### CORRECTIONS

AN INTRODUCTION TO NUMERICAL ANALYSIS, 2ND ED.

<table>
<thead>
<tr>
<th>Page</th>
<th>Line</th>
<th>Corrected version of text</th>
</tr>
</thead>
<tbody>
<tr>
<td>5*</td>
<td>(1.1.7)</td>
<td>$+ \left( \frac{\alpha}{n+1} \right) \frac{x^{n+1}}{(1+\xi_x)^{n+1-\alpha}}$</td>
</tr>
<tr>
<td>8</td>
<td>-3, -4</td>
<td>$+ \frac{1}{2} \left[ (x-6)^2 \frac{\partial^2 f(\delta, \gamma)}{\partial x^2} + 2(x-6)(y-2) \frac{\partial^2 f(\delta, \gamma)}{\partial x \partial y}</td>
</tr>
</tbody>
</table><p>ight.$ |
|      |       | $+ (y-2)^2 \frac{\partial^2 f(\delta, \gamma)}{\partial y^2} \right]$                     |
| 10   | 13    | $|v| \geq 0; |v| = 0$ if and only if...                                                 |
| 13   |      | Table 1.1 For the first entry for PRIME 850, the $\delta$ value should be 1.19E-7.      |
| 16   | -14, -15 | $\delta = 2^{-22} \pm 2.38 \times 10^{-7}$ chopped arithmetic [ \delta = 2^{-23} \pm 1.19 \times 10^{-7}$ rounded arithmetic |
| 28*  | (1.4.20) | $f(x_T, y_T) - \ldots$                                                                   |
| 32   | 5     | ... has a mean of $-\delta/2, \ldots$                                                    |
| 32   | (1.5.10) | $\ldots \leq -E \leq \ldots$                                                            |
| 32*  | (1.5.12) | $\sqrt{x^T x} = \left[ \sum_{j=1}^{m} x_j^2 \right]^{1/2}$                            |
| 33   | (1.5.15) | $(1 + \gamma_j)$                                                                        |
| 36*  | -8    | $K(x) = \text{Supremum}<em>{\delta y} \left| \frac{\delta x}{\delta y} \right|$ is $\text{Supremum} \ldots$ |
| 44   | 7     | $\ldots g(x) , dx = \ldots$                                                             |
| 56   | 17–26 | This paragraph should not be indented because it is not part of the definition preceding it. |
| 64   | 20    | $\alpha - x_n = -\frac{f(x_n)}{f'(x_n)}$                                                 |
| 67   |      | Replace $x_n - x</em>{n-1}$ with $x_{n+1} - x_n$.                                             |
| 71*  | -6    | $\ldots f(x_n) / f'(x_n) \quad n \geq 0$                                                 |
| 75   | 16    | $|f(z)| \leq 10^{-10}$                                                                    |
| 98*  | -9    | $\ldots -1.001$                                                                          |</p>
<table>
<thead>
<tr>
<th>Page</th>
<th>Line</th>
<th>Corrected version of text</th>
</tr>
</thead>
<tbody>
<tr>
<td>100*</td>
<td>(2.9.22)</td>
<td>( \cdots + \frac{0.02j^6(-1)^{j-1}}{(j-1)!(7-j)!} \cdots )</td>
</tr>
<tr>
<td>113</td>
<td>–4</td>
<td>( \cdots ) Davidson. ( \cdots )</td>
</tr>
<tr>
<td>123</td>
<td>4</td>
<td>Replace ( \hat{x}_{n-2} ) with ( \hat{x}_n ).</td>
</tr>
<tr>
<td>123</td>
<td>14</td>
<td>( g(x) - a = (x - a)h(x) ) ( \cdots )</td>
</tr>
<tr>
<td>126</td>
<td>Prob. 47, Line 2</td>
<td>( \cdots y = 0.5 + h \cdot \tan^{-1}(x^2 + y^2) )</td>
</tr>
<tr>
<td>132*</td>
<td>(3.1.4)</td>
<td>( \cdots \prod_{0 \leq j &lt; i \leq n} \cdots )</td>
</tr>
<tr>
<td>140*</td>
<td>Table 3.1, col. 3</td>
<td>Add entry ( f[x_4, x_5] ) at the bottom of the column.</td>
</tr>
<tr>
<td>148*</td>
<td>–5</td>
<td>( 1 )</td>
</tr>
<tr>
<td>150*</td>
<td>–2</td>
<td>( \cdots (-.000005) = 1.466288 - .00000012 )</td>
</tr>
<tr>
<td>163</td>
<td>–4</td>
<td>have been used in a...</td>
</tr>
<tr>
<td>165</td>
<td>1</td>
<td>Replace ( \xi_x ) with ( \xi_i ).</td>
</tr>
<tr>
<td>165</td>
<td>(3.7.8)</td>
<td>( \cdots ) Max ( x_{i-1} \leq t \leq x_i \left</td>
</tr>
<tr>
<td>166</td>
<td>(3.7.10)</td>
<td>( \cdots ) Max ( x_{i-1} \leq t \leq x_i \left</td>
</tr>
<tr>
<td>176*</td>
<td>5</td>
<td>( \cdots \leq ) Max ( \alpha_{k-3} \ldots )</td>
</tr>
<tr>
<td>183</td>
<td>–5</td>
<td>( \cdots ) the most widely used...</td>
</tr>
<tr>
<td>191</td>
<td>Prob. 32(a), Line 4</td>
<td>( \cdots x_0 \leq x \leq x_3. )</td>
</tr>
<tr>
<td>192*</td>
<td>Prob. 38, Line 5</td>
<td>( \int_{x_0}^{x_n} [s''(x)]^2 , dx )</td>
</tr>
<tr>
<td>207</td>
<td>2</td>
<td>( \cdots ) Given ( f \in C[a, b] \ldots )</td>
</tr>
<tr>
<td>210*</td>
<td>–8</td>
<td>( \cdots \vphi(x) = \frac{1}{2} \sqrt{\frac{5}{2}}(3x^2 - 1) )</td>
</tr>
<tr>
<td>211</td>
<td>(4.4.14)</td>
<td>Replace ( m = m = 0 ) with ( m = n = 0. )</td>
</tr>
<tr>
<td>216</td>
<td>10, 11</td>
<td>Replace “orthogonal” with “orthonormal.”</td>
</tr>
<tr>
<td>216</td>
<td>–1</td>
<td>Change ( b_j ) to ( b_j ).</td>
</tr>
<tr>
<td>221</td>
<td>–3</td>
<td>Change ( \sum_{j=0}^{n} ) to ( \sum_{j=0}^{n} )</td>
</tr>
<tr>
<td>226</td>
<td>11</td>
<td>( \cdots ) theory of Fourier series...</td>
</tr>
<tr>
<td>227*</td>
<td>7</td>
<td>( \cdots \sqrt{5} - 1 = 0.414. ) Then</td>
</tr>
<tr>
<td>227*</td>
<td>–6</td>
<td>( \cdots &lt; \frac{2}{2n+5} \cdot \frac{\alpha^{2n+5}}{1 - \alpha^2} )</td>
</tr>
<tr>
<td>Page</td>
<td>Line</td>
<td>Corrected version of text</td>
</tr>
<tr>
<td>-------</td>
<td>--------</td>
<td>------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>228*</td>
<td>2</td>
<td>$\alpha^{2n+3} \cdots \frac{\alpha^{2n+3}}{2n+3} \cdots$</td>
</tr>
<tr>
<td>232*</td>
<td>(4.7.31)</td>
<td>$\cdots = \sum_{k=0}^{n} c_{n,k} T_k(x)$</td>
</tr>
<tr>
<td>241</td>
<td>Prob. 11(a), Line 2</td>
<td>$q_1'(x) = .955 + .414x$</td>
</tr>
<tr>
<td>258*</td>
<td>5</td>
<td>$\cdots = \sum_{j=1}^{n/2} \frac{\alpha^{2n+3}}{2n+3} \cdots \frac{\alpha^{2n+3}}{2n+3} \cdots$</td>
</tr>
<tr>
<td>258</td>
<td>(5.1.18)</td>
<td>Replace $= ,$ with $\dot{=}$.</td>
</tr>
<tr>
<td>261*</td>
<td>2</td>
<td>$\cdots f(x) = x^3 \sqrt{x} \cdots$</td>
</tr>
<tr>
<td>272*</td>
<td>(5.3.12)</td>
<td>$\cdots + \sum_{j=1}^{n} f'(x_j) \hat{h}_j(x)$</td>
</tr>
<tr>
<td>313*</td>
<td>(5.6.28)</td>
<td>$\cdots + h[\psi_1(j - 1) + \cdots$</td>
</tr>
<tr>
<td>315</td>
<td>2</td>
<td>the cases $w(x)\cdots$</td>
</tr>
<tr>
<td>320</td>
<td>3</td>
<td>Change $h^* = .0022$ to $h^* = .022$</td>
</tr>
<tr>
<td>338*</td>
<td>–12</td>
<td>$\cdots = f(x, Y(x; \epsilon)) \cdots$</td>
</tr>
<tr>
<td>338</td>
<td>–10</td>
<td>Replace $Z(x)$ with $Z(x; \epsilon)$</td>
</tr>
<tr>
<td>341</td>
<td>17</td>
<td>Change “given” to “give.”</td>
</tr>
<tr>
<td>348</td>
<td>1</td>
<td>Change “at least” to “about.”</td>
</tr>
<tr>
<td>348</td>
<td>–1</td>
<td>...leads to (6.2.24).</td>
</tr>
<tr>
<td>350</td>
<td>14</td>
<td>Further assume that $Y_0 = \hat{y}_0$. Then</td>
</tr>
<tr>
<td>352</td>
<td>2</td>
<td>$\cdots h = .01 ,$ case\ldots</td>
</tr>
<tr>
<td>352</td>
<td>(6.2.34)</td>
<td>$</td>
</tr>
<tr>
<td>360</td>
<td>9</td>
<td>$\cdots - y_h(x_n)</td>
</tr>
<tr>
<td>361</td>
<td>–16</td>
<td>...each step has an error</td>
</tr>
<tr>
<td>362</td>
<td>–6, –7</td>
<td>To analyze the convergence of (6.4.2), we use Theorem 6.6. From (6.4.1), (6.3.4), (6.3.5), we easily obtain that</td>
</tr>
<tr>
<td>366</td>
<td>–7</td>
<td>Change “decrease” to “oscillate.”</td>
</tr>
<tr>
<td>370*</td>
<td>(6.5.18)</td>
<td>$\cdots \left[ \frac{k^2}{12} |Y^{(3)}|_{\infty} \right]$</td>
</tr>
<tr>
<td>370</td>
<td>12</td>
<td>$\cdots$ Assuming $e_0 = \delta_0 h^2 + \cdots$</td>
</tr>
<tr>
<td>372</td>
<td>17</td>
<td>$\cdots = \frac{1}{3} [y_h(x_n) - \cdots$</td>
</tr>
<tr>
<td></td>
<td>table heading</td>
<td>Change last column heading to $\frac{1}{3} [y_h(x) - y_{2h}(x)]$.</td>
</tr>
</tbody>
</table>
Step 20 Append: “Also, \( x_1 := x_0 + h. \)"

\[ \cdots \max_{x_n \leq t \leq x} |Y(t) - u_n(t)| \geq x \]

... and \( Y'_j = Y'(x_j) \)

with \( x_{n-p+1} \leq \zeta_n \leq x_{n+1} \ldots \)

(6.8.24) is simply

... solution (6.8.22).

... of \( h \lambda \) are \(-1 < h \lambda < 0.\)

(6.9.9) \( \cdots + h\lambda \beta r^p \)

with \( r = 2 \) yields

\( \cdots \gamma_1 f(x, y) + \ldots \)

\( \cdots + f_y^4 f^2 \) \( ^{1/2} \)

(6.10.27) \( \cdots - F(x, z; h; f) \leq \cdots \)

(6.11.18) \( \cdots s_m = \frac{\varphi(s_m)}{\varphi'(s_m)} \ldots \)

(6.11.16) \( \ldots \) values are obtained from those in (6.11.16)\ldots

\( y'(0) = y'(1) = 0, \quad |y(x)| < \pi \)

... then \( Y(x; s^*) \) will satisfy

Prob. 14, Line 2 \( y_{n+1} = \frac{1}{2}(y_n + y_{n-1}) + \ldots \)

\( x = (1, 2, 3) \)

(6.10.30)

Prob. 13(b), Line 2 \( \ldots x, y \in \mathbb{R}^n \)

By examining in detail the structure of \( D \) and \( N \), based on their origin in the Jordan canonical form of \( A \), we have \( DN = ND \). Then

By examining in detail the structure of \( D \) and \( N \), based on their origin in the Jordan canonical form of \( A \), we have \( DN = ND \). Then

\( \| (I - A)^{-1} \| \| A \|^{m+1} \)

\( A^{-1}(B - A)B^{-1} \)
501* Prob. 21 Prove the following: for $x \in \mathbb{C}^n$

511 -6 \[
\begin{pmatrix}
    u_{1j} \\
    \vdots \\
    u_{jj} \\
    0 \\
    \vdots \\
    0
\end{pmatrix}
\]

517 -7 of $A$ by an appropriate...

519* 8 \[b_{ij} = \frac{a_{ij}}{s_i}, \quad j = 1, \ldots, n\]

519 \[\begin{pmatrix}
    a_{ik}^{(k)} \\
    s_i^{(k)}
\end{pmatrix}
\]

520 2 Insert the following sentence into Line 2, following “rows $i$ and $k$”: Also interchange the values of $s_i^{(k)}$ and $s_k^{(k)}$, and denote the resulting new values by $s_j^{(k+1)}, j = 1, \ldots, n$, most of which have not changed [see step 10 of the algorithm Factor, given below].

521 17. \[\text{det} := a_{nn} \cdot \text{det}; \quad \text{ierr} := 0 \quad \text{and exit the algorithm.}\]

522 Gauss-Jordan method...

525 -11 \[(8.3.9)\text{–}(8.3.12)\]...

525 -9 \[\ldots \text{the first row of $L$ times...}\]

525 \[(8.3.14)\]... $j = 1, \ldots, i - 1$

530 13 \[\|e\| \leq \ldots\]

530 -2 \[1 \leq \|I\| = \|AA^{-1}\|\ldots\]

537 1 \[\ldots \text{bound (8.4.23) is...}\]

537 -2 Change $\|\hat{x}\|$ to $\|\hat{x}\|_{\infty}$.

538* -1 \[\frac{\|R\|}{\|A\| \|C\|} \leq \frac{\|A^{-1} - C\|}{\|C\|} \leq \ldots\]

544* 8 \[= -\epsilon \begin{pmatrix}
    \frac{1}{4} & \frac{1}{2} & \frac{1}{4} \\
    -\frac{1}{2} & 0 & \frac{1}{2} \\
    -\frac{1}{4} & -\frac{1}{2} & -\frac{1}{4}
\end{pmatrix}\]
\[ \alpha_i = \sum_{j=1}^{i-1} \left| \frac{a_{ij}}{a_{ii}} \right| \ldots \]

548* 12 partial differential equations.

552 4 \ldots rather than the much smaller \ldots

553* -10 \ldots the “bilinear” interpolation \ldots

561* -10 \ldots van der Vorst (1986) \ldots

564 1 Replace “that” with “than.”

567 -14 \ldots and van der Vorst

574 1 \ldots van der Vorst (1986) \ldots

575* Prob. 4 \ldots \int_0^1 \cos(\pi \ell x(t)) \, dt \ldots

580* Prob. 29, Line 3 \ldots \| A_i \| + \| C_i \| < \frac{1}{\| B_i^{-1} \|}, \ldots

581* Prob. 31, Line 3 \[ x^{(k+1)} = b + A x^{(k)}, \quad k \geq 0 \]

582* Prob. 34(a), Line 1 \ldots in (8.8.1) to the

590 18–21 Let \( S \) be a connected union of \( m \) of the circles, all of which are disjoint from the remaining \( n - m \) circles. Each path \( \Gamma_1 \equiv \{ \lambda_1(\varepsilon) \mid 0 \leq \varepsilon \leq 1 \} \) which begins at a center \( a_i \) within \( S \) must remain within it. To see this, first note from above that \( \Gamma_i \) must remain in the union of all \( Z_k(1) \). If \( \Gamma_i \) does not remain in \( S \), then it must be in one of the remaining \( n - m \) circles for some values of \( \varepsilon \). But this will contradict the continuity of \( \lambda_i(\varepsilon) \) as \( S \) is not connected to the remaining \( n - m \) circles. Since the number of eigenvalues counted as roots of \( \det(A - \lambda I) \) is constant, the above argument shows that the number of such eigenvalues within each connected component \( S \) must remain constant for \( 0 \leq \varepsilon \leq 1 \). This proves the second result.

593 -1 \[ \| E \|_2 = \ldots \]

600 15 are the normalized eigenvectors \ldots

600 (9.1.41) \[ \cdots = u_k + \varepsilon a_k u_k + \varepsilon \sum_{j=1}^{n} \frac{1}{j \neq k} \]

603 5 Let \( \beta_m \) be a \ldots

603 6 \[ z^{(m)} = \frac{w^{(m)}}{\beta_m} \ldots \]
<table>
<thead>
<tr>
<th>Page</th>
<th>Line</th>
<th>Corrected version of text</th>
</tr>
</thead>
<tbody>
<tr>
<td>603</td>
<td>–10</td>
<td>( z^{(1)} = \frac{w^{(1)}}{\beta_1} = \ldots )</td>
</tr>
<tr>
<td>603*</td>
<td>–7</td>
<td>( \ldots \sigma_1 \frac{A^2 z^{(0)}}{|A z^{(0)}|_\infty} )</td>
</tr>
<tr>
<td>603</td>
<td>–6</td>
<td>( \beta_2 = \mu \ldots )</td>
</tr>
<tr>
<td>603</td>
<td>–5</td>
<td>( z^{(2)} = \frac{w^{(2)}}{\beta_2} = \ldots )</td>
</tr>
<tr>
<td>604*</td>
<td>–3</td>
<td>( \lambda_1^{(m)} = \left[ \sigma_m \cdot \frac{A^m z^{(0)}}{|A^{m-1} z^{(0)}|_\infty} \right] k \ldots )</td>
</tr>
<tr>
<td>610*</td>
<td>–3</td>
<td>( \ldots = [0_{r-1}, \hat{w}^T]^T )</td>
</tr>
<tr>
<td>611*</td>
<td>11</td>
<td>( w = \begin{bmatrix} 0_{r-1} \ v \end{bmatrix} )</td>
</tr>
<tr>
<td>616</td>
<td>–6</td>
<td>( T ) is related to ( A ) by</td>
</tr>
<tr>
<td>621</td>
<td>–1</td>
<td>( (1, -1, 0, 1, -1, 0, 1) )</td>
</tr>
<tr>
<td>627</td>
<td>(9.5.16)</td>
<td>( \ldots ) as ( m \to \infty )</td>
</tr>
<tr>
<td>627</td>
<td>–10</td>
<td>From (9.5.13),</td>
</tr>
<tr>
<td>629</td>
<td>11</td>
<td>(9.2.2)–(9.2.3); and for simplicity in analysis and implementation, we replace ( \beta_m ) by ( |w^{(m+1)}|_\infty ).</td>
</tr>
<tr>
<td>630</td>
<td>(9.6.11)</td>
<td>( \ldots ) ( U w^{(1)} = e )</td>
</tr>
<tr>
<td>632</td>
<td>8</td>
<td>( \ldots - E \hat{z} \hat{z}^{(m)} )</td>
</tr>
<tr>
<td>632</td>
<td>9</td>
<td>Using ( |z^{(m)}|<em>2 \leq \sqrt{n}|z^{(m)}|</em>\infty \leq \sqrt{n} ), the residual ( \eta ) satisfies</td>
</tr>
<tr>
<td>632</td>
<td>10</td>
<td>( + \frac{\sqrt{n}}{|\hat{w}|_2} )</td>
</tr>
<tr>
<td>632</td>
<td>11</td>
<td>( + \frac{\sqrt{n}}{|\hat{w}|_2} )</td>
</tr>
<tr>
<td>632</td>
<td>–4</td>
<td>( \eta = A \hat{z} - \lambda \hat{z} = \ldots )</td>
</tr>
<tr>
<td>635</td>
<td>–11</td>
<td>( \ldots ) For any ( x \in \mathbb{R}^n ) and any…</td>
</tr>
<tr>
<td>637</td>
<td>–15</td>
<td>Replace (8.7.20) with (9.7.20)</td>
</tr>
</tbody>
</table>
From (9.7.19), if...

Replace the table headings as follows:

$x_i \rightarrow t_i, y_i \rightarrow b_i$

Change label on horizontal scale from $x$ to $t$.

$mn^2 + \frac{n^3}{3}$

... $[x^T A^T A x \geq 0$ for all $x]$...

above the diagonal. Thus $R$ has the form of the matrix $F$ of (9.7.5). We will then have $R = F$

with $\mu_i = \sqrt{X_i}$. Letting $B = AU$ in (9.7.42), we

have the desired SVD:

$u_k(\epsilon) = u_k(0) + ...$

$\cdots + A^T A)^{-1} A^T = A^+$

NETLIB@ORNL.GOV on INTERNET

The Mathworks, Inc.
3 Apple Hill Drive
Natick, MA 01760-2098
URL: www.mathworks.com
E-mail: info@mathworks.com

Prob. 39

$B_i^{(m)}(x) = \frac{x_{i+m} - x}{x_{i+m} - x_{i+1}} B_i^{(m-1)}(x) + \frac{x - x_i}{x_{i+m-1} - x_i} B_i^{(m-1)}(x)$