Corrections to the Second Printing: Chapter 2

p. 153, Example 2.1.9, this row reduction is incomplete. The second line of the equation should read:

\[
\begin{bmatrix}
1 & 0 & 1 & -1 \\
0 & 1 & 1 & 1 \\
0 & 0 & 0 & 3
\end{bmatrix}
\rightarrow
\begin{bmatrix}
R_1 & 2R_2 \\
R_3 & 2R_2 \\
R_3/3
\end{bmatrix}
\rightarrow
\begin{bmatrix}
1 & 0 & 1 & -1 \\
0 & 1 & 1 & 1 \\
0 & 0 & 0 & 1
\end{bmatrix}
\rightarrow
\begin{bmatrix}
R_1 + R_3 \\
R_2 - R_3 \\
0 & 0 & 0 & 1
\end{bmatrix}.
\]

p. 171, Equations 2.4.13 and 2.4.14 should include a plus sign after the dots:

\[b_1 \mathbf{v}_1 + \cdots + b_k \mathbf{v}_k \quad \text{and} \quad c_1 \mathbf{v}_1 + \cdots + c_k \mathbf{v}_k\]

In the line after Equation 2.4.14, replace \( b_k = c_k \) by \( b_k - c_k \). But if the only solution to that equation is \( b_1 - c_1 = 0, \ldots, b_k - c_k = 0 \) …

p. 191 in Equation 2.6.3, \(|DS(A)|H\) should be \(|DS(A)|H\)

p. 192 In Example 2.6.7, we denote by \( C^2 \) the space of \( C^2 \) functions: functions that are twice continuously differentiable.

p. 199 The caption to Figure 2.7.1 should read:

Newton’s method: we start with \( a_0 \), drawing the tangent to the parabola \( y = x^2 - b \) at the point with \( x \)-coordinate \( a_0 \). The point where that tangent intersects the \( x \)-axis is \( a_1 \). Now we draw the tangent to the parabola at the point with \( x \)-coordinate \( a_1 \). That tangent intersects the \( x \)-axis at \( a_2 \) … . Each time we calculate \( a_{n+1} \) from \( a_n \), we are calculating the intersection with the \( x \)-axis of the line tangent to the parabola at the point with \( x \)-coordinate \( a_n \).

In addition, four lines before Example 2.7.2, “at \( a_n \)” should be “at \( \left( \frac{a_n^2}{a_n - b} \right) \),” i.e., at the point on the parabola with \( x \)-coordinate \( a_n \).

p. 204, in the margin note about different notations for partial derivatives, replace \( f_{x_1}x_2 \) by \( f_{x_1x_2} \):

\[
D_j(D_if)(a) = \frac{\partial^2 f}{\partial x_j \partial x_i}(a) = f_{x_1x_2}(a).
\]

p. 205 The first equation in Equation 2.7.40 should be \( D_1 f_1 = 1 \), not \( D_1 f = 1 \).

p. 205 In Example 2.7.9, The sentence beginning “So our Lipschitz ratio is … ” should be replaced by
So if \(|x|, |y| \leq \frac{\sqrt{3}}{2}\), we can take
\[ c_{2,1} = c_{1,1,2} = 3A \quad \text{with all others 0, so} \quad \sqrt{c_{2,1}^2 + c_{1,1,2}^2} = 3A\sqrt{2}. \]

Thus we have
\[ ||\text{Df}(x) - \text{Df}(y)|| \leq 3\sqrt{2}A|x - y|. \quad \triangle \]

2.7.42

Note that in Example 2.7.5 we got 3A, a better result.

p. 205 footnote: “... gives results that are often good enough,” not “... gives results that are
good enough.”

p.206 In Equation 2.7.43, \(D_2 D_1 F_1 = D_1 D_2 F_1 = -\sin(x+y)\) (not \(\sin(xy)\)) and \(D_2 D_2 F_2 = -x^2 \cos xy\)
(not \(x^2 \cos xy\)).

There are other changes as well; this entire example now reads

Let us find a Lipschitz ratio for the derivative of \(F(x, y) = \begin{pmatrix} \sin(x + y) \\ \cos(xy) \end{pmatrix}\), for \(|x| < 2, |y| < 2\). We compute
\[
\begin{align*}
D_1 D_1 F_1 &= D_2 D_2 F_1 = D_2 D_1 F_1 = D_1 D_2 F_1 = -\sin(x+y), \\
D_1 D_2 F_2 &= -y^2 \cos(xy), \quad D_2 D_1 F_2 = D_1 D_2 F_2 = -(\sin(xy) + xy \cos(xy)), \\
D_2 D_2 F_2 &= -x^2 \cos xy.
\end{align*}
\]

2.7.43

Since \(|\sin|\) and \(|\cos|\) are bounded by 1, if we set \(|x| < 2, |y| < 2\), this gives
\[
\begin{align*}
\|D_1 D_1 F_1\| &= \|D_2 D_2 F_1\| = \|D_2 D_1 F_1\| = \|D_1 D_2 F_1\| \leq 1, \\
\|D_1 D_1 F_2\|, \|D_2 D_2 F_2\| &\leq 4, \quad \|D_2 D_1 F_2\| = \|D_1 D_2 F_2\| \leq 5.
\end{align*}
\]

2.7.44

So for \(|x| < 2, |y| < 2\), we have a Lipschitz ratio
\[ M \leq \sqrt{4 + 16 + 16 + 25 + 25} = \sqrt{86} < 9.3; \]

i.e.,
\[ \|\text{Df}(u) - \text{Df}(v)\| \leq 9.3 |u - v|. \quad \triangle \]

2.7.45

(By fiddling with the trigonometry, one can get the \(\sqrt{86}\) down to \(\sqrt{78} \approx 8.8\), but the advantage of
Proposition 2.7.8 is that it gives a systematic way to compute Lipschitz ratios; you don’t have to
worry about being clever.)

p. 207 In the statement of Theorem 2.7.11 we should have specified that \(U_0\) is a subset of \(U\).

p. 209 Equation 2.7.56: A minus sign is missing from the term corresponding to \(-[D\tilde{F}(a_0)]^{-1}\); the
equation should be
\[
\tilde{F}_0 = \begin{pmatrix}
-1 \\
\cos 2 \\
-\cos 2 - 1
\end{pmatrix}
\begin{pmatrix}
\cos 2 \\
1 - \cos 2 \\
0
\end{pmatrix}
\begin{pmatrix}
0 \\
\sin 2 - 1 \\
\sin 2 - 1
\end{pmatrix}
\begin{pmatrix}
\sin 2 - 1 \\
1 - \cos 2 \\
0
\end{pmatrix}
\begin{pmatrix}
\tilde{F}(a_0) \\
\tilde{F}(a_0)
\end{pmatrix}
\sim
\begin{pmatrix}
-0.064 \\
\end{pmatrix}.
\]
p. 212, first margin note: 20 steps is overly generous; if seven or eight don’t work, you have a poor initial condition.

p. 215, Equation 2.8.7, the term on the far right should be $\sqrt{\frac{3+\sqrt{5}}{2}}$, not $\sqrt{\frac{1+\sqrt{5}}{2}}$.

p. 222, caption to Figure 2.9.4: the inequality is in the wrong direction. The displayed equation should be

$$\frac{1}{2R|L^{-1}|^2} > M_R.$$ 

p. 223 Equation 2.9.11: the $Df$ on the left-hand side should be $Df_y$.

p. 225, In Equation 2.9.17, $F\left(\theta - \pi\right)$ not $F\left(\theta + \pi\right)$ (but this does not affect the result).

p. 228 Equation 2.9.22, second entry in first line should have $D_{n+m}F(c)$ not $D_mF(c)$:

$$L = \begin{pmatrix} [D_1F(c), \ldots, D_nF(c)] & [D_{n+1}F(c), \ldots, D_{n+m}F(c)] \\ 0 & I_m \end{pmatrix}.$$ 

p. 230, last margin note: $D_1F$ is a $1 \times 1$ matrix, not $a \times 1$.

p. 232 Exercise 2.1.9, the last line of part (c) should be

$$Q(n) = \frac{2}{3} n^3 + \frac{3}{2} n^2 - \frac{7}{6} n \quad \text{operations.}$$ 

Part (g): $n^2 - n$ operations, not $n^2 - 1$.

p. 234 In Exercise 2.2.7, $k$ is used with two different meanings. Part (b) might be clearer as follows:

(b) Let $\mathbf{v}_k$, $k = 1, \ldots, 5$ be the columns of $A$. What can you say about the systems of equations

$$[\mathbf{v}_m, \ldots, \mathbf{v}_m] \begin{bmatrix} x_1 \\ \vdots \\ x_m \end{bmatrix} = \mathbf{v}_{m+1}$$

for $m = 1, 2, 3, 4$.

p. 238 Exercise 2.4.10: in the sentence immediately before Equation 2.4.10, “unmarked index” should be “marked index”:

let $j(l)$ be the largest marked index such that $j(l) < l$, and write . . . .

p. 243 Exercise 2.6.7 part (c) needs a comma and some dots; it should read

Using the basis $1, x, x^2, \ldots, x^n$, compute the matrices of the same differential operator $T$, viewed as an operator from $P_3$ to $P_3$, from $P_3$ to $P_4$, \ldots , $P_n$ to $P_n$ (polynomials of degree at most 3, 4, \ldots , $n$).

p. 245 Exercise 2.7.13 should be with exercises for Section 2.9