Errata for Third Printing of Numerical Methods with MATLAB: Implementations and Applications

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This document lists only the technical errors in the mathematics or in the prose. Typographical errors in spelling and punctuation are not included. Some changes to the prose to clarify a technical concept are noted. The errors noted here are in the *third printing*.

Chapter 2: Interactive Computing in MATLAB

page 36

At about the middle of the page the expression `>> x = (end-3,end) = [\,]` should be

```
x(end-3,end) = []
```

page 81, Exercise 28

The tabulated data for viscosity of water are inconsistent with the contents of `H2Ovisc.dat`. The data in `H2Ovisc.dat` are correct. The table should read

T °C	μ_{air} kg/(m·s)	T °C	$\mu_{\text{H}_2\text{O}}$ kg/(m·s)
0	1.720×10^{-5}	0	1.787×10^{-3}
20	1.817×10^{-5}	5	1.519×10^{-4}
40	1.911×10^{-5}	10	1.307×10^{-4}
60	2.002×10^{-5}	20	1.002×10^{-4}
80	2.091×10^{-5}	30	7.975×10^{-4}
100	2.177×10^{-5}	40	6.529×10^{-4}
127	2.294×10^{-5}	50	5.468×10^{-4}
177	2.493×10^{-5}	60	4.665×10^{-4}
227	2.701×10^{-5}	70	4.042×10^{-4}
		80	3.547×10^{-4}
		90	3.147×10^{-4}
		100	2.818×10^{-4}

Chapter 3: MATLAB Programming

page 145, Exercise 24

On the third line of page 145, the formula for $x_{\max}$ should be $x_{\max} = L - \sqrt{b(b+2a)/3}$. The closing parenthesis should immediately follow a, not 3.

Chapter 5: Unavoidable Errors in Computing

page 197

In the last line of the page, change $\sum_{j=1}^{k} b_k 2^{-k}$ to $\sum_{j=1}^{k} b_j 2^{-j}$, i.e., replace k inside the sum with j.

page 198

In the displayed equation at the top of the page, change $\sum_{j=1}^{k} b_k 2^{-k}$ to $\sum_{j=1}^{k} b_j 2^{-j}$, i.e., replace k inside the sum with j.

page 198, Algorithm 5.1

Inside the `else` block, the line $r_k = r_{k-1}$ is missing. The correct version of the algorithm is

Algorithm 5.1 Conversion from Floating-Point to Binary

$r_0 = \mathrm{x}$
for $k = 1, 2, \ldots, m$
  if $r_{k-1} \geq 2^{-k}$
    $b_k = 1$
    $r_k = r_{k-1} - 2^{-k}$
  else
    $b_k = 0$
    $r_k = r_{k-1}$
  end if
end for

page 218

The displayed equation for T_k is missing a minus sign on the right hand side. The correct equation is

$$T_k = -\frac{x^2}{k(k-1)} T_{k-2}.$$

The code in `sinser` is correct.

page 226

In Equation (5.24) and in the last sentence of the paragraph preceding Equation (5.24), change $E(h, x)$ to $E(x, h)$.

Chapter 6: Finding the Roots of $f(x) = 0$

page 253

In the displayed equation in §6.2.1, the convergence criteria for fixed point iteration should read

$$\left|g'(x)\right| < 1, \quad \text{and} \quad a \le g(x) \le b, \quad \text{for all } x : a \le x \le b.$$

page 254, Algorithm 6.3

In the fourth line of the algorithm, the test should be

$$\text{if sign}\left(f(x_m)\right) = \text{sign}\left(f(a)\right)$$

i.e., replace $f(x_a)$ with $f(a)$.

page 257

There is a minus sign missing from the right hand side of equation immediately under Table 6.1. The equation should read

$$n = -\log_2\left(\frac{\delta_n}{\delta_0}\right)$$

page 272

The displayed equation for Δx near the middle of the page is missing a minus sign on the right hand side. The correct equation is

$$\Delta x = -f(x_k)\frac{x_k - x_{k-1}}{f(x_k) - f(x_{k-1})}.$$

page 281

The order of the c_i in Equation (6.15) are reversed. The correct form of the equation is

$$c_1\lambda^4 + c_2\lambda^3 + c_3\lambda^2 + c_4\lambda + c_5 = 0. \tag{6.15}$$

page 285, Exercise 7

$|g'(x) < 1|$ should be $|g'(x)| < 1$.

page 286, Exercise 14

In the third line, the stopping criterion should be $|f(x)| < 5 \times 10^{-10}$, not $f(x) < 5 \times 10^{-10}$.

Chapter 7: A Review of Linear Algebra

page 318, Algorithm 7.2

The statement "initialize $b = \texttt{zeros}(n, 1)$" should be "initialize $b = \texttt{zeros}(m, 1)$"

page 358, Exercise 7
Part (b) (only) should read

> Column scaling: $B = AD$, ...

page 360, Exercise 19
At the end of the last sentence, replace γ with ζ.

Chapter 8: Solving Systems of Equations

page 394, Algorithm 8.5
Replace the fourth line of the algorithm with

> find i_p such that $|\tilde{a}_{i_p,i}| = \max(|\tilde{a}_{ki}|)$ for $k = i \ldots n$

page 405
The value of δ specified in the second line of text is inconsistent with the value of the first element of `bp` in the MATLAB example. Change $\delta = 0.01$ to $\delta = 0.001$. In other words, the second equation on the page should read

> Consider $b' = [1 + \delta,\ 2]^T$ where $\delta = 0.001$.

page 407
Insert "with pivoting" after "elimination" in the second rule of thumb at the bottom of the page (inside the box). The second rule of thumb should read

> ...the numerical solution to $Ax = b$ by any variant of Gaussian elimination with pivoting is correct to d digits, ...

page 411
The displayed equation in the middle of the page should read

$$Ux = y$$

i.e., replace b with y.

page 412
In the last two displayed equations on the page, change $j = 1, \ldots, n$ to $k = i + 1, \ldots, n; j = i, \ldots, n$. In Equation (8.41), change m_{ki} to m_{kj}.

Chapter 10: Interpolation

page 528, Equation (10.4)
The exponent of the second term on the right hand side should be $n-2$, not $n-1$.

page 529, Example 10.4

The price for 1986 should be 133.5, not 113.5.

page 530

In third line of the paragraph preceding Equation (10.8) is a reference to Equation (8.38). Equation (8.38) is on page 407, not page 363.

page 538

In the equation for $P_n(x)$, the last term contains an extraneous factor of $(x - x_{n+1})$. The correct definition of $P_n(x)$ is

$$P_n(x) = c_1 + c_2(x - x_1) + c_3(x - x_1)(x - x_2) + \cdots + c_{n+1}(x - x_1)(x - x_2)\cdots(x - x_n),$$

page 545, Example 10.8

Two thirds down the page, after "The fourth and fifth columns are filled in with", the displayed equations for the third order and fourth order divided differences contain errors. The denominators of both terms are reversed (the have the wrong sign), and the arguments of the divided differences in the numerator are in the wrong order. The correct versions of these equations are

$$f[V_{i-2}, V_{i-1}, V_i] = \frac{f[V_{i-1}, V_i] - f[V_{i-2}, V_{i-1}]}{V_i - V_{i-2}}$$

and

$$f[V_{i-3}, V_{i-2}, V_{i-1}, V_i] = \frac{f[V_{i-2}, V_{i-1}, V_i] - f[V_{i-3}, V_{i-2}, V_{i-1}]}{V_i - V_{i-3}},$$

page 562

In Equation 10.35, the x on the left hand side should be $\hat{x}$. In other words the left hand side of the equation is $P_i(\hat{x}) =$.

page 563

In Equation 10.36, the x on the left hand side should be $\hat{x}$. In other words the left hand side of the equation is $P_i(\hat{x}) =$.

page 583, Figure 10.19

The legend in each of the subplots is incorrect. The solid line is $x\exp(-x)$ and the dashed line is the spline plot. The correct plot is created with the `compSplinePlot` function in version 1.04 of the NMM toolbox.

Chapter 11: Numerical Integration

page 599, Example 11.1

The the upper limit of the integral is $\pi/2$ (not 2π), the width of the sheet is $L = 2aE$ (not $4aE$), and the parameter of the elliptic integral is $k^2 = 1 - b^2/a^2$ (not $k = 1 - b^2/a^2$).

page 603

In the middle of the page, the integrand should be $x^3 - c$, not $x^3 - 1$.

page 613, Equation (11.9)

The three coefficients involving h^2 should be $1/(2h^2)$, $-1/h^2$, and $1/(2h^2)$, respectively. The correct form of Equation (11.9) is

$$P_2(x) = \frac{1}{2h^2}(x - x_2)(x - x_3)f_1 - \frac{1}{h^2}(x - x_1)(x - x_3)f_2 + \frac{1}{2h^2}(x - x_1)(x - x_2)f_3 \tag{11.9}$$

page 613, Figure 11.9

On the right half of the figure, the point labelled (x_{n-3}, f_{n-3}) should be (x_{n-4}, f_{n-4}).

page 617

In the first line of the expression for $\int_a^b P_n(x)\,dx$, the second term has subscripts of 1 instead of 2. The correct expression is

$$\int_a^b P_n(x)\,dx = \int_a^b \left[L_1(x)f_1 + L_2(x)f_2 + \cdots + L_n(x)f_n\right]\,dx$$

page 621

In the last sentence on the page, change "which is a factor of 100 smaller than the error produced by Simpson's rule" to "much smaller than the error produced by the Trapezoid rule"

page 636, Figure 11.13

In the right half of the diagram, the two intervals are incorrectly labelled as having a size of 1/2 in the transformed coordinate z. The correct interval width is one, which is consistent with the magnitudes on the z axis.

page 649

In the second displayed equation from the top of the page, in Equation (11.41), and in Equation (11.42), replace $S_1 - S_2$ with $S_2 - S_1$. (In other words, make the change in three places.)

page 669, Exercise 7

The variable `y` does not appear in the `trapezoid` function. Change all occurrences of `y` to `f`. The displayed line of code should read

```
I = h * (0.5*f(1) + sum(f(2:n)) + 0.5*f(n));
```

On the first line of page 670, change `y(2:n-1)` to `f(2:n-1)`, and change `y(2:n)` to `f(2:n)`.

Chapter 12: Numerical Integration of ODEs

page 688, Equation (12.14)
Change $f(t, y)$ to $f(t, z_j)$.

page 717
In the eighth line from the bottom of the page, change α_1 to α_2. The sentence in the middle of the line should begin

> The α_2 coefficient describes both ...

Appendix A: Eigenvalues and Eigensystems

page 756
In the third line from the top of the page, insert "square roots of" before "eigenvalues". The corrected text should read

> the singular values of A are the square roots of the eigenvalues of $A^T A$ if $m \geq n$...