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 ν 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 $g(x) = f_{X_1}(x_1) = \ldots = f_{X_n}(x_n)$. For consistency, (4.20) should then read

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

(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

$$L(q|\upsilon) = \prod_{i=1}^n f_{\Upsilon_i}(\upsilon_i; q).$$

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 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, θ 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 $v = [v_1, \ldots, v_n]$ rather than $v = [v_1, \ldots, v_N]$.

(xiv) Page 105: In Exercise 4.6, the variances should be $\sigma_z^2 = 1/3$ and $\sigma_x^2 = (b-a)^2/12$.

Chapter 5

(i) Page 111: In Example 5.2, we should have $\phi_1(x) = 1, \lambda_1 = \text{length}(\mathcal{D})$.

(ii) Pages 111-112: To remain consistent with equation (5.1), the variables u, u_ℓ, u_r and u_0 should be T, T_ℓ, 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 $A^T P = QR$.

(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 θ 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 θ 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

$$\pi(q|v) \approx \frac{1}{\sum_{i=1}^{k} e^{-(SS_{\zeta^i} - SS_q)/2\sigma_0^2} w^i}.$$

(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 $s_k^2 \sim$ Inv-gamma(a_{val}, b_{val}).

(v) Pages 165: The covariance estimate is $V = s_0^2[\mathcal{X}^T(q_s^0. \times s)\mathcal{X}^T(q_s^0. \times s)]$.

(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^k 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 $s_k^2 \sim$ 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 $V = s_0^2[\mathcal{X}^T(q_s^0. \times s)\mathcal{X}^T(q_s^0. \times s)]$.

(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,

$$\frac{du}{dt} = f(t, Q, u), \ t > 0$$
$$u(0, Q) = u_0.$$

(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 $-\frac{1}{\gamma_i}$ 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 ω_F rather than ω.

Chapter 11

(i) Page 241: To be consistent with Table 11.1, the first equation should read

$$I^{(1)}f = \frac{1}{2}\int_{-1}^{1} f(q)dq \approx \frac{1}{2}\sum_{r=1}^{R} f(q^r)w^r.$$

(ii) Page 242: The upper limit and stepsize in the trapezoid rule should be corrected in (11.3) to yield

$$Q_\ell^{(1)}f = \frac{h_\ell}{2}\left[f(0) + f(1) + 2\sum_{r=1}^{R_\ell - 2} f(q_\ell^r)\right]$$

The line following (11.4) should be changed to state "The weights are thus $[\frac{h_\ell}{2}, h_\ell, \cdots, h_\ell, \frac{h_\ell}{2}]$."

(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 $T_{source} = -49.08\ ^oC$, $h = 0.00172$, $\eta = -0.0841$ 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 `fminsearch.m`. Due to confounding between the physical and algebraic model components, different values will be obtained if one uses `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 Computating*, in press.