

Feb. 27, 2018

**Errata for the International Edition (black and grey softcover version) 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-

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**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]

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

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

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

" $X_m$ "

should be:

" $X_\phi$ "

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

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

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**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:

"...+3 $\pi$ /4)."

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

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**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]

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

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

should be changed to:

"... in Section 3.1**3**, for ...".

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

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**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]

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

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

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

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**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]

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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]

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**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]

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**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  $h(k)$  of ..."

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

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**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]

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**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]

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**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]

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**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]

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**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]

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**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]

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

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

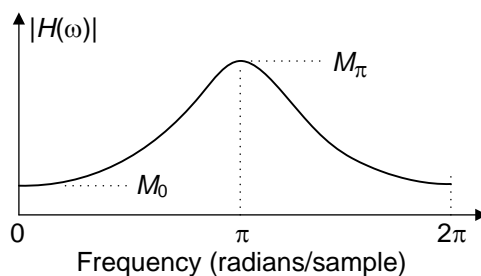
should be changed to:

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

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

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**Page 330:** The right side of Figure P6-20 should look like the following:



[Found by Kip Haggerty (11/22/14)]; [Production Error]

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

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

should be changed to:

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

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

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

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

should be changed to:

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

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

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

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

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]

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

"... and use Eq. (2-13) with  $m_{\text{odd}} = 5$  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]

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**Page 446:** In Problem 8.8, the minus sign in the denominator should be a plus sign. The following is correct.

$$\tan(\alpha) = \frac{e^{j\alpha} - e^{-j\alpha}}{j(e^{j\alpha} + e^{-j\alpha})}$$

[Found by Lee Fugal, (1/5/13)]; [Author Error]

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**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]

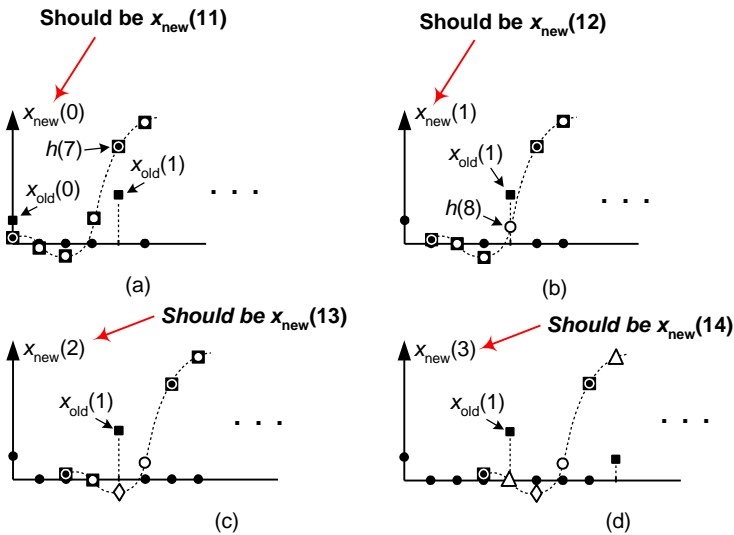
Page 489: In Figure 10-5(c) the frequency axis labels marked **(-3f<sub>s,old</sub>) and (3f<sub>s,old</sub>)**

should be:

**(-3f<sub>s,new</sub>) and (3f<sub>s,new</sub>).**

[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]

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

$n$	Three-bit integrator accumulator			Four-bit integrator accumulator		
	$v(n)$	$w(n-5)$	$v(n)$	$w(n)$	$w(n-5)$	$v(n)$
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:

$n$	Three-bit integrator accumulator			Four-bit integrator accumulator		
	$w(n)$	$w(n-5)$	$v(n)$	$w(n)$	$w(n-5)$	$v(n)$
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 586:** Eq. (11-36) has a missing  $\pi$  character. That equation should be:

$$\alpha = \cos(2\pi f_c/f_s) - 1 + \sqrt{\cos^2(2\pi f_c/f_s) - 4\cos(2\pi f_c/f_s) + 3} \quad (11-36)$$

[Found by Zachary Blackwell (2/27/18)]; [Typesetting Software 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]

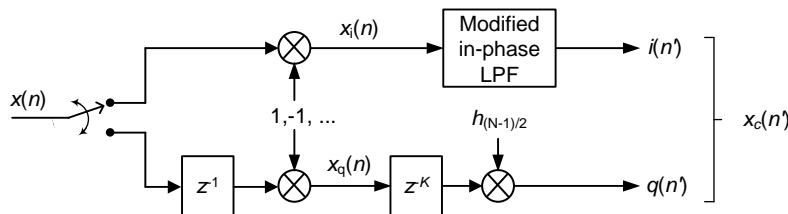
**Page 645:** In Figure 13-2(b) and 13-2(d), the vertical axes should be labeled ' $\phi(m)$ ' and ' $\phi_{1,-1}(m)$ ' respectively.

[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]



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

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

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

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

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

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

$$27\text{Max}/32 + 19\text{Min}/16$$

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

$$27\text{Max}/32 + 9\text{Min}/16$$

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

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**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:

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

$= \frac{0 - j7.9999}{2} = 0 - j4.0 = 4 - 90^\circ,$	Replace: $= 4 - 90^\circ$	With: $= 4\angle -90^\circ$
$X_a(2) = \frac{X_r(6) + X_r(2) + j[X_i(2) - X_i(6)]}{2} = \frac{0.0 + 2.8282 + j[2.8282 - 0.0]}{2}$	$= 2 - 45^\circ$	$= 2\angle 45^\circ$
$= \frac{2.8282 + j2.8282}{2} = 1.414 + j1.414 = 2 - 45^\circ,$	$= 0 - 0^\circ$	$= 0\angle 0^\circ$
$X_a(3) = \frac{X_r(5) + X_r(3) + j[X_i(3) - X_i(5)]}{2} = \frac{0.0 + 0.0 + j[0.0 - 0.0]}{2} = 0 - 0^\circ,$	$= 0 - 0^\circ$	$= 0\angle 0^\circ$
$X_a(4) = \frac{X_r(4) + X_r(4) + j[X_i(4) - X_i(4)]}{2} = \frac{0.0 + 0.0 + j[0.0 - 0.0]}{2} = 0 - 0^\circ,$	$= 0 - 0^\circ$	$= 0\angle 0^\circ$
$X_a(5) = \frac{X_r(3) + X_r(5) + j[X_i(5) - X_i(3)]}{2} = \frac{0.0 + 0.0 + j[0.0 - 0.0]}{2} = 0 - 0^\circ,$	$= 2 - 45^\circ$	$= 2\angle -45^\circ$
$X_a(6) = \frac{X_r(2) + X_r(6) + j[X_i(6) - X_i(2)]}{2} = \frac{2.8282 + 0.0 + j[0.0 - 2.8282]}{2}$	$= 4 - 90^\circ$	$= 4\angle 90^\circ$
$= \frac{2.8282 - j2.8282}{2} = 1.414 - j1.414 = 2 - 45^\circ, \text{ and}$		
$X_a(7) = \frac{X_r(1) + X_r(7) + j[X_i(7) - X_i(1)]}{2} = \frac{-2.8282 + 2.8282 + j[6.8282 + 1.1717]}{2}$		
$= \frac{0.0 + j7.9999}{2} = 0 + j4.0 = 4 - 90^\circ.$		

[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 (" $\angle$ ") 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.

$= \frac{5.656 + j5.656}{2} = 2.828 + j2.828 = 4 - 45^\circ,$	Replace: $= 4 - 45^\circ$	With: $= 4\angle 45^\circ$
$X_b(2) = \frac{X_i(6) + X_i(2) + j[X_r(6) - X_r(2)]}{2} = \frac{0.0 + 2.8282 + j[0.0 - 2.8282]}{2}$	$= 2 - 45^\circ$	$= 2\angle -45^\circ$
$= \frac{2.8282 - j2.8282}{2} = 1.414 - j1.414 = 2 - 45^\circ,$	$= 0 - 0^\circ$	$= 0\angle 0^\circ$
$X_b(3) = \frac{X_i(5) + X_i(3) + j[X_r(5) - X_r(3)]}{2} = \frac{0.0 + 0.0 + j[0.0 - 0.0]}{2} = 0 - 0^\circ, \text{ and}$	$= 0 - 0^\circ$	$= 0\angle 0^\circ$
$X_b(4) = \frac{X_i(4) + X_i(4) + j[X_r(4) - X_r(4)]}{2} = \frac{0.0 + 0.0 + j[0.0 - 0.0]}{2} = 0 - 0^\circ.$		

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

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**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]

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**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
<b>2N</b>	<b>2(N-1)</b>

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

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**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

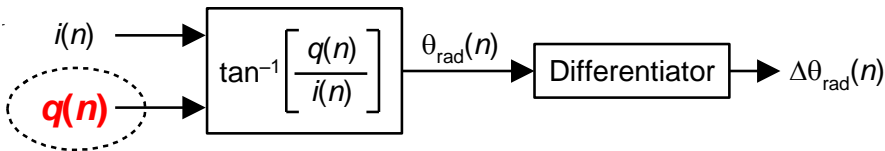
should be changed to:

Real multiplies	Real additions	Real multiplies	Real additions
<b>2N</b>	<b>2(N-1)</b>	<b>2N</b>	<b>2(N-1)</b>

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

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**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]

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**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]

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**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]

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**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]

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**Page 802:** In the fifth line of the first paragraph the text:

"(0"  $k$  "  $N-1$  )"

should be:

"(0  $\leq k \leq N-1$  )"

[Found by Edward Beadle (7/19/16)]; [Production Error]

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**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 three expressions read as:

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

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

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**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  $\phi$  making Eq. (A-5) look like:

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

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

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**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:

$$\dots = \sqrt[3]{125} e^{j(75^\circ+n360^\circ)/3} \quad (\text{A-27})$$

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

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

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

should be:

"... -cos(**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(**2** $\omega t$ ))..."

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

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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 the book so you can check for any recently-detected "typos."

Thanks,  
[-Rick Lyons-]

