Corrections to the First Printing

Chapter 2

(i) Page 48, Paragraph 1: “cells/µ l” should be “cells/µl” without the space.

(ii) Page 48, Paragraph 2: “Uninfected cells $T_i$” should not have the asterisk.

Chapter 3

(i) Page 52: Equation (3.4) should read

$$z(t, \omega) = e^{a(\omega)t} \left[ z_0(\omega) + \int_0^t e^{-a(\omega)s} b(s, \omega) ds \right]$$

(ii) Page 55: Last Paragraph: Remove comma after copper.

(iii) Page 57: The reference [50] should be cited for the Neutron Diffusion example.

(iv) Page 61: In (3.39), the index should read $j = 1, \ldots, n$ rather than $t_j = 1, \ldots, n$. Two sentences later, it should read “Note that $\nu$ and $N$ respectively designate the dimension of the response and the number of states.”

Chapter 4

(i) Page 73: Karl Person should be Karl Pearson.

(ii) Page 79: To clarify, consider $n$ random samples $X_1, \ldots, X_n$ from a population with pdf $g(x)$. They are identically distributed if $g(x) = f_X(x_1) = \cdots = f_X(x_n)$. For consistency, (4.20) should then read

$$f_X(x_1, \cdots, x_n) = \prod_{i=1}^n f_X(x_i).$$

(iii) Page 81, Line 6: “A $(1 - \alpha) \times 100\%$ confidence interval” should read “The 95.45% confidence interval”.

(iv) Page 81, Example 4.33. Note that $1 - \alpha/2$ is the probability rather than the interval.

(v) Pages 83: The likelihood function at the bottom of the page should be

$$L(q|\nu) = \prod_{i=1}^n f_{T_i}(\nu_i; q).$$

This same expression should be used in the definition of the MLE on page 84.

(vi) Page 84: The condition before (4.29) should read $\frac{\partial}{\partial q}(\ell(q, \sigma^2|Q) = 0$.

(vii) Page 90: To compare to the previous definition of a random variable, we assume here that there is an ordering on $S$. This does not have to be true in general, in which case one would modify the measure-theoretic definition. For this reason, a general $S$-valued random variable does not necessarily have a mean.
(viii) Page 92: The percentage of teams who win/lose their next game is [0.64, 0.36].
(ix) Page 97: The solution is $z(t, \omega)$.
(x) Page 99: The number 100 is never used and can be replaced by “a large number of”.
(xi) Page 100: We added the following sentence to the footnote. “For example, $\theta$ is typically used to
denote calibration parameters in statistics whereas $q$ is commonly employed in the mathematics
literature.”
(xii) Page 102: Replace ‘mean’ by ‘mode’ since the latter is easier to distinguish.
(xiii) Page 103: The observations in Example 4.69 should be $\upsilon = [\upsilon_1, \ldots, \upsilon_n]$ rather than $\upsilon =
[\upsilon_1, \ldots, \upsilon_N]$.
(xiv) Page 105: In Exercise 4.6, the variances should be $\sigma^2_z = 1/3$ and $\sigma^2_x = (b - a)^2/12$.

Chapter 5

(i) Page 111: In Example 5.2, we should have $\phi_1(x) = 1, \lambda_1 = \text{length}(D)$.
(ii) Pages 111-112: To remain consistent with equation (5.1), the variables $u, u_\ell, u_r$ and $u_0$ should
be $T, T_\ell, T_r$ and $T_0$.

Chapter 6

(i) Pages 113-114: The discussion is clarified if one refers to the parameter set when defining the
concepts of identifiability and influential parameter spaces.
(ii) Page 114, Figure 6.1(b): For consistency, the parameters values in the figure and first paragraph
should be designated $q^1$ and $q^2$ rather than $q_1$ and $q_2$, which can be confused with the parameter
components.
(iii) Page 115, Paragraph 2: This should be $K = \frac{k}{m}$.
(iv) Page 117: In the line following (6.3), this should read $\Sigma \in \mathbb{R}^{n \times p}$.
(v) Page 119: Algorithm 6.10 (Random Range Finder).
(vi) Page 120: The first line should have $t_i = (i - 1)\Delta t, \Delta t = \frac{1}{n-1}, i = 1, \ldots, n$.
(vii) Page 120: In Case i, the pivoted QR factorization should be $A^TP = QR$.
(viii) Pages 120-121: The rank of $A$ and dimension of the identifiable subspace should be 49 rather
than 50.

Chapter 7

(i) Page 132: We added the following sentence to the end of the first paragraph. “Finally, we note
that parameters are often denoted by $\theta$ in the statistics literature.”
(ii) Page 141: Equation (7.9) should be cited after (7.29) rather than (7.3).
(iii) Pages 147-148: Subscript c should be subscript C.

(iv) Page 153, Exercise 7.8: This should be two standard deviations.

Chapter 8

(i) Page 155: we added the following paragraph in the introduction to the chapter. “We remind readers that calibration parameters and observed data are commonly denoted by \( \theta \) and \( y \) in the statistics literature. It is also common to employ the same notation for the random variable and realization and let the context dictate the meaning.”

(ii) Page 158: Equation (8.6) should read

\[
\pi(q|v) \approx \frac{1}{\sum_{i=1}^{k} e^{-(SS_{ci}-SS_{q})/2\sigma_{0}^{2}w^{i}}},
\]

(iii) Page 164: The Jeffreys prior should read

\[
\pi_{0}(q,\sigma^{2}) = \frac{1}{\sigma^{2}}.
\]

(iv) Page 164: In Algorithm 8.5, (a) and (g) should read (a) Sample \( z_{k} \sim N(0,I_{p}) \) and (g) Update \( s_{k}^{2} \sim \text{Inv-gamma}(a_{val},b_{val}). \)

(v) Pages 165: The covariance estimate is \( V = s_{0}^{2}[(X^{T}(q_{s}^{0} \times s)X^{T}(q_{s}^{0} \times s)]. \)

(vi) Page 167: Figure 8.6 has been updated so that the C chain and density match.

(vii) Page 173: The first sentence should read “In theory, \( \text{cov}(q^{0},\cdots,q^{k-1}) \) can be computed using the empirical covariance formula

\[
\text{cov}(q^{0},\cdots,q^{k-1}) = \frac{1}{k-1}\left(\sum_{i=0}^{k-1} q^{i}(q^{i})^{T} - k\bar{q}^{k}(\bar{q}^{k})^{T}\right)
\]

where \( \bar{q}^{k} = \frac{1}{k} \sum_{i=0}^{k-1} q^{i} \) and \( q^{i} \) are column vectors.” Similarly, in the equation following (8.20), \( q^{i} \) should be \( q^{i} \) in the first two lines.

(viii) Page 175: In Algorithm 8.8, (a) and (g) should read (a) Sample \( z_{k} \sim N(0,I_{p}) \) and (g) Update \( s_{k}^{2} \sim \text{Inv-gamma}(a_{val},b_{val}). \)

(ix) Page 176: Step 2 should read Sample \( z_{k} \sim N(0,I_{p}). \)

(x) Page 176: The covariance estimate is \( V = s_{0}^{2}[(X^{T}(q_{s}^{0} \times s)X^{T}(q_{s}^{0} \times s)]. \)

(xi) Page 182: In the caption of Figure 8.15, \( bE \) should be \( b_{E}. \)

(xii) Pages 182-183: The parameter dimension should be changed from \( d \) to \( p \) to remain consistent with previous notation.
Chapter 9

(i) Pages 198-199: The t-distributions should be modified to be $t_{n-p,1-\alpha/2}$ to be consistent with previous notation.

(ii) Page 200: The t-distributions are $t_{n-2,1-\alpha/2}$.

(iii) Page 201: The caption of Figure 9.5 should be modified to reference the confidence and prediction intervals specified using the linear theory in Section 9.4.1.

Chapter 10

(i) Page 211: The basis function in (10.13) should be $\psi_i(q)$ rather than $\psi(q)$.

(ii) Page 211: In Example 10.3, we should have $Q \sim \mathcal{U}(-1,1)$.

(iii) Page 215: Equation (10.22) should have the independent variable $t$ rather than $x$,

$$\frac{du}{dt} = f(t, Q, u), \quad t > 0$$

$$u(0, Q) = u_0.$$

(iv) Page 216: The period is missing at the end of the first sentence in the subsection Stochastic Galerkin Method.

(v) Page 217: Two lines before (10.33) should have $q^r$ as collocation points $q^{m}$.

(vi) Page 219: In the Stochastic Weak Formulation, the index range should be $k = 0, \ldots, K$ for $\Psi_k(Q)$ rather than $k = 1, \ldots, K$.

(vii) Page 226: In the first sentence of Section 10.3, the word ‘simply’ should be 'simple'.

(viii) Page 227: Equation (10.52) should have the factor $-\gamma_i$ rather than $-\gamma_i$. The lower index in the equation following (10.54) should be $n = 0$.

(ix) Pages 232-233: The heat equation (10.60) should have ordinary derivatives $\frac{d^2u}{dx^2}$ rather than partial derivatives.

(x) Page 235: The second expression in (10.64) should be

$$\text{var} \left[ y^K(\omega_F,Q) \right] = \sum_{k=1}^{K} y_k^2(\omega_F)\gamma_k.$$

(xi) Page 235: Because we are considering $Q_1, Q_2$ and $Q_3$ as normally distributed random variables with mean 0 and standard deviation 1, $N(0,1)$, it is clearer if we write the density as

$$\rho_Q(q) = \left( \frac{1}{\sqrt{2\pi}} \right)^3 e^{-q_1^2/2}e^{-q_2^2/2}e^{-q_3^2/2}$$

and the quadrature points as $q^r = [q_1^{r_1}, q_2^{r_2}, q_3^{r_3}]$.

(xii) Page 236: The x-label in Figure 10.4(a) should be $\omega_F$ rather than $\omega$. 

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Chapter 11

(i) Page 241: To be consistent with Table 11.1, the first equation should read
\[ I^{(1)} f = \frac{1}{2} \int_{-1}^{1} f(q) dq \approx \frac{1}{2} \sum_{r=1}^{R} f(q_r^r) w_r. \]

(ii) Page 242: The upper limit and stepsize in the trapezoid rule should be corrected in (11.3) to yield
\[ Q^{(1)} f = \frac{h_\ell}{2} \left[ f(0) + f(1) + 2 \sum_{r=1}^{R-2} f(q_\ell^r) \right]. \]
The line following (11.4) should be changed to state “The weights are thus \([h_\ell^2, h_\ell, \cdots, h_\ell, \frac{h_\ell}{2}]\).”

(iii) Page 251: In the final two equations, the collocation points should be denoted by \(q^j\) rather than \(q_j\).

Chapter 12

(i) Page 263: In the line following (12.2), \(T_{source}\) should be interpreted as a nonphysical source term rather than the source temperature. This is illustrated by the correct parameter estimates \(T_{source} = -49.08 \, ^\circ C, \, h = 0.00172, \, \eta = -0.0841\) at the bottom of the page. The footnote should be deleted.

(ii) Page 264: In the second line, the parameters should be \(q = [T_{source}, h, \eta]\). We note that constraints must be placed on these parameters to address parameter identifiability for a single data set.

(iii) Page 265: As illustrated in the posted code, the optimal parameters were obtained using the MATLAB routine \texttt{fminsearch.m}. Due to confounding between the physical and algebraic model components, different values will be obtained if one uses \texttt{lsqnonlin.m}. This indicates a number of close local minima.

(iv) Page 269: In Exercise 12.1, it is easier to use the model (12.1) than (12.3). This is also true in Exercise 12.3 on Page 270.

Chapter 13

(i) Page 275: The final limits in (13.9) should be \(j > i\) rather than \(j \geq i\).

(ii) Page 276: We replaced \(q^1\) and \(q^2\) with \(q^i\) and \(q^j\) to provide general relations.

(ii) Page 279: The lower limit in (13.23) should be \(k = 0\). The expression in the third line after (13.23) should read \(\Psi_k(q^m) = \delta_{km}\).

Chapter 15

(i) Page 328: In Example 15.8, \(Q_1 \sim N(0, \sigma_1^2)\).
(ii) Page 334: In Example 15.14, $k = 2$ should be replaced with $p = 2$.

Bibliography

(i) The title of [3] should be “Estimation and prediction with HIV-treatment interruption data.”

(ii) Citation [66] can be appended to include *SIAM Journal on Scientific Computing*, in press.