3} + \frac{1}{(1-q)^2},$$

p. 442 (B.13) should be changed from

$$\begin{aligned}\int_{-\infty}^\infty \frac{1}{\sqrt{2\sigma^2}} e^{-(x-m)^2/2\sigma^2}\, dx &= \frac{1}{\sqrt{2\sigma^2}} \int_{-\infty}^\infty e^{-r^2}\, \sigma\, dr \\ &= \frac{\sqrt{2\pi}}{\sqrt{2\pi}} = 1.\end{aligned}$$

to

$$\int_{-\infty}^{\infty} \frac{1}{\sqrt{2\pi\sigma^2}} e^{-(x-m)^2/2\sigma^2}\, dx = \frac{1}{\sqrt{2\pi\sigma^2}} \int_{-\infty}^{\infty} e^{-r^2/2}\, \sigma\, dr = \frac{\sqrt{2\pi}\sigma}{\sqrt{2\pi\sigma^2}} = 1.$$

p. 446: **Uniform pmf**. $\Omega = \mathcal{Z}_n = \{0, 1, \ldots, n-1\}$ and $p(k) = 1/n$; $k \in \mathcal{Z}_n$.
mean: $(n+1)/2$
variance: $(2n+1)(n+1)n/6 - ((n+1)/2)^2$.
should be

Uniform pmf. $\Omega = \mathcal{Z}_n = \{0, 1, \ldots, n-1\}$ and $p(k) = 1/n$; $k \in \mathcal{Z}_n$.
mean: $(n-1)/2$
variance: $(2n-1)(n-1)/6 - [(n-1)/2]^2 = (n^2-1)/12$.

The variance of the geometric pmf should be $(1-p)/p^2$, not $2/p^2$.

p. 447, the mean of the Uniform pdf should be $(b+a)/2$ and not $(b-a)/2$. The variance of the Gamma pdf is a^2b and not ab.