Errata for the Indian Edition (ISBN 978-81-317-6436-7) of "Understanding Digital Signal Processing, 3/E",

by Richard Lyons

I beg your pardon for the typographical errors in the book. (Almost 40% of those errors were caused by faulty software at the Printer, and cannot be detected until after the book is actually printed.) It will not take long to make these corrections. I promise.

-Rick Lyons-

Page 43: The text in the first line of this page should be changed from

"... in Figures 2-9(c) and 2-9(d)."

to:

"... in Figures 2-9(a), 2-9(b), and 2-9(e)."

[Found by Walter Schulte (6/6/11)]; [Author Error]

Page 43: In Figure 2-10 the strange 'ñ' characters should be minus signs.

[Found by Author (9/14/11)]; [Production Error]

Page 57: On the right side of Eq. (3-6), the text:

"X_(m)"

should be:

"$X_{\phi}(m)$"

as it is on the left side of Eq. (3-8).

[Found by Turki Almadhi (12/5/10)]; [Production Error]

Page 58: On the right side of Eq. (3-10) there is a missing right parenthesis between the "4" and the period. The equation should end with:

"...+3π/4**)**."

[Found by Lionel Keene (12/18/10)]; [Production Error]

Page 77: In the third line of the text, the words:

"... Sections 3.14 and 3.15 discuss ..."

should be changed to:

"... Section 3.13 discusses ..."

[Found by Lionel Keene (12/29/10)]; [Author Error]

Page 90: In the second line of Section 3.10, the text:

"... in Section 3.16, for ..."

should be changed to:

"... in Section 3.13, for ...".

[Found by Anonymous (11/27/11)]; [Author Error]

Page 91: In the sixth line from the bottom of the page, the value:

"... or -1.45 dB, ..."

should be changed to:

"... or **-1.72** dB, ...".

[Found by Rajeev Krishnamurthi (4/10/12)]; [Author Error]

Page 101: The last term in Equ. (3-37) has a missing minus sign in its exponent. The last term should be:

$$\ldots + e^{-jq(K-1)}].$$

[Found by Stan Moore, 3/19/12.][Production Error]

Page 114: Here's a truly strange error by the typesetting people. Equation (3-51), printed as:

$$\sum_{n=-\infty}^{\infty} x(n)e^{-j\omega n}$$

should be changed to:

$$X(\omega) = \frac{\sin(N\omega/2)}{\sin(\omega/2)}.$$

[Found by Stan Shear (4/3/13)]; [Production Error]

On page 136, in Figure 4-2, the lower right four twiddle factors:

W_8^4, W_8^5, W_8^6, W_8^7

should be

$-W_8^0$, $-W_8^1$, $-W_8^2$, $-W_8^3$

[Found by Saul Iverson, 10/3/17.][Author Error]

Page 179: In the line just above Eq. (5-10), the text:

"... as Eq. (3-59), is ... "

should be changed to:

"... as Eq. (3-**47**), is ... "

[Found by Stan Shear (4/4/13)]; [Author Error]

Page 212: In the first line of text, in the text:

"... impulse response $x(k)$ of ..."

the "x" should be changed to "h" making the text read as:

"... impulse response $\boldsymbol{h}(k)$ of ...""

[Found by Martin Forrester (3/28/11)]; [Author Error]

Page 219: The third term on the right side of Eq. (5-35)

"... $h(2)e^{-j0\omega}$ ..."

should be:

"... $h(2)e^{-j2\omega}$ ...".

[Found by Mark Tachiki (11/28/13)]; [Author Error]

Page 285: In the 7th line up from the bottom of the page, the text printed as:

"$(3!)^2 = 24$"

should be changed to:

"$(3!)^2 = \mathbf{36}$"

[Found by Bert RAM Aerts (8/30/14)]; [Production Error]

Page 346: The denominators in Eq. (7-10) printed as:

$$h_{SL1}(k) = \frac{-1}{6}, \frac{8}{6}, 0, \frac{-8}{6}, \frac{1}{6} \qquad (7\text{-}10)$$

should be changed to:

$$h_{SL1}(k) = \frac{-1}{12}, \frac{8}{12}, 0, \frac{-8}{12}, \frac{1}{12} \qquad (7\text{-}10)$$

[Found by Author (4/20/14)]; [Author Error]

Page 346: The denominators in Eq. (7-11) printed as:

$$h_{SL2}(k) = \frac{-22}{126}, \frac{67}{126}, \frac{58}{126}, 0, \frac{-58}{126}, \frac{-67}{126}, \frac{22}{126} \qquad (7\text{-}11)$$

should be changed to:

$$h_{SL2}(k) = \frac{-22}{252}, \frac{67}{252}, \frac{58}{252}, 0, \frac{-58}{252}, \frac{-67}{252}, \frac{22}{252} \qquad (7\text{-}11)$$

[Found by Joseph Galante (4/15/14)]; [Author Error]

Page 266: In the 3rd line from the top, the expression:

"$-\pi \leq \omega \leq +\omega$"

should be changed to:

"$-\pi \leq \omega \leq +\pi$"

[Found by Mark Tachiki (12/5/13)]; [Author Error]

Page 286: In the center Section 2 portion of Figure 6-27, the printed

b'(0)

should be changed to:

b''(0)

[Found by Yancen Li (8/11/14)]; [Author Error]

Page 305: In the eleventh line below Eq. (6-104)

"... 6-21(b). Knowing that ..."

should be changed to:

"... 6-22(c). Knowing that ..."

[Found by Yancen Li (7/14/14)]; [Author Error]

Page 312: In the third line from the bottom of the page, the text

"...in the form of Eq. (6-43)."

should be changed to:

"...in the form of Eq. (6-60)."

[Found by Yancen Li (8/11/14)]; [Author Error]

Page 317: In the fourth line from the top of the page, the text

"...design filter in Figure 6-28(a)... "

should be changed to:

"...design filter in Figure 6-36(a)... "

[Found by Yancen Li (8/11/14)]; [Author Error]

Page 348: The upper right side of Eq. (7-13) contains four typos as shown by the red ovals n the following expression.

$$= \frac{j}{2\pi}\left[\frac{e^{j\omega_c k}}{k} - \frac{j\omega_c e^{j\omega_c k}}{k} - \frac{e^{-j\omega k}}{k^2} + \frac{j\omega_c e^{-j\omega_c k}}{k}\right]$$

That part of Eq. (7-13) should be changed to:

$$= \frac{j}{2\pi}\left[\frac{e^{j\omega_c k}}{k^2} - \frac{j\omega_c e^{j\omega_c k}}{k} - \frac{e^{-j\omega_c k}}{k^2} - \frac{j\omega_c e^{-j\omega_c k}}{k}\right]$$

[Found by Author, (1/22/11)]; [Author & Production Error]

Page 443: In the 3rd line up from the bottom of the page, the text:

"... and use Eq. (2-13) with m_{odd} = 5 to set ..."

should be changed to:

"... and use Eq. (2-11) with k = 3 to set ..."

[Found by Jiwoo Kim, (2/5/12)]; [Author Error]

Page 484: In the 12th line, the text:

"... band *B*v, the ..."

should be changed to:

"... band *B*', the ...".

[Found by Jiwoo Kim, (1/12/12)]; [Author Error]

Page 486: Eq. (5-3) contains two inappropriate small 'a' characters. The printed Eq. (5-3) should be changed to:

$$N \approx \frac{Atten}{22(f_{stop} - f_{pass})} = \frac{60}{22(2.2/400 - 1.8/400)} \approx 2727$$

[Found by Author, (6/16/11)]; [Production Error]

Page 489: **In Figure 10-5(c) the frequency axis labels marked**

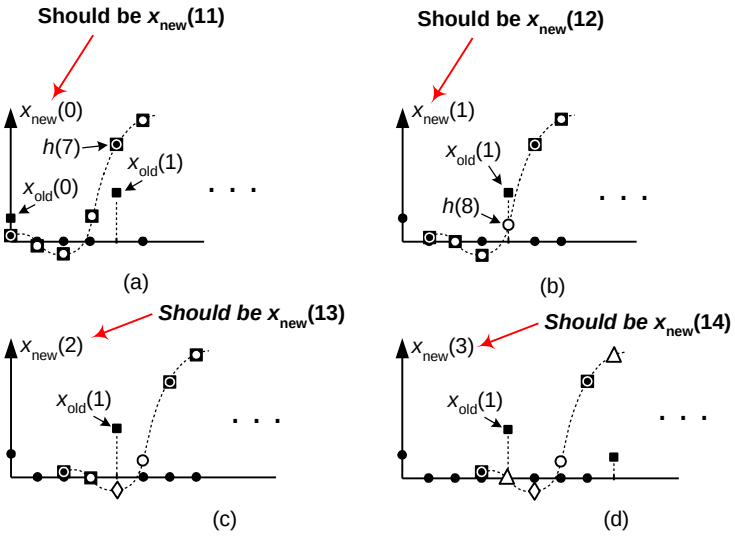
$(-3f_{s,old})$ and $(3f_{s,old})$

should be:

$(-3f_{s,new})$ and $(3f_{s,new})$.

[Found by Author, (2/25/17)]; [Author Error]

Page 497: The labels of the vertical axes in Figure 10-11 should be changed as shown below.



[Found by Martin Forrester (3/24/11)]; [Author Error]

Page 530: On the left side of Figure 10-35 all instances of of

"±"

should be changed to:

"-", minus signs.

[Found by Author, (9/14/11)]; [Production Error]

Page 531: On the left side of Figure 10-36 all instances of of

"±"

should be changed to:

"-", minus signs.

[Found by Author, (9/14/11)]; [Production Error]

Page 535: At the upper-left side of Table 10-2, the "$v(n)$" (circled in **red** below):

	Three-bit integrator accumulator				Four-bit integrator accumulator		
n	$v(n)$	$w(n–5)$	$v(n)$		$w(n)$	$w(n–5)$	$v(n)$
0	0	0	0		0	0	0
1	1	0	1		1	0	1

should be changed to

"$w(n)$"

making the upper-left side of the Table 10-2 look as shown below:

	Three-bit integrator accumulator				Four-bit integrator accumulator		
n	$w(n)$	$w(n–5)$	$v(n)$		$w(n)$	$w(n–5)$	$v(n)$
0	0	0	0		0	0	0
1	1	0	1		1	0	1

[Found by Author (2/1/11)]; [Author Error]

Page 548: In the next to the last line before Figure P10-10 complex-valued expression:

$$e^{-j2n/4}$$

should be changed to:

$$e^{-j2\pi n/4}$$

[Found by Renato Lopes, (10/29/13)]; [Author Error]

Page 620: On the 2nd and 3rd lines down from the top, the references to Eqs. (D-11) and (D-12) should be changed to Eqs. (D-28) and (D-29).

[Found by Prof. Kip Haggerty (1/1/16)]; [Author Error]

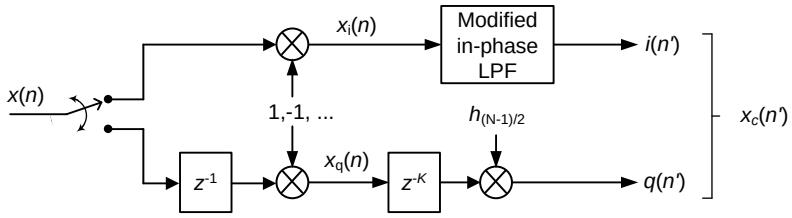
Page 645: In Figure 13-2(b) and 13-2(d), the verical axes should be labeled '$\phi(m)$' and '$\phi_{1,-1}(m)$' respectively.

[Found by Jiwoo Kim (2/18/12)]; [production Error]

Page 650: in the fifth line down, delete the text:

"...followed by another K delay..."

In Figure 13-6(c) the final z^{-K} delay block should be deleted making that figure become:



[Found by Brian Frantz, 8/8/17.][Author Error]

Page 654: In the second part of Equation (13-7), printed as:

$$|V| = \begin{cases} \text{Max} + \text{Min}/8, & \text{if Min} < 3\text{Max}/8 \\ 27\text{Max}/32 + 19\text{Min}/16, & \text{if Min} \geq 3\text{Max}/8 \end{cases} \qquad (13\text{–}7)$$

the "19" should be changed to a "9", making the equation look like:

$$|V| = \begin{cases} \text{Max} + \text{Min}/8, & \text{if Min} < 3\text{Max}/8 \\ 27\text{Max}/32 + 9\text{Min}/16, & \text{if Min} \geq 3\text{Max}/8 \end{cases} \qquad (13\text{–}7)$$

[Found by Author (4/2/11)]; [Author Error]

Page 655: On the left side of the third line up from the bottom of Table 13-2, in the expression:

27Max/32 + 19Min/16

the "19" should be changed to a "9", making the expression look like:

27Max/32 + 9Min/16

[Found by Author (4/2/11)]; [Author Error]

Page 663: This page contains **seven** software-induced "typos" where an angle symbol ("∠") was inadvertently replaced by a hyphen followed by a space ("- "). Those typos are circled in red in the left panel below. The corrections are shown below in the right panel. (Correct angle symbols ("∠") can be seen at the bottom right of page 697.)

For example, the top line below should look like:

$$= \frac{0 - j7.9999}{2} = 0 - j4 = 4\angle\text{-}90^{\text{o}}$$

$$= \frac{0 - j7.9999}{2} = 0 - j4.0 = \boxed{4-}\ -90^{o},$$

$$X_a(2) = \frac{X_r(6) + X_r(2) + j[X_i(2) - X_i(6)]}{2} = \frac{0.0 + 2.8282 + j[2.8282 - 0.0]}{2}$$

$$= \frac{2.8282 + j2.8282}{2} = 1.414 + j1.414 = \boxed{2-}\ 45^{o},$$

$$X_a(3) = \frac{X_r(5) + X_r(3) + j[X_i(3) - X_i(5)]}{2} = \frac{0.0 + 0.0 + j[0.0 - 0.0]}{2} = \boxed{0-}\ 0^{o},$$

$$X_a(4) = \frac{X_r(4) + X_r(4) + j[X_i(4) - X_i(4)]}{2} = \frac{0.0 + 0.0 + j[0.0 - 0.0]}{2} = \boxed{0-}\ 0^{o},$$

$$X_a(5) = \frac{X_r(3) + X_r(5) + j[X_i(5) - X_i(3)]}{2} = \frac{0.0 + 0.0 + j[0.0 - 0.0]}{2} = \boxed{0-}\ 0^{o},$$

$$X_a(6) = \frac{X_r(2) + X_r(6) + j[X_i(6) - X_i(2)]}{2} = \frac{2.8282 + 0.0 + j[0.0 - 2.8282]}{2}$$

$$= \frac{2.8282 - j2.8282}{2} = 1.414 - j1.414 = \boxed{2-}\ -45^{o}, \text{ and}$$

$$X_a(7) = \frac{X_r(1) + X_r(7) + j[X_i(7) - X_i(1)]}{2} = \frac{-2.8282 + 2.8282 + j[6.8282 + 1.1717]}{2}$$

$$= \frac{0.0 + j7.9999}{2} = 0 + j4.0 = \boxed{4-}\ 90^{o}.$$

Replace:	With:
= 4- -90°	= 4∠-90°
= 2- 45°	= 2∠45°
= 0- 0°	= 0∠0°
= 0- 0°	= 0∠0°
= 0- 0°	= 0∠0°
= 2- -45°	= 2∠-45°
= 4- 90°	= 4∠90°

[Found by Author, (1/29/11)]; [Production Error]

Continued on next page ....

Page 664: Similar to the typos on page 691, this page contains **four** "typos" where an angle symbol ("∠") was incorrectly replaced by a hyphen followed by a space ("- "). Those typos are circled in red in the left panel below. The corrections are shown below in the right panel.

$$= \frac{5.656 + j5.656}{2} = 2.828 + j2.828 = \boxed{4-}\ 45^{o},$$

$$X_b(2) = \frac{X_i(6) + X_i(2) + j[X_r(6) - X_r(2)]}{2} = \frac{0.0 + 2.8282 + j[0.0 - 2.8282]}{2}$$

$$= \frac{2.8282 - j2.8282}{2} = 1.414 - j1.414 = \boxed{2-}\ -45^{o},$$

$$X_b(3) = \frac{X_i(5) + X_i(3) + j[X_r(5) - X_r(3)]}{2} = \frac{0.0 + 0.0 + j[0.0 - 0.0]}{2} = \boxed{0-}\ 0^{o}, \text{ and}$$

$$X_b(4) = \frac{X_i(4) + X_i(4) + j[X_r(4) - X_r(4)]}{2} = \frac{0.0 + 0.0 + j[0.0 - 0.0]}{2} = \boxed{0-}\ 0^{o}.$$

Replace:	With:
= 4- -45°	= 4∠45°
= 2- -45°	= 2∠-45°
= 0- 0°	= 0∠0°
= 0- 0°	= 0∠0°

[Found by Author, (1/29/11)]; [Production Error]

Page 664: In the first line of the last paragraph, the text:

"From Section 4.4, ..."

should be changed to:

"From Section **4.6**, ..."

[Found by Author (2/23/11)]; [Author Error]

Page 713: In the first line of Table 13-4, the two values:

Real multiplies	Real additions
4N	2N

should be changed to:

Real multiplies	Real additions
2N	**2(N-1)**

[Found by Pavel Rajmic (3/5/14)]; [Author Error]

Page 720: In the first line of Table 13-5, the four values:

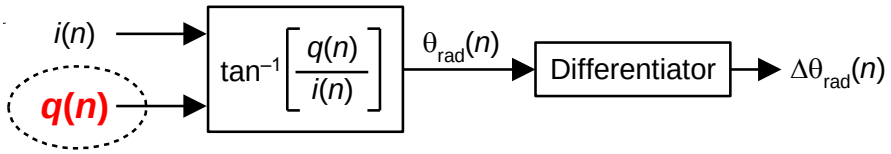
Real multiplies	Real additions	Real multiplies	Real additions
4N	2N	4N	2N

should be changed to:

Real multiplies	Real additions	Real multiplies	Real additions
2N	**2(N-1)**	**2N**	**2(N-1)**

[Found by Author (3/5/14)]; [Author Error]

Page 731: In Figure 13-60, the the two inputs to the arctangent operation should be:



[Found by Kendall Castor-Perry (8/10/12)]; [Production Error]

Page 777: In the third line of the first paragraph the text:

"... in Figure 13-92(c),"

should be changed to:

"... in Figure 13-9**1**(c),"

[Found by Les Mills (5/3/11)]; [Author Error]

Page 785: In the third line up from the bottom of the page, the text:

"... 13-99(c)."

should be changed to

"... 13-99(**b**)."

[Found by Author (1/23/11)]; [Author Error]

Page 786: In the fourth line below Eq. (13-162), the text:

"... Figure 13-99(c) ..."

should be changed to

"... Figure 13-99(**b**) ..."

[Found by Author (1/23/11)]; [Author Error]

Page 812: In the first paragraph following Figure 13-121, that starts with "Ah, but there's ...",there are three instances of the expression:

$$e^{-j2\pi m/N}$$

Those expressions should have the letter "*n*" inserted in the exponent, making all <u>three</u> expressions read as:

$$e^{-j2\pi nmN}$$

[Found by Author, 7/9/12.][Author Error]

Page 821: The left side of Equ. (A-5) looks like the following:

$$-_r = \frac{\pi\phi_d}{180}.$$

The minus sign should be a Greek ϕ making Eq. (A-5) look like:

$$\phi_r = \frac{\pi\phi_d}{180}.$$

[Found by Stan Moore, 3/19/12.][Production Error]

Page 826: The cube root bar on the right side of Eq. (A-27) should not extend over the angle argument. The right side of Eq. (A-27) should look as follows:

$$\ldots = \sqrt[3]{125}\, e^{j(75^o+n360^o)/3} \qquad \text{(A-27)}$$

[Found by Turki Almadhi (12/1/10)]; [Production Error]

Page 847: Two corrections: On the left side of the second line of Eq. (D-12), the term:

"... $-\cos(\omega t)]$ ...

should be:

"... $-\cos(\mathbf{2}\omega t)]$ ...

On the right side of the second line of Eq. (D-12), the term:

"... $-\frac{1}{2}(\sin(\omega t))$..."

should be:

"... $-\frac{1}{4}(\sin(\mathbf{2}\omega t))$..."

[Found by Julian Vrbancich, 10/23/12; [Author Error]

Dear Reader, if you find any additional errors, no matter how trivial, please notify me at: **R.Lyons@ieee.org**
I'd sure appreciate hearing from you and I promise I'll reply to your E-mail.

A suggestion: This errata is complete on the day you first received it. However, I have learned over the years that because of the way books are produced, as time goes by additional typographical errors will be detected. So what this means is that 6-12 months from now you might want to send me an E-mail requesting the errata **FOR YOUR PARTICULAR PRINTING NUMBER** of the book so you can check for any recently-detected "typos."

Thanks,
[-Rick Lyons-]