Typos and Mistakes Found in *Practical Electronics for Inventors*, 2^{nd} ed., by Paul Scherz (McGraw-Hill, 2007)

Most of the items on this errata sheet were compiled by Martin Ligare during the spring semester of 2008 during the teaching of an Applied Electronics course at Bucknell University. This list does not cover the entire text — it is most complete for the portions of the text that were assigned reading for this course. This document is available at `http://www.eg.bucknell.edu/physics/ph235/`. Additional items were identified by Steve Baker of the Naval Postgraduate School,

contributions are noted with initials. Additional material for this list should be sent to `mligare@bucknell.edu`. (This document was last updated June 15, 2009.)

- p. 9, final paragraph: The statement that "[w]hen the switch is open . . . the battery generates no voltage across its terminals" is incorrect. The discussion of the chemistry in the following paragraph on p. 10 should also be ignored. It is, of course, true that no current will flow when the switch is open, but that's because the open switch is an effectively infinite resistance.

- p. 10, second to last paragraph: "when a **bond** electron" should read "when a **bound** electron."

- p. 12, Fig. 2.7 and p. 70, Fig. 2.63, and probably elsewhere: There is inconsistency in the text regarding the sign of potential differences when they are written in the form V_{AB}:

  $$V_{AB} = V_B - V_A \qquad \text{or} \qquad V_{AB} = V_A - V_B?$$

  The discussion on p. 12 is consistent with the definition on the right, the examples in the top level of the shaded region in Fig. 2.63 are consistent with the definition on the left, and in the examples on the bottom level of the shaded region conflict with each other! (In this course, I will try to stick with the definition on the left; that's the way it's written in the lab manual.) In Fig. 2.63 the quantity $V_b - V_a$ is called *both* V_{ba} and V_{ab} in different places.

- p. 19, First paragraph: "grand boundary" should be "grain boundary."

- p. 25, resistivity of copper given in Fig. 2.19 should be $\rho = 1.7 \times 10^{-8}\,\Omega\cdot\mathrm{m}$ and the conductivity should be $\sigma = 6.0 \times 10^{7}\,\Omega^{-1}\cdot\mathrm{m}^{-1}$.

- p. 35: Eq. (2.11) is a mess, as is the following definition of the gradient. For three-dimensional heat flow in an *isotropic* medium, Fourier's Law of Conduction is

  $$\vec{q} = -k\,\nabla T,$$

  where $\vec{q}$ is the heat flux *vector* (with dimensions $\mathrm{J}\cdot\mathrm{m}^{-2}\cdot\mathrm{s}^{-1}$, or $\mathrm{W}\cdot\mathrm{m}^{-2}$) and k is the thermal conductivity (with dimensions $\mathrm{W}\cdot\mathrm{m}^{-1}\cdot\mathrm{K}^{-1}$). The vector gradient of the temperature field is

  $$\nabla T = \left(\hat{i}\frac{d}{dx} + \hat{j}\frac{d}{dy} + \hat{k}\frac{d}{dz}\right)T.$$

  For one-dimensional flow Fourier's Law reduces to the scalar equation

  $$\frac{dQ}{dt} = -kA\frac{dT}{dx},$$

  where A is the cross-sectional area perpendicular to the direction of heat flow. This is essentially Eq. (2.12).

- p. 51, Example: "100-Ω battery" should be "100 Ω resistor."

- p. 52, Example 2: "power generated by the resistor" should read "power dissipated in the resistor."

- p. 52, Section Heading for 2.12.2: This heading should be "Resistors in Parallel." Resistors in Series are discussed in the following section, 2.12.3.

- p. 58, last paragraph, second sentence: "A signal equivalent resistance" should be "A single equivalent resistance."

- pp. 59-60: The results of the calculations are not accurate to the quoted precision.

- p. 66, Fig. 2.56: The "Measuring Current" illustration should have an **A** in the circle, not a **V**.

- p. 68, end of first paragraph: "current rating, given in watts" should be replaced with "current rating, given in amps (or equivalent power rating given in watts)."

- p. 69, Answer for Example 1: The answer for part **c** should be 4 A.

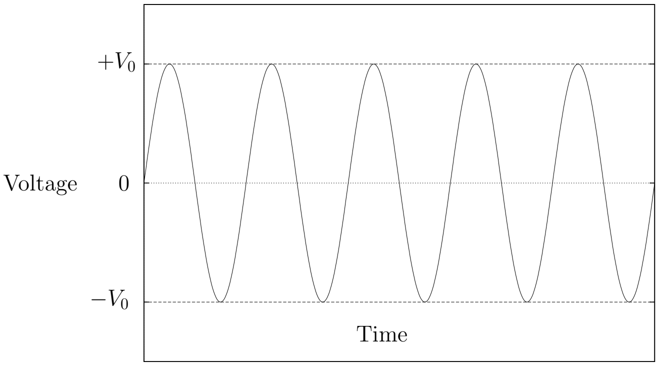
- p. 70, Eq. (2.20): This is equation is missing the important value of the sum. It should read:

$$\sum_{\text{closedpath}} \Delta V = V_1 + V_2 + \cdots + V_N = 0.$$

- p. 70, Fig. 2.63: See comment for p. 12.

- p. 73, Fig. 2.67b: The third equation (for the junction rule at **c**) should be $I_6 - I_4 - I_3 = 0$. The determinant is correct, as are the values for all the currents in Fig. 2.68.

- Section 2.20, including Figs. 2.77, 2.80, 2.82, 2.84, 2.85; Section 2.21, discussion on p. 87 and Figs. 2.86 and 2.87: Scherz uses the term *amplitude* in non-standard way. The *amplitude* of a sinusoidal waveform is conventionally the largest value of the waveform; in the following illustration the amplitude of the voltage signal is V_0.



(The *peak-to-peak* amplitude is $2V_0$, and the *RMS* amplitude is $V_0/\sqrt{2}$.)

- p. 75, Equation for I_2: The negative sign in the numerator is wrong; the equation should read

$$I_2 = I_{21} + I_{22} = \frac{V_A + I_B R_1}{R_1 + R_2}.$$

- p. 80, Example Answer: There is no advantage to applying Thévenin's theorem in steps as is suggested here; the answer given is correct but it is trivial to arrive at this answer using in one step.

- p. 81, Fig. 2.78: In the rightmost figure, the labeling of the angle θ is not really correct. The angle in the flux equation $\Phi = AB\cos\theta$ is the angle between $\vec{B}$ and the *normal* to the surface of $\vec{A}$. In this specific case, with the axis of rotation perpendicular to the field, the illustrated angle happens to have the same value as the angle in the flux equation, but it's not a good to label angles incorrectly. Also, the vertical axis for the sine-wave graph on the right isn't labeled. It should be labeled V to avoid any confusion with Φ or I (which are also sinusoidal, but with a different phase). Also, the equation for I is missing a factor N, and there are missing vector signs in the dot product for flux. (Similar problems occur in the version of this figure on p. 120.)

- p. 85, Fig. 2.84: The relationship between the illustrated rotating arrow (phasor) representing the sinusoidal signal and the algebraic representation of the signal as $V(t) = V_P \sin(2\pi t + 0°)$ is unconventional. According to the relationship given in the text, the signal is the projection of the rotating phasor on the *vertical* axis, rather than the horizontal axis. It would be more consistent with the usual complex number representation of sinusoidal signals ($V(t) = \mathrm{Re}(\tilde{V})$) if text had $V(t) = V_P \cos(2\pi t + 0°)$ here.

- p. 88, Eq. 2.26 and following discussion of averages of sinusoidal waves and power: This discussion is at best misleading. Problems start with Eq. (2.26), which should read:

  $$P(t) = \frac{V(t)^2}{R} = \frac{V_P^2}{R} \sin^2(2\pi f t).$$

  The text discusses how sine functions average to zero (which is correct) but then concludes (in the first sentence of the last paragraph) "[s]o we must find an alternative way of describing this energy-delivering aspect of ac, other than the average value." This is wrong; using the correct expression for instantaneous power shows that average power involves the average value of the *square* of a sine function, and this doesn't go to zero — it goes to 1/2. No "alternative way" is necessary.

- p. 90, first line: The note on Measuring RMS Voltages is on pages 91-92, not 90-91.

- p. 91, Example 4: The correct answer with the indicated precision is $72\,\Omega$.

- p. 91, Example 5: The given answer is incorrect. It should be $400\,\Omega$, not $6.3\,\Omega$.

- p. 95, first paragraph: The sentence, "At this point, the battery doesn't see a potential difference across its terminals" is wrong. There is still a potential difference across the terminals of the battery; electrical equilibrium doesn't affect the terminal voltage — it is unchanged (and equal to the non-zero potential across the plates of the capacitor).

- p. 102, Fig. 2.97: In two places in the figure "chuck of charge" should be "chunk of charge."
- p. 105, Example 2: The given answer is correct *only if* the RC time constant of the circuit is much less than 10 ms. The value of R isn't mentioned in the statement of the problem, and perhaps that is meant to imply that $R = 0$, but assumptions like this aren't good in introductory material.
- p. 105, Example 3 (and many other places in the text): It is conventional to put the units at the end of mathematical expressions. It is much clearer to write $5e^{-t}\,\mathrm{V}$ instead of $5\,\mathrm{V}e^{-t}$.
- p. 105, Eq. (2.42), the second integral is missing a dt; it should read

  $$\int VC\,\frac{dV}{dt}\,dt.$$

- p. 106, Fig. 2.101 and discussion: The value for the resistance should be $R = 10\,\mathrm{k}\Omega$. (In informal discussions of resistance values the "Ohms" is often elided, but that convention hasn't been introduced, and it isn't used elsewhere in the text.)
- p. 107, Fig. 2.103 and discussion: The value for the resistance should be $R = 3\,\mathrm{k}\Omega$. See preceding comment.
- p. 110, first paragraph of 2.23.12: Language: better to say "a capacitor will either pass or limit current flow, depending on the frequency."
- p. 110, Section 2.23.12 and Fig. 2.106, especially the second paragraph of the section: The notation might be confusing. The language "In period OA . . . " risks confusion, both because "period" does not refer to the period of the sine wave, and OA might be confused with zero amperes.
- p. 111, first sentence of Section 2.23.13: The text reads "The amount of charge that can be placed on a capacitor is proportional to the applied voltage and the capacitance." This sentence would be more accurate and simpler as "The amount of charge on a

capacitor is equal to the voltage drop across the capacitor times the capacitance." (The phrase "can be" makes it sound like this might be the maximum charge, when in fact the charge and the voltage are not independent.)

- p. 112, Fig. 2.107: The caption should read "Log-log graph showing how reactance decreases with frequency . . . " instead of "Semi-log graph showing how reactance increases with frequency . . . "

- p. 113, Capacitive divider: The statement is made that "the dc case is not relevant" and "[t]he formula for determining the ac divider is different from the resistive divider." First, capacitors work as voltage dividers for dc, and the formula is the same as in the ac case. (The text even notes that the result is independent of frequency.) I would also argue that the right way to think about this is in terms of impedances, and then the formula for capacitors is the same as the formula for resistors with the replacement $R \to Z_C$.

- p. 113, sentence that begins "Cir-" at the very bottom of the page and continues on to p. 114: Not all fields are "circular"; the field lines around *infinite straight* wires are circular, but it's not strictly true for other configurations. Also, steady currents create fields, but they are not "radiating" fields. Radiation is the result of accelerated charges, i.e., changing currents.

- p. 114, first sentence of 2.24.1: This sentence would be better if it said "*the field of* a charge at rest can be represented . . . "

- p. 115, Fig. 2.110, part e.: I think the field symbols $\vec{E}$ and $\vec{B}$ should have subscripts indicating that these are the *radiation* fields, not the total fields. Also, the electric field vector at the 2 o'clock position is pointing the wrong way.

- p. 116, Fig. 2.111E: The field lines encircling the wires at the bottom, where the current is directed into the page, have the wrong direction on them. (Thanks to Robert Strzelczyk for pointing out this mistake.)

- p. 116, Fig. 2.112, left panel: The order of magnitude of the dipole moment of an atom with an unpaired electron is $10^{-23}\,\mathrm{A{\cdot}m^2}$.

- p. 118, first paragraph: The statement that "for a negative charge … we must use the left hand" is a bit prescriptive. Most physicists always use the right hand, and reverse the directions for negative charges.

- p. 118, second paragraph: the text says "the net magnetic field of one wire can exert a force on the other wire … provided the current is fairly large." The force is not conditional. This would be better stated as "the magnetic field of one wire exerts a force on the other wire." (It is true that if the currents are small, the forces will be small, but the forces always exist for non-zero currents.)

- p. 118, last sentence on the page: The internal dipoles aren't moving. This sentence should be something like "we associate the the macroscopic (observed) force with the forces on the moving charges that comprise the microscopic internal magnetic dipoles … ."

- p. 119, first full paragraph: The text states "the effect of the induced force is one akin to an electromotive force … ". It's not *akin* to an EMF, it *is* an EMF.

- p. 119, Eq. (2.49): The integrand should be written in terms of vector quantities: $\int \vec{B} \cdot d\vec{A}$.

- p. 119: Fig. 2.116 is incomprehensible.

- p. 120, Fig. 2.117: The problems with this figure are similar to those in the version of this figure on p. 81. In the rightmost figure, the labeling of the angle θ is not really correct. The angle in the flux equation $\Phi = AB\cos\theta$ is the angle between $\vec{B}$ and the *normal* to the surface of $\vec{A}$. In this specific case, with the axis of rotation perpendicular to the field, the illustrated angle happens to have the same value as the angle in the flux equation, but it's not a good to label angles incorrectly. Also, the vertical axis for the sine-wave graph on the right isn't labeled. It should be labeled V to avoid any confusion with Φ or I (which are also sinusoidal, but with a different phase). Also, the equation for I is missing a factor N, and there are missing vector signs in the dot product for flux. (Similar problems occur in the version of this figure on p. 120.)

- p. 125 (Fig. 2.123), and p. 126 (Fig. 2.124): The voltage graphs in both of these figures should indicate that they are graphs of the voltage *across the inductor*, V_L.

In both of the figures there is a misleading statement, “Net Voltage = Induced + Applied.” The magnitude of the voltage drop across an in ideal inductor is simply given by $V_L = LdI/dt$. The magnitude of the voltage drop across a real inductor is $V_L = IR_{\rm int} + L\,dI/dt$; this is a sum, but there is nothing in the sum that resembles an “applied” voltage.

- p. 126 (Fig. 2.124), second paragraph: The wording here is misleading. “[W]hen the switch is thrown from position A to B” no voltage is “set up across the inductor attempting to drive the current to zero.” The voltage V_S that had been driving the current is simply removed from the circuit.

- p. 128, Example: “following two circuits” should be “following three circuits.” (I would also suggest moving the parenthetic comment at the end about the assumed internal resistance of the inductor to the problem statement itself.)

- p. 128, Example, answer to (c): If the 12 V battery is considered to be ideal (i.e., the internal resistance is zero) the parallel resistance has no effect on the brightness of the lamp. [G.C.]

- p. 131, definition of μ_0 near the top of the page: The units are wrong. The units of μ_0 are T·m/A (or equivalently N/A^2). The units are also written in a potentially confusing way. Units should be in roman font, to distinguish them from algebraic symbols that are a part of mathematical expressions. This convention is observed in most of the text, but not for the A (for Amperes) in this expression. This can get get very confusing lower in the page when an italic A is used for area, and the same italic A is used for Amperes.

- p. 131, paragraph following Eq. (2.54): the text incorrectly states that “if you want to double the inductance . . . you add . . . $\sqrt{2}$ times the original number of turns . . . .” You don’t add this number of turns, you add enough turns turns so that the number of turns is equal to $\sqrt{2}$ times the number of original turns. The statement in words at the end of the sentence, “or 40 percent more turns,” is correct.

- p. 131, Answer to Example 2: There are several mistakes here, even though the answer comes out right. First, the equation for L is incorrect. It should be either $L =$

$\mu_0 N^2 A/l$, or equivalently $L = \mu_0 n^2 Al$. The first form is the way it appears in Eq. (2.54), and the second form is the way the solution is worked out (with the switch of N to n). The Answer is also missing an intermediate equals sign. (Note: the units of μ_0 are correct here, but the font for the Amperes is especially misleading in this context.)

- p. 133, Eq. (2.55): Limits of integration should really be used to get this expression right. This is the integrated power from a condition in which $I = 0$ up to a final value of current.
- p. 139, font quibble in first full paragraph: "If the inductance L is ..." should be "If the inductance L is ..." (See first comment for p. 131 above.)
- p. 139, Answer for Example 9: The units are incorrect for the time-derivative of the current; they should be A/s, not V/s.
- p. 139, last sentence on page: "inducted" should be "induced."
- p. 141, Example 12: This question is ill-posed and there isn't enough information given to answer a well-posed version of the question. In addition, the solution contains an integration error and an algebraic error. The problem statement "Calculate the total current that flows ..." makes no sense. It's like stating that a car accelerates at $5\,\mathrm{m/s^2}$ for $3\,\mathrm{m/s}$ and asking for the total velocity. A well-posed question would ask for the velocity as a function of time, or for the instantaneous velocity at a specific time, or perhaps average velocity during the interval, but "total velocity" doesn't have any meaning. Both velocity and current are rates of change. A well-posed question problem about a car would also have to give an initial velocity; a well-posed Example 12 would similarly require an initial current to be given.

  Here's my version of Example 12: Suppose you apply a linearly increasing voltage across an ideal 1 H inductor. The initial current through the inductor is 0.5 A, and the voltage ramps from 5 to 10 V over a 10 ms interval. Calculate the current through the inductor as a function of time.

  Answer: Kirchoff's Voltage Law gives

$$V_{\text{applied}} - L\frac{dI}{dt} = 0.$$

Integrating this gives

$$\int_{t'=0}^{t} \frac{dI}{dt'}\,dt' = \int_{t'=0}^{t} V_{\text{applied}}\,dt',$$

or

$$I(t) - I(0) = \int_{t'=0}^{t} (mt' + b)\,dt'.$$

Carrying out the integration gives

$$I(t) = I(0) + \frac{1}{2}mt^2 + bt.$$

At $t = 0.01\,\text{s}$ (the end of the ramp) the current is

$$I(0.01) = 0.5 + \frac{1}{2} \times 500 \times 0.01^2 + 5 \times 0.01 = 0.575\,\text{A}.$$

The answer in the text ignores the initial current and has a numerical error in the last equality.

- p. 143, second full paragraph: The text states "[T]he current never reaches the Ohm's Law value." This would be better as the "[T]he current never reaches the *no-inductor* value." Ohm's Law always gives the voltage drop across across the resistor in this circuit, and this can always be used to find the voltage across the inductor, so "the Ohm's Law value" isn't really meaningful.

- p. 144, first and second equations on page: For the de-energizing LR circuit of Fig. 2.128, there is no V_S because the battery is no longer in the circuit. The left-hand side of the first equation and the right-hand side of the second should both be zero.

- p. 145, final paragraph in discussion of Fig. 2.138. This paragraph is at best unnecessary, and at worst misleading. There are no negative numbers in the argument of a logarithm here. The quantity $(-V_L/V_S)$ is a positive number, because V_L is negative (see equation for V_L at the bottom of p. 144).

- p. 146, Fig. 2.140: The diagrams are great — they show the kind of signals you might actually see in an inductive circuit, but the discussion is completely inadequate (and wrong) without explicit inclusion of the internal resistance of the source. If the source is ideal, the graphs of V_S must be square waves, whether the load is inductive or not.

- p. 147, bottom of page: Inductive reactance of a wire is discussed, but reactance hasn't be introduced previously in the text.

- p. 148, Section 2.24.14: Much of this material is redundant with the discussion of Fig. 2.118 on p. 120; Fig. 2.143 on p. 148 is identical to Fig. 2.118.

- p. 155, Section 2.25: (This is a pedagogical comment, not a note regarding a mistake.) I find it much easier to deal directly with the charge on the capacitor q_C rather than the quantity $\int I\,dt$.

- p. 157, second equation from the top: The right-hand side of this equation should be $V_0 \sin \omega t$, not $10\,\mathrm{V} \sin \omega t$.

- p. 157, third equation from the top: The right-hand side of this equation should be $+\omega V_0 \cos \omega t$, not $-\omega V_0 \sin \omega t$.

- p. 158, first sentence: The text states that step functions haven't been considered yet. They were considered in Sections 2.23.5, 2.23.8 (and will be discussed in Section 2.34).

- p. 158, Fig. 2.152: The sign convention for voltages is inconsistent and confusing. It seems like V_R is the voltage drop across the resistor (going clockwise around the loop) and V_C is the voltage drop across the capacitor (going in the same direction). A consistent notation would have V_L be the voltage drop across the inductor, in which case the equation at the top of the figure would be $-V_L - V_R - V_C = ?$. (It might be better to reverse all signs to give $V_L + V_R + V_C = ?$, but the sign of all three potential differences should be the same.)

- p. 161, first equation: The far right equation has an upper case "theta." This is not a new symbol, and refers to the same quantity as the previous lower-case "theta's"; it should read $z = r\angle\theta$.

- p. 162, Table 2.10: In the section of the table for Rectangular Form — Multiplication (the middle section of the top row) there is a mistake. The first line should read $Z_1 \times Z_2 = (ac - bd) + j(ad + bc)$. The Example is also wrong; the answer should be $-26 - j23$.

  I also think it is confusing to use asterisks in this Table. It is possible to confuse them with the symbol indicating complex conjugation.

- p. 163, first equation after shaded box: The third part of this equation is wrong in both the numerator and the denominator. It should read

  $$\frac{7.07\angle -45.0^\circ}{(5\angle 53.1^\circ)(8.25\angle 76.0^\circ)}$$

  Subsequent expressions in this equation and in the following equation are also incorrect because of this mistake.

- p. 163, Eq. (2.66): This equation is correct, but I think it's important to point out that $|Z|$ is just another symbol for r, and $\arg(Z)$ is just another name for the phase θ.

- p. 165, second full paragraph, first sentence: This sentence needs an additional clause: "…all currents and voltages within the circuit will be sinusoidal in nature *at long times after all transients have died out.*"

- p. 168, Fig. 2.159: The expression for z on the left should be $z = r\cos\theta + j\sin\theta$, and the expression for V on the right should be $V = V_0\cos(\omega t) + jV_0\sin(\omega t)$. (The "$j$'s are missing in the text.)

- pp. 170-171: The definitions of capacitive and inductive reactance on these pages conflict with the previous definitions on p. 111 and p. 151. Previously reactances were real numbers, and here they are complex. Conventions for reactances and impedances aren't universal, but it's most common (and best to my mind) for reactances to be pure real numbers. Whatever choice of conventions is made, it should be used consistently throughout the text. One convention with real reactances:

  $$X_C = \frac{1}{\omega C}, \qquad \text{and} \qquad Z_C = -jX_C = \frac{1}{j\omega C} = -j\frac{1}{\omega C},$$

  and

  $$X_L = \omega L, \qquad \text{and} \qquad Z_L = jX_L = j\omega L.$$

  In this convention,

  $$Z_{\text{total}} = Z_R + Z_C + Z_L = R - jX_C + jX_L.$$

  Another convention with real reactances:

  $$X_C = -\frac{1}{\omega C}, \qquad \text{and} \qquad Z_C = jX_C = -j\frac{1}{j\omega C} = \frac{1}{j\omega C},$$

and

$$X_L = \omega L, \qquad \text{and} \qquad Z_L = jX_L = j\omega L.$$

In this convention

$$Z_{\text{total}} = Z_R + Z_C + Z_L = R + jX_C + jX_L = R + jX_{\text{total}}.$$

- p. 172, Fig. 2.65: The impedance on the lower right should be labeled Z_6, not Z_1.
- p. 173, Example 2, Answer: In part (a) the answer should involve an inverse tangent:

  $$\sqrt{R^2 + \left(\frac{1}{\omega C}\right)} \angle \tan^{-1}\left(-\frac{1}{R\omega C}\right).$$

  In part (b) the first term in the phase angle should be negative, and it can be simplified:

  $$\left\{-\tan^{-1}\left(\frac{R}{\omega C}\right) - \tan^{-1}\left[\frac{\omega L - 1/(\omega C)}{R}\right]\right\}.$$

- p. 182, section heading: Should be **Series Impedance (LC Circuit)** instead of **Parallel Impedance (LC Circuit)**.
- p. 187, equation for Z_{THEV}: The numerator in the third expression on the first line has a spurious "=" sign.
- p. 187, paragraph after the equation for I_R: The values of the current and phase angle in this paragraph are wrong. It should read "Don't let the complex expression fool you; the resistor current is indeed 3.28 mA, but lags the source by 24.3°.
- p. 187, Fig. 2.175: It is misleading to put the "+" and "−" signs on the inductor and the capacitor in the figure. In this case, the actual polarities of the voltage drops across the inductor and capacitor are opposite.
- p. 188, first sentence of second paragraph of the Example: The sentence should read: "The current through the *series* impedance ..."
- p. 188, equation for I near bottom of page: the phase is wrong in the last line; it should be +90°.
- p. 188, Fig. 2.176: The impedance scales on the graphs are not correct. At $f = 67\,\text{kHz}$, the total complex impedance should be about $+4j\,\Omega$, and at $f = 60\,\text{kHz}$ it should be about $-4.7j\,\Omega$.

- p. 189, first equations: The left-hand side of the first equation should be written as $|Z_{\mathrm{TOT}}|$, and the left-hand side of the second as $|I|$.

- p. 190, second and third equations: The left-hand side of the first equation in this set should be written as $|Z_{\mathrm{TOT}}|$, and the left-hand side of the second as $|I|$.

- p. 190, equation for I: the units should be A, not Ω.

- p. 194, Eq. (2.81), and first two equations on p. 195: In all of these equations, the frequency in the denominator should be the resonant frequency f_0.

- p. 211, Section 2.33.1, Pass Filters: The results of the calculations for the gains are correct (although there are spurious primes ($'$) in the denominator of the last two equations on p. 211, in the equation at the top of p. 213, and in the denominator of the top two equations on p. 214) but the terminology along the way is incorrect; for example, on p. 211 the "output impedance" of the filter (i.e., a voltage divider) is *not* the impedance of the capacitor — it's the impedance of the parallel combination of the resistor and the capacitor. The output is measured across the capacitor, but that's not what is meant by output impedance of a two-port network. (The output impedance is z_{22} in the z-parameter model of a two-port network, or g_{22} in the g-parameter model, or more simply, the Thévenin resistance measured at the output terminals.) Similar comments apply to all of the worked examples in this section.

- p. 214, First equation at the top of the page: The numerator should be $j\omega\tau$ instead of $j\omega t$.

- p. 214, Fourth equation from the top: The numerator and the denominator are interchanged; the phase should be

$$\arg(H) = \phi = \tan^{-1}\left(\frac{\omega_c}{\omega}\right).$$

- p. 215, Fourth equation from the top: The square root in the denominator extends too far. The equation should read

$$H = \frac{\omega L \angle 90^\circ}{\sqrt{R^2 + (\omega L)^2} \angle \tan^{-1}(\omega L/R)}.$$

- p. 215, Sixth equation from the top: It would make much more sense to simplify this equation by canceling the R's to give:

$$|H| = \left|\frac{V_{\text{out}}}{V_{\text{in}}}\right| = \frac{\omega/\omega_c}{\sqrt{1 + (\omega/\omega_c)^2}}.$$

- p. 215, Seventh equation from the top: The equation for the phase is correct, but it might be simpler as

$$\arg(H) = \phi = \tan^{-1}\left(\frac{\omega_c}{\omega}\right).$$

- p. 216, Bandpass Filter Example: The first sentence of the example should read "To find the transfer function of attenuation of the *unloaded* RLC circuit ..."

- p. 217, Notch Filter Example: The first sentence of the example should read "To find the transfer function of attenuation of the *unloaded* RLC circuit ..."

- p. 217, first two equations in Notch Filter Example: the resistance R_1 appears in the wrong equation. The equations should be

$$V_{\text{in}} = \left(R_1 + R_{\text{coil}} + j\omega L - j\frac{1}{\omega C}\right) \times I,$$

  and

$$V_{\text{out}} = \left(R_{\text{coil}} + j\omega L - j\frac{1}{\omega C}\right) \times I,$$

- p. 217, Fig. 2.195: The figure on p. 217 is a Notch Filter, but the caption discusses a Parallel Notch Filter. The Parallel Notch Filter is illustrated on the following page.

- p. 218, Example: The output impedance of the voltage divider is *not* equal to R_2. The results for V_{Th} and Z_{Th} in Fig. 2.196 are correct, but the terminology is all wrong. (See comments for p. 211.)

- p. 221, Third equation from the bottom: The final exponent is incorrect (and the units are misplaced as discussed above). The equation should be:

$$I = \frac{10\,\text{V}}{10\,\Omega}\left(1 - e^{-10t/0.001}\right) = 1.0\left(1 - e^{-10{,}000t}\right)\,\text{A}.$$

- p. 221, last equation at bottom of page: The exponent in the middle term is incorrect (and the units are misplaced as discussed above). The equation should read:

$$V_L = L\frac{dI_L}{dt} = V_S e^{-Rt/L} = 10e^{-10{,}000t}\,\text{V}.$$

- p. 222, First equation in the Example: It's not really correct to have the same variable serve as a variable of integration and a limit. The equation would be better as

  $$V_S = RI + \frac{1}{C}\int_0^t I(t')\,dt',$$

  or perhaps more simply as

  $$V_S = RI + \frac{q_C(t)}{C}.$$

  The same comment also applies to the third equation on p. 223.

- p. 222, Example: This example could be handled just like the example on the previous page.

- p. 224: Example 2: Although the general answer for the current is correct, it is more clearly written as

  $$I(t) = \left(0.8 + 1.60e^{-6t}\right)\ \mathrm{A}.$$

  The value of the current at $t = 0.1\,\mathrm{s}$ is not correct; it should be

  $$I(0.1) = \left(0.8 + 1.60e^{(-6\times 0.1)}\right) = 1.68\,\mathrm{A}.$$

  The value of the voltage across the resistor that follows is also not correct. the *magnitude* of the voltage across the resistor is

  $$V_R = IR = 1.68\,\mathrm{A} \times 20\,\Omega = 33.6\,\mathrm{V},$$

  The voltage across the inductor is also wrong. Normal sign conventions give

  $$24\,\mathrm{V} = V_L + V_R,$$

  or

  $$\begin{aligned} V_L &= 24\,\mathrm{V} - V_R \\ &= 24\,\mathrm{V} - 33.6\,\mathrm{V} \\ &= -9.6\,\mathrm{V}. \end{aligned}$$

  The negative sign means that the polarity of V_L actually has the same sense as the polarity of the 24 V source.

  The somewhat paradoxical result that $V_R > 24\,\mathrm{V}$ merits some discussion (or else a simpler example should be chosen).

- p. 225, Example 3: The first line of the answer refers to I_2; this should be I_L. The current is 0.99 A, not 0.97 A.

- p. 374 near bottom (and index entry on p. 938): "Currie temperature (TC)" should be "Curie temperature (T_C).

- p. 406, Fig. 3.120: The electrolytic (polarized) capacitors on the negative side of the supply (C2 and C6) have the wrong polarity. The schematic is also missing a connection point at the junction at the "top" of capacitor C3. [M.A.]

- p. 419, Fig. 4.13: The potential difference across the diode in the Forward Biasing case is completely unrealistic.

- p. 419, Diode *I*-*V* curve in Fig. 4.13: This graph is potentially misleading. The peak inverse voltage rating is typically several orders of magnitude greater than the turn-on voltage, and the leakage current is many, many orders of magnitude less than the peak forward current rating. This isn't the case in this diagram. I have seen diagrams like this in which the scale on the axes is different to the left and below the origin (for example Volts to the right, and 100's of Volts to the left, and mA above the origin and μA below.

- p. 422, Voltage Regulator Example: The discussion suggests that the "series resistor ...should be equal to: $R_S = (V_{\text{in}} - V_{\text{out}})/I$." This value is actually an upper limit on R_S. The value of R_S should be chosen such that

  $$R_S < \frac{V_{\text{in}} - V_{\text{out}}}{I},$$

  and the lower limit should be determined by the current carrying capacity of the diodes. The 1 kΩ resistor chosen for the figure is consistent with the value $(V_{\text{in}} - V_{\text{out}})/I$ being an upper limit.

  If a diode drop of 0.6 V is assumed in the figure for this example, the current through the R_L should be 1.8 mA, the current through R_S should be 3.2 mA, and the current through the diodes should be 1.4 mA.

  This example could use additional discussion.

- p. 424, Adjustable Waveform Clipper: The negative end of the diode should be about 0.6 V *lower* than the desired output level (not higher as stated in the text).

  The use of a 10 kΩ resistor on the input and a 10 kΩ potentiometer to provide the voltage reference isn't a great choice. If a voltage divider is to be used to provide the voltage reference it's equivalent resistance should be much less than that of the input resistor. (If it isn't, there will be a significant change in the reference voltage as the input voltage increases above $V_{\text{ref}} + 0.6$, and the clipped parts of the waveform won't be flat.) There are, of course, settings of the potentiometer such that the parallel resistance of the two "halves" is very small, but if the potentiometer is set "in the middle" the parallel resistance will be 2.5 kΩ, and this will lead to noticeable deviations from the illustrated behavior.

- p. 443: **Rule 2.** The discussion of NPN transistors is wrong. The sentence should read "... the base voltage of an *npn* transistor must be at least 0.6 V greater than the the emitter voltage; otherwise the transistor will *not* pass an collector-to-emitter current." (The sentence talks about emitter-to-collector currents, which doesn't make sense.)

- p. 448, Discussion of emitter follower: For the illustrated circuit it would be better to say "whenever $V_B \leq 0.6$ V the transistor will turn off."

- p. 472, beginning of *Technical Info and Formulas ...* section: "Prdcting" should be "Predicting."

- p. 472, Transconductance section at bottom of page: "the change is gate-source voltage" should read "the change in gate-source voltage."

- p. 509, section on Visible-Light LEDs: typical operating currents are more on the order of 20 mA (rather than the listed 1 to 3 mA).

- p. 537, Notation for negative supply voltage in text and figures: The author calls the positive supply voltage $+V_S$ and the negative supply voltage $-V_S$. This implies that the two supply voltages have the same magnitude. Many op-amps are designed to be run this way, e.g., with supplies at ±15 V, but this is not always true. In fact, many op-amps (and especially comparators) are designed to run from single-sided supplies, in which case the positive and negative supplies clearly don't have the same magnitude. To avoid trouble (see discussion below of Fig. 7.28 on p. 555 for an example) the positive and negative supply voltages should have different labels (V_{CC} and V_{EE} are a common choice).

- p. 538, second paragraph: The output of the amplifier in Fig. 7.3 given in the text is incorrect; it should be $-V\text{in}R_F/R_{\text{in}}$.
- p. 538, second paragraph: The statement is made that the output of the inverting amplifier is negative is "a result of the inverting input." This is misleading at best. This is an inverting amplifier because of the specific feedback network that is used.
- p. 545, Integrator section: The final result, $V_{\text{out}} = -V_{\text{in}}t/RC$ is only correct in the special case in which V_{in} is constant, and the output of the integrator starts at time $t = 0$ with $V_{\text{out}} = 0$. The graph of the triangle wave output should be inverted.
- p. 550, paragraph on *Voltage Gain*: This paragraph is about the open-loop gain A_0, not A_v.
- p. 555, Fig. 7.28: The negative supply voltages in this figure are grounded. It is true that many comparators are designed to run from single-sided supplies, but this is not universally true, and at this point the text is talking about using general op-amps as comparators, so the figure should be consistent with other figures in the text. (This raises the issue of how to label the supply voltages — see comment above regarding discussion on p. 537. If the labeling of the supply voltages implies that they have the same magnitude, it's impossible to draw a figure like this that covers the possibility of both single-sided and dual supplies.)
- p. 560, Section 7.16: This brief section is really an application that should come in the next section *after* the discussion of op-amps as LED drivers.
- p. 586, first paragraph: The statement of the principle of *RC* relaxation oscillators wrongly implies that the discharge of the capacitor must be rapid - the word *rapidly* should be removed from this sentence. (Note that in the first circuit example, the Simple Square-Wave Relaxation Oscillator, the discharging time constant is exactly the same as the charging time constant.)

- p. 586, Fig. 9.2: The inverting and non-inverting inputs of the op-amp are reversed.

- p. 586, Simple Square-Wave Relaxation Oscillator: The second expression in the equation for V_T is missing a factor of V_2 (or +15 V).

- p. 586, Discussion to the right of Fig. 9.3: third-to-last sentence should read something like "…when the anode-to-cathode voltage is greater *by one diode drop* than its *gate-to-cathode* voltage" (italics added). [S.B.]

- p. 587, Simple Triangle-wave/Square-wave Generator: The discussion here has a conceptual error, and the formula is wrong (it's not even dimensionally correct). The statement "It will remain in the saturated state until the voltage at the non-inverting input drops below the negative threshold value ($-V_T$)" is simply wrong; it should read "It will remain in the saturated state until the voltage at the non-inverting input drops below *zero*." The voltage V_1 at the input side of R_2 does have a non-zero threshold, and this threshold is given by
  $$V_T = -\frac{R_2}{R_3} V_{\rm sat}.$$

- p. 588, Equation to the right of Fig. 9.5: This equation is not even dimensionally correct. It should read
  $$f = \frac{1}{4RC\ln 2} \simeq \frac{1}{2.8RC}.$$
  [S.B.]

- p. 588, Section 9.2: I have an editorial comment regarding this section. This seems like the wrong place to introduce 555 timers because flip-flops, which are an important part of 555s, aren't introduced in the text until Section 12.6.

- p. 590, Fig. 9.7: The value of $t_{\rm low}$ given in the work immediately below the circuit diagram is 9.6 ms, while the value given in the graph to the right is 9.4 ms. The second value is consistent with the data.

- p. 590, Fig. 9.7, graph of "Frequency vs. C_1, R_1 and R_2": The values given along the lines in the graph are values of $R_1 + 2R_2$, not $R_1 + R_2$ as indicated in the graph.

- p. 590, Discussion accompanying Fig. 9.7: In the last line of the first paragraph the word "expression" should be "expressions."

- p. 591, Fig. 9.9: The pin 6 input should be connected within the 555 to the non-inverting input of comparator 1. In the figure it's not connected to anything.
- p. 593, Practical Tip: The suggestion in the tip of using a $0.1\,\mu$F capacitor betwee pins 5 and ground is not consistent with the $0.01\,\mu$F shown in Figs. 9.7, 9.8, 9.10, 9.12, and 9.13. The exact value of this capacitor is not critical, but common practice is to use the smaller value. [G.C.]
- p. 594, last paragraph: In the last two sentences the "556" should be "566." [G.C.]
- p. 595, Fig. 9.15, top circuit: There are two resistors labeled R_3; the resistor below the op-amp should be labeled R_4. For a Wien-bridge oscillator to work, the resistors must satisfy the condition $R_3/R_4 = 2$ (which gives a gain of non-inverting gain of 3); to meet this condition the resistor labeled R_3 should be $200\,\text{k}\Omega$ for the given R_4. The discussion to the right of of the figure should be corrected to state that it is R_3 and R_4 that set the non-inverting gain. [S.B.]
- p. 599, Fig. 9.20, graph of reactance: Exchange the terms "capacitive" and "inductive" (but not the "+90°" and "−90°"). [S.B.]
- p. 606, Fig. 10.10a and p. 606, Fig. 10.10c: The electrolytic (polarized) capacitors on the negative side of the supply have the wrong polarity. (In Fig. 10b the polarity is correct.) The schematics are also missing a connection point at the junction at the "top" of capacitor C3. [M.A.]
- p. 632, last paragraph of Section 12.1.1, 5th line: change "may interrupt" to "may interpret." [S.B.]
- p. 632, Fig. 12.2: Title of righthand subfigure should be "Binary-to-Decimal Conversion. [S.B.]
- p. 633, Conversion of 247_8 to decimal: 9×8^0 should be 7×8^0.
- p. 633, Fig. 12.3: In example of Octal-to-Binary Conversion the digit 3 should be converted to 011 instead of 010.
- p. 634, Table 12.1: The decimal 08 should be represented in BCD as 0000 1000, not 0001 1000.

- p. 636, Fig. 12.7: In the first line of text accompanying this figure change “decimal” to “binary.” [S.B.]

- p. 645, Fig. 12.19, lower circuit in the box in the lower right corner of the figure: The labels on the inputs to the upper NAND gate should be switched, so that B is the upper input and A is the lower input.

- p. 646, Discussion accompanying Fig. 12.20: There are several mistakes in this discussion.
  - The sentence starting “Using Identities 17 ...” should read “Using Identities 17 ($B\overline{B} = 0$) and 11 ($\overline{B} + 0 = \overline{B}$), you get”
  - The equation following the sentence above should be

    $$\text{out} = A\overline{B} + 0 + \overline{B} + BC = A\overline{B} + BC + \overline{B}$$

  - The equation after the sentence starting “Using Identities 12 ...” should be

    $$\text{out} = \overline{B}(1) + BC = \overline{B} + BC$$

- p. 656, first line: change “bared” to “barred.” [S.B.]

- p. 681, last line on page: “cross-AND SR flip-flop” should be “cross-NAND SR flip-flop.”

- p. 682, Fig. 12.70: In the circuit diagram the outputs Q and $\overline{Q}$ are reversed. They are also reversed in the timing diagram. (The truth table is correct, but it is inconsistent with the circuit diagram and the timing diagram.

- p. 682, Fig. 12.70: It’s conventional to label the inputs on the cross-NAND inputs $\overline{S}$ and $\overline{R}$ to indicate that the set and reset conditions are triggered when the inputs go low.

- p. 703, Fig. 12.102: In title of top right subfigure change “seperate” to “separate.” [S.B.]

- p. 704, Fig. 12.104: In title of top right subfigure change “seperate” to “separate.” [S.B.]

- p. 706, First sentence: Change first occurence of “74193” to “74192.” [S.B.]

- p. 714, Fig. 12.117: The label on the top line of the timing diagram should be CLK, not $\overline{\text{CLK}}$.

- p. 714, Fig. 12.117: The initial state for P_0, P_1, P_2, and P_3 in the timing diagram is wrong. When the $\overline{\text{CLR}}$ line goes low, the flip-flops are all reset, which means that the outputs are low. When the $\overline{\text{CLR}}$ line goes high, nothing should change: the flip-flops will remain in the reset state until there is a rising edge on S_{CLK}.

- p. 714, Section 12.8.3: The text reads: “When a clock pulse is applied during this load mode, the 4-bit parallel word is latched simultaneously into the four flip-flops . . . ” In the timing diagram no clock pulses are applied during the load mode because the clock is inhibited. The timing diagram makes sense — the load mode loads the parallel word into the inputs, and *after* the loading of the inputs is complete the clock is enabled to step the data through the flip-flops.

- p. 714, Fig. 12.118: There are multiple uses of the symbols D_0-D_3 in this diagram. They are used for the parallel input data lines, and they are used for the D inputs of the flip-flops. This can lead to confusion, especially in interpretation of the timing diagram.

- p. 818, Fig. 13.9: Resistor in top left subfigure should be labeled $470\,\Omega$.

- p. 887: There is a section discussing “magnetic wire.” This wire is really called “magnet wire.” It is used to make electromagnets (and inductors and transformers) but the wire itself is *not* magnetic.