

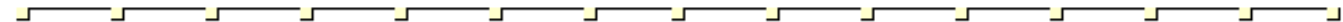
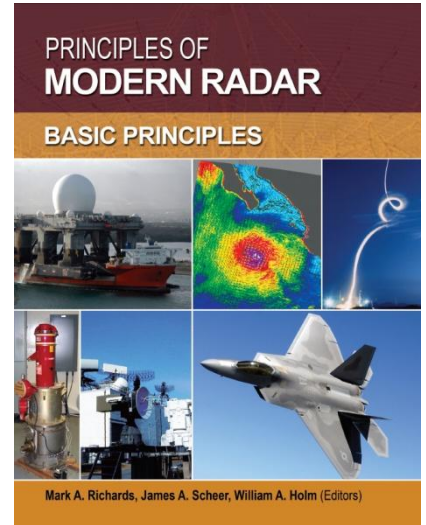
Errata and Non-Errata Edits for 1ST Printing

Principles of Modern Radar: Basic Principles

Mark A. Richards, James A. Scheer,
William A. Holm (editors)

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Chapter	Page	Location on Page	Correction
1	42	4 th line	Change “Theater” to “Terminal”
1	43	Caption of Fig. 1-42	Change “Theater” to “Terminal”
1	56	Problem 3	Answer (a): change “mile” to “statute mile”. Answer (d): Change “miles” to “statute miles”
1	57	Problem 9	Replace the entire problem statement with the following: “Consider the special case of an interferometer, which can be described as a 2-element phased array antenna, consisting of two isotropic, in-phase, radiating elements separated by a distance d . Assume d is much greater than λ , the wavelength of the transmitted EM wave. Show that the first null off boresight in the far-field antenna pattern occurs at angle $\theta = \lambda/2d$ radians.”
2	77	last paragraph of 2.13.1, 1 st sentence	Replace the entire sentence beginning “Chapter 5 includes ...” with “Chapter 5 provides the formula for the calculation of the clutter area A_c .”
2	77	last paragraph, 2 nd sentence	Replace the entire sentence beginning “Chapter 5 includes ...” with “Chapter 5 provides the formula for the calculation of the clutter volume V_c .”
2	85	Problem 8, 1 st line	Change “... as in problem 4, we ...” to “... as in problem 5, we ...”
3		Throughout the chapter	The first 3 equations in Chapter 3 are mis-numbered. They are numbered 12.1, 12.2, and 12.3. Change these to 3.1, 3.2 and 3.3 respectively. Then, increment the numbers of all the subsequent equations by 3, (e.g. 3.1 becomes 3.4, etc.) Also, renumber any references to these equations by adding 3, (that is when referencing eq. 3.12 change to 3.15, etc.)
3	113	Problem 8	Change 10^{-3} to 10^{-5}
3	113	Problem 11, line 3	Change “... the engagement.)” to “... the search time.)”
4	123	Table 4-1	The two “n/a” entries should be changed to “n/a ¹ ” to indicate a footnote, and the following footnote added: “ ¹ Attenuation coefficients for rain and snow are based primarily on fall rate in this attenuation model”.

Chapter	Page	Location on Page	Correction
4	156	Figure 4-42	Change Δr to δR inside the figure.
5	167	Table 5-1, 1 st entry, both columns	Change "... of radar return signal ..." to "... transmitted radar signal ..." in both columns
5	168	Eq. (5.3)	<ul style="list-style-type: none"> Change j to $-j$ in the argument of the exponential in the first two lines only, not in the 3rd line Change θ to θ_l in the first two lines
5	168	Immediately after Eq. (5.3)	Change "where σ is ..." to "where d is the nominal range to the resolution cell and σ is ..."
5	169	3 rd line above (5.6)	Change "dBsm" to "dBsm/sm"
5	169	2 nd line above (5.7)	Delete the entire sentence "Both were considered in Section 2.13."
5	170	Eqs. (5.9) & (5.10)	Change $\csc \delta$ to $\sec \delta$ in both of these equations
5	170	Eq. (5.11)	Replace with $\tan \delta = \frac{\pi R \tan(\phi_3/2)}{c\tau}$
5	170	Eq. (5.12)	Replace with $\tan \delta = \frac{\pi R \phi_3}{2c\tau}$
5	170	2 nd -to-last text line	Delete the entire sentence "The formula for V was given in Chapter 2."
5	174	last paragraph, 3 rd line	Change $1/\lambda$ to $2\pi/\lambda$
5	186	Eq. (5.20)	On the right-hand side of the equation, change $P_\alpha(v)$ to $p_\alpha(v)$ (Do not change the $P_\alpha(\sigma)$ on the left-hand side of the equation)
5	201	4 th line	Change "circumference" to "diameter"
5	206	5 th line	Change 5.4.2 to 5.5.
5	206	Section 5.4.1, 2 nd line	Change "Figures 5-13 through 5-16" to "Figures 5-11 through 5-14"
5	206	Section 5.4.1, 4 th line	Change "Figures 5-20 through 5-22" to "Figures 5-18 through 5-20"
5	210	Problem 3, 4 th line	Change "Assuming pulse-limited clutter interference, at what range ..." to "Assume the clutter interference is pulse-limited and that σ^0 does not vary with range. At what range ..."
5	210	Problem 8, line 1	Change "1 ms" to "200 μs "
7	248	2 nd text line	Change "... RCS of a trihedral ..." to "RCS of a square-sided trihedral ..."
7	259	Table 7-2, entry for Chi-square of degree 4	Change the expression for the mean of to $\bar{\zeta} = \frac{3}{4} \sqrt{\frac{\pi \bar{\sigma}}{2}}$.
7	261	1 st and 2 nd lines above Eq. (7.20)	Change $L_1 \sin \theta + L_2 \cos \theta$ to $L_1 \sin \theta + L_2 \cos \theta $.
7	261	Eq. (7.20)	Change equation to $\Delta f = \frac{c}{2(L_1 \sin \theta + L_2 \cos \theta)}$
7	270	Problem 2	Add a new sentence at the end: "Assume D/λ is an integer."
7	270	Problem 3	Change "For a given value ..." to "For a given integer value ..."

Chapter	Page	Location on Page	Correction
7	270	Problem 5, line 3	Change "...a variances of $\bar{\sigma}^2(1+a^2)/(1+a^2)^2$..." to "a variance of $\bar{\sigma}^2(1+2a^2)/(1+a^2)^2$..."
7	271	Problem 8, line 1	Change "What is the estimated ..." to "What is the maximum estimated ..."
7	271	Problem 11, line 3	Change θ to $\Delta\theta$
8	279	Equation 8.16	$p_I(t) = \sum_{n=-\infty}^{\infty} p_{\tau}(t - n \cdot T) = p_{\tau}(t) * \sum_{n=-\infty}^{\infty} \delta_D(t - n \cdot T)$
8	281	Equation 8.21	$\begin{aligned} P_F(f) &= T_d \text{sinc}(\pi f T_d) * P_{\tau}(f) \\ &= T_d \text{sinc}(\pi f T_d) * \left\{ \frac{A\tau}{T} \sum_{k=-\infty}^{\infty} \text{sinc}(\pi \tau k \cdot PRF) \cdot \delta_D(f - k \cdot PRF) \right\} \\ &= \frac{AT_d\tau}{T} \sum_{k=-\infty}^{\infty} \text{sinc}(\pi \tau k \cdot PRF) \text{sinc}[\pi(f - k \cdot PRF)T_d] \end{aligned}$
8	281	Line above Equation 8.21	$X(f) * \delta_D(f - f_0) = X(f - f_0)$
8	285	4 th line	Change "... the pulse length, τ ." to "... the CPI, T_d ."
8	286	Middle of 2 nd paragraph	Change "... the reciprocal of the dwell time," to "... the reciprocal of the waveform duration."
8	288	4 th line from bottom	Change "... is called the <i>in-phase</i> or <i>I channel</i> ; the lower is called the <i>quadrature</i> or <i>Q channel</i> ." to "... is called the <i>in-phase</i> or <i>I channel</i> because it is the real part of the corresponding complex sinusoid; the lower is called the <i>quadrature</i> or <i>Q channel</i> and is the imaginary part of the complex sinusoid."
8	303	Problem 1, line 2	Change "... equation (8.2)." to "... equation (8.4)."
8	304	Problem 1, last line	Change "... equation (8.1)." to "... equation (8.2)."
8	304	Problem 3, 3 rd line	Change "... directly in front of the radar, and ..." to "... directly overhead of the radar at an altitude of 5 km, and ..."
8	304	Problem 5	Change "Doppler resolution" to "Rayleigh resolution in Doppler frequency"
8	304	Problem 6, 2 nd line	Change "... resolved in frequency?" to "... resolved in frequency (separated by one Rayleigh resolution)?"
8	304	Problem 8, 1 st line	Change "Figure 8-7." To "Figure 8-6."
8	304	Problem 13, line 2	Change "100 m/s" to "150 m/s"
8	304	Problem 14, line 2	Change "Figure 8-16" to "Figure 8-21"
8	305	Problem 19, 1 st line	Change "... has a PRF ..." to "... has an RF of 10 GHz and a PRF ..."
10	388	Problem 2, line 5	Change " $1.3806503 \times 10^{-23} \text{ m}^2 \cdot \text{kg/s} \cdot \text{K}$ " to " $1.3807 \times 10^{-23} \text{ Joules/K}$ "
10	388	Problem 5. Line 1	Change "-100 dBc/Hz" to "-100 dBc"
10	389	Problem 8, 2 nd line on p. 389	Change "-75 dBc/Hz" to "-75 dBc"
10	389	Problem 9, 1 st line	Change "... with a 1.000 W TWT amplifier." to "... with a 5,000 W TWT amplifier operating at a transmit duty cycle of 10%."
11	416	Problem 14, line 2	Change "... down 70 dB, ..." to "... down below the peak signal by 70 dB, ..."
11	416	Problem 15, line 1	Change "Figure 10-26" to "Figure 11-27"
12	421	Last line before 2 nd -to-last paragraph	Change " $S_{min} = 1 \times 10^{-16}$ per Hz (equivalent to -160 dBc/Hz)" to " $S_{min} = 1 \times 10^{-14}$ per Hz (equivalent to -140 dBc/Hz)"
12	456	Problem 8, 3 rd line	Change "noise level be in the ..." to "noise level (in dBc/Hz) be in the ..."

Chapter	Page	Location on Page	Correction
12	456	Problem 8, lines 3-5	Replace the entire parenthetical comment with the following: “(Recall that the phase noise power spectral density in dBc/Hz must be multiplied by the filter bandwidth to determine the complete CIF.)”
12	456	problem 12(a), 3 rd line	Change “... up to and including the third harmonic ...” to “... up to and including the second harmonic ...”
12	456	problem 12(d)	Add this statement at the end. : “Assume all signals are less than 10 MHz bandwidth.”
12	456	problem 13	Change “... signals from 5.85 ...” to “... signals in the 3 dB passband from 5.85 ...”
13	464	Section 13.4 Heading	Change “FLOPS” to “FLOPs”
13	465-471	Odd page header	Change “FLOPS” to “FLOPs”
13	472	Fig. 13-7	Change “OLA, LO = 100” to “OLA, LO = 200”
13	466	Table 13-2, 2 nd line	Change “2 real add, subtract” to “2 real adds + 2 real subtracts”
13	466	8 th line	Change “26, 13” to “35, 18”
13	466	9 th line	Change “148” to “161”
13	487	2 nd paragraph, 3 rd line	Change “[49,50]” to “[50,51]”
13	491	Problem 4, line 1	Change “... into 10 100-point segments, ...” to “... into 5 200-point segments, ...”
13	491	Problem 4, line 2	Change 139 to 239
14	496	4 th line	Change “Chapter 10” to “Chapter 11”
14	499	Fig. 14-2	Change “A/T” to “A/T _s ” on lower right diagram
14	500	Fig. 14-3	Change labels “A/T” to “A/T _s ” and “T” to “T _s ” on lower left diagram
14	514	5 th line	Change “The range frequency ...” to the “The <i>two-way</i> range frequency ...”
14	514	6 th line	Change “... in range frequency ...” to the “... in two-way range frequency ...”
14	514	7 th line from bottom	Change “... time domain to develop ...” to “... time domain: develop ...”
14	521	Fig. 14-21 caption	Change $2N/\log_2 N$ to $2K/\log_2 K$
14	524	1 st line after (14.37)	Change \mathbf{x}_{n_0} to \mathbf{X}_{n_0}
14	524	2 nd line after (14.38)	Change \mathbf{x}_{n_0} to \mathbf{X}_{n_0}
14	529	last paragraph, 1 st line	Change M to $M+1$
14	530	Fig. 14-25	Change $y(t)$ to $y_1(t)$
14	539	5 th line	Change “... operation; if $s[n] = x[n] + w[n]$, $c_{sx}[m] = c_{xx}[m] + c_{wx}[m]$.” to “... operation in the sense that if $s[n] = x[n] + w[n]$, $c_{sy}[m] = c_{xy}[m] + c_{wy}[m]$.”
14	541	Eq. (14.71)	Change $\mathbf{W} * \mathbf{W}^T$ to $\mathbf{W} \cdot \mathbf{W}^T$
14	541	Eq. (14.76)	Change χ to SNR
14	545	Problem 11, 2 nd line	Change “... of (14.29) to ...” to “... of (14.29) and (14.30) to ...”

Chapter	Page	Location on Page	Correction
14	545	Problem 8, 5 th text line	Change “fact” to “facts”
14	545	Problem 8	Add a second formula in line with the first one, so the middle of this problem has the following two formulas: $\sum_{k=1}^n k = n(n+1)/2, \quad \sum_{k=1}^n k^2 = n(n+1)(2n+1)/6$
14	545	Problem 12	Add a new sentence at the end: “Assume that the FFT requires $(K/2)\log_2 K$ complex multiplications, regardless of the value of K .”
14	545	Problem 15	Change “(14.45)” to “(14.55)”
14	545	Problem 15	Add a new sentence at the end: “Assume that $x[n]$ is stationary with mean m , variance σ_x^2 , and that $x[n]$ is independent of $x[k]$ for $n \neq k$.”
14	546	Problem 18, 5 th line	Change “ $m = M$.” to “ $m = M-1$.”
15	552	last line	Change “ $p_y(y H_0)$ and $p_y(y H_0)$ ” to “ $p_y(y H_0)$ and $p_y(y H_1)$ ”
15	562	Last line before (15.15)	Change “NCCS2” to “Rician”
15	564	Eq. (15.22)	Change $2\tilde{m}^2 z$ to $2\tilde{m}z$ $p_z(z H_1) = \begin{cases} \frac{2z}{\sigma_n^2} \exp\left[-\frac{1}{\sigma_n^2}(z^2 + \tilde{m}^2)\right] I_0\left(\frac{2\tilde{m}z}{\sigma_n^2}\right), & z \geq 0 \\ 0, & z < 0 \end{cases}$
15	568	Eq. (15.35)	Change the first exponent from $-1/\sigma_n^2(\mathbf{Y}^H \mathbf{Y} + E)$ to $-(\mathbf{Y}^H \mathbf{Y} + E)/\sigma_n^2$
15	568	Eq. (15.37)	Change the first exponent from $-1/\sigma_n^2(\mathbf{Y}^H \mathbf{Y} + E)$ to $-(\mathbf{Y}^H \mathbf{Y} + E)/\sigma_n^2$
15	570	1 st line after (15.46)	Change χ_1 to χ
15	570	2 nd paragraph, 1 st line	Change “... in \mathbf{s} or ...” to “... in \mathbf{S} or ...”
15	578	2 nd paragraph of Section 15.5.9, line 2	Change “Figure 15-12” to “Figure 15-13”
15	580	1 st line	Change “Figure 15-13” to “Figure 15-14”
15	586	Problem 10, 2 nd line	Change “problem 3” to “problem 4”
15	586	Problem 12, 2 nd line	Change “... problem 1.” to “... problem 11.”
16	591	3 rd paragraph, 2 nd line	Change “... a specified probability ...” to “... a specific probability ...”
16	593	3 rd -to-last line	Change “... greater-of [5-7], smaller-of [6-8], ...” to “... greatest-of [5-7], smallest-of [6-8], ...”
16	614	Eq. (16.53)	Change “ $-v$ ” to “ $+v$ ” in the denominator of the term in the summation at the end of the equation
16	617	Fig. 16-22	In the legend, change “Greater-of” to “Greatest of” and “Smaller-of” to “Smallest-of”.
16	617	Fig. 16-22	Two line styles are interchanged in the legend. Please keep the order of the labels the same, but swap the line styles for “Greatest-of” and “Censored”. Thus, move the dash-dot line style up and associate it with “Greatest-of”, and move the dotted line style down and associate it with “Censored”.

Chapter	Page	Location on Page	Correction
16	Various	Various	Change the word “ordered” or “Ordered” to “order” or “Order” in the following places: <ul style="list-style-type: none"> • P. 593, 34rd line from bottom • P. 608, 4th line above section 16.6.1 • P. 614, Heading 16.6.2.3; also 1st line of that section • P. 615, Fig. 16-20 legend; also Fig. 16-20 caption; also 1st line of section 16.6.3 • P. 616: 3rd line • P. 617: Fig. 16-22 legend • P. 623, problem 12, line 1; also problem 15, choices (b) and (e)
17	634	Eq. (17.12)	Change h to H
17	635	Eq. (17.16)	Change f_b to f_s
17	638	Eq. (17.20)	Change $S_c(f_d)$ to $S_{cc}(f_d)$ (two occurrences)
17	638	1 st line after (17.31)	Change “where each term is understood to be a function of the Doppler shift f_d and G is ...” to just “where G is ...”
17	639	Eq. (17.24)	Change $S_c(f_d)$ to $S_{cc}(f_d)$ (two occurrences)
17	650	7 th line from bottom	Change “... frequency is again equal to a DFT sampling frequency, but ...” to “... frequency $\hat{f}_s = 0.275$ again, but ...”
17	652	Eq. (17.38)	Change \tilde{T} to T
17	652	Last line before (17.39)	Change y to Y
17	652	Eq. (17.39)	Change \tilde{Y} to Y
17	653	2 nd line	Change \tilde{Y} to Y
17	653	Eq. (17.40)	Change \tilde{Y} to Y
17	669	1 st line after (17.55)	Change \hat{P}_x to \hat{P}
17	675	problem 5	Change “... these parameters using ...” to “... these parameters for both rectangular and Hamming windows using ...”
17	675	problem 7	Change f_b to f_s
17	675	problem 8(d)	Change “range-velocity” to “range-Doppler”
17	676	problem 10, last line	Change “... from -10,000 to +10,000 Hz.” to “... from -20,000 to +20,000 Hz.”
17	676	problem 12, 3 rd line	Change $s_y[0]$ to $\phi_{yy}[0]$, and $s_y[1]$ to $\phi_{yy}[1]$
17	676	problem 12, 3 rd line	Change $\exp(j\pi/3)$ to $\exp(-j\pi/3)$
18	679	1 st paragraph, 7 th line	Change “... to the signal at a signal-to-noise ratio (SNR) of 20 dB, the output ...” to “... to the matched filter input signal, the output ...”
18	679	2 nd paragraph, 4 th line	Change “SNR” to “signal-to-noise ratio (SNR)”
18	711	Problem 7	Change “CRLB” to “MCRLB” (two occurrences).
18	711	Problem 7	Change (18.78) to (18.70).

Chapter	Page	Location on Page	Correction
20	810	Eq. (20.99)	Please change the second portion from $B_{chip} \tau$ to τB_{chip}
20	822	Last paragraph, 1 st line	Change “127-length” to “31-length”
20	822	Last paragraph, 4 th line	Change “... for the 127 MLS is ...” to “... for a 127-length MLS is ...”
20	822	Caption of Fig. 20-32	Change “127-length” to “31-length”
21	891	Problem 5, line 1	Change “... system collecting against ...” to “... system performing a stripmap collection against ...”
n/a	899	Ch. 1, prob. 17	Change all 4 answers to the following values: (a) 15.7 degrees (b) 4.25 degrees (c) 361.2 feet (d) 97.9 feet
n/a	899	Ch. 3, prob. 5	Change “ 1.11×10^{-3} ” to “ 1.11×10^{-2} ”
n/a	900	Ch. 3, prob. 11	Change “2 seconds ³ ” to “1.75 seconds”
n/a	901	Ch. 8, prob. 1	Change “ 2.22×10^{-4} ” to “ 2.2236×10^{-4} ”
n/a	901	Ch. 8, prob. 3	Replace the entire answer with the following: “The radial velocity is initially close to 200 mph (89.4 m/s), decreases to zero when the aircraft is directly overhead, and decreases asymptotically to -200 mph (-89.4 m/s) as the aircraft flies away.”
n/a	901	Ch. 8, prob. 10	Change Δf to Δf_d
n/a	901	Ch. 8, prob. 13	Change “232.7 Hz” to “329 Hz”
n/a	901	Ch. 8, prob. 15	Change 23.27% to 65.1%
n/a	901	Ch. 8, prob. 17	Change “30.467 km” to “20.4 km”
n/a	902	Ch. 12, problem 1(a)	Change “-97” to “-94”
n/a	902	Ch. 14, prob. 3	Replace the entire answer with “ $f_s = 35$ MHz”
n/a	903	Ch. 15, prob. 11	Change 12.139 to 3.035, and change 0.8676 to 0.798
n/a	903	Ch. 17, prob. 2	Change “Range change” to “Two-way range change”

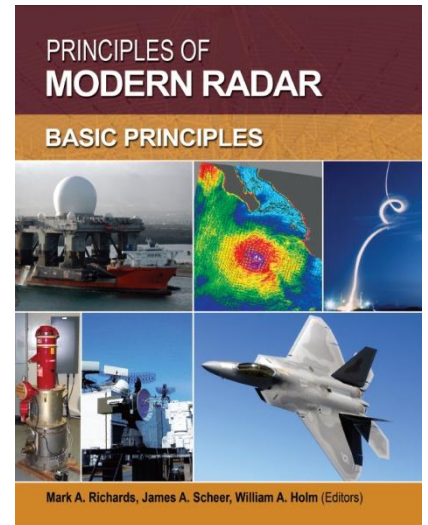
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Chapter	Page	Location on Page	Correction
4	164	Problem 9, 1 st line	Change “ $\lambda/10$ ” to “ $\lambda/50$ ”.
5	168	Eq. (5.3)	Change θ_1 to θ_i in the first two lines.
7	259	Table 7-2, entry for Chi-square of degree 4	Change the expression for the mean of $\bar{\zeta}$ to $\bar{\zeta} = \frac{3}{4} \sqrt{\frac{\pi \bar{\sigma}}{2}}$.
7	261	1 st and 2 nd lines above Eq. (7.20)	Change $L_1 \sin \theta + L_2 \cos \theta$ to $L_1 \sin \theta + L_2 \cos \theta $.
8	278	1 st line of Eq. (8.15)	Change $Ae^{-j2\pi ft} dt \int_{-\tau/2}^{+\tau/2} Ae^{-j2\pi ft} dt$ to $\int_{-\tau/2}^{+\tau/2} Ae^{-j2\pi ft} dt$.
17	635	Eq. (17.16)	Change f_b to f_s
19	723-724	Eq. (19.19) & Eq. (19.21)	Change _____ to _____
19	767	Eq. (19.234)	Change _____ to _____

Non-Errata Edits

Chapter	Page	Location on Page	Correction
1	40	Section 1.9.1.2, 1 st paragraph	Change “It scans mechanically in the azimuth direction and electronically in the elevation dimension by means of frequency scanning.” to “It scans mechanically in the azimuth direction and forms simultaneous receive beams stacked in elevation with monopulse processing for elevation calculations.”
5	168	Text after (5.3)	Change “... clutter return, and ϕ is the equivalent phase.” to “... clutter return, ϕ is the equivalent phase, and d is the nominal range to the range bin.” (pagination may make this one tough, it can be left out if absolutely necessary)
5	170	3 rd line after (5.10)	Change “fine-range” to “fine range”
5	201	4 th line of text	Change “circumference” to “diameter”
5	202	1 st text line	Change “... layers to forward scatter more ...” to “layers and forward scatters more ...”
5	203	3 rd text line	Change “... D for ...” to “... D in equation (5.30) for ...”
5	206	1 st line	Change “required” to “common”
5	206	Section 5.4.1, 1 st paragraph	All of the figure number refs in this paragraph are too high by 2. So Figure 51-13 becomes Figure 5-11, etc. The table refs are OK as is.
5	208	Ref. [10], line 1	Change “ <i>statistics</i> ” to “ <i>Statistics</i> ”