Electromagnetic Waves and Antennas – S. J. Orfanidis
Errata List – August 28, 2019

The page numbers refer to the online version of the book posted on the web page:
http://www.ece.rutgers.edu/~orfanidi/ewa/

p.73. In text line above Eq. (2.13.12), instead of, $k^2 = \omega^2 \mu \epsilon = \omega^2 |\mu\epsilon|^2 e^{-j(\vartheta_c + \vartheta_{\mu})}$, read, $k^2 = \omega^2 \mu \epsilon = \omega^2 |\mu\epsilon| e^{-j(\vartheta_c + \vartheta_{\mu})}$.

p.122. In text line above Eq. (3.10.24), instead of, $T_{\text{compr}} = 2\pi T/\omega_0 = 1/B$, read, $T_{\text{compr}} = 2\pi /T\omega_0 = 1/B$.

p.166. In paragraph below Eq. (5.4.11), instead of, “can be can be”, read, “can be”.

p.205. In fifth text line from top, instead of, “we write (7.15.2)”, read, “we write (7.15.1)”.

p.205. In paragraph below Eq. (3.10.24), instead of, “Example 8.8.2, uses the values,” read, “Example 8.8.2, uses the values,”

p.205. In paragraph below Eq. (7.14.3), instead of, “Using Eq. (7.5.5) with $\rho_{TM}$,” read, “Using Eq. (7.5.5) with $\rho_{TM}$,”

p.258. Fourth text line from the bottom, instead of, “Using Eq. (7.5.5) with $xn^2$ replaced by $xn^2/nT^2$ in $\rho_{TM}$,” read, “Using Eq. (7.5.5) with $xn^2/nT^2$ in $\rho_{TM}$,”

p.267. Eighth text line from the top, instead of, $D_R = \omega^2 \mu_0 (\sin^2 \vartheta_c - \sin^2 \vartheta)\rho_0 \mu_0 (\sin^2 \vartheta_c - \sin^2 \vartheta)\rho_0$.

p.282. In paragraph below Eq. (7.14.3), instead of, “is the one the minimizes”, read, “is the one that minimizes”. 

p.283. Sixth text line from the bottom, instead of, $A_0 A_0$, read, $A_0 A_0$.

p.285. Sixth text line from the top, instead of, “we write (7.15.2)”, read, “we write (7.15.1)”.

p.287. In Eq. (7.15.15), the factor, $\sin^2 \vartheta_a$, should be, $\sin \vartheta_a$.

p.308. Third text line from the bottom, instead of, $\vartheta_1 = \sin a (\sin \vartheta_a /n_1)$, read, $\vartheta_1 = \sin a (\sin \vartheta_a /n_1)$

p.315. Text line below Eq. (8.5.3), instead of, “Sec. 7.7”, read, “Sec. 7.11”.

p.325. In Eq. (8.6.9), the ratios, $1 - \rho_{TM} \Gamma/1 - \rho_{TM} \Gamma/1 - \rho_{TM} \Gamma$, should be multiplied by a factor of $E_0$.

p.329. Last text line, instead of, $\alpha' = \sqrt{\alpha_z^2 + k_0 (1 - n^2)}$, read, $\alpha' = \sqrt{\alpha_z^2 + k_0 (1 - n^2)}$.

p.340. Example 8.8.2, uses the values, $n_H = 3, n_L = 1.38$, and, $L_L = 0.15$, and also instead of, $[F_1, F_2] = [1.0933, 1.3891], \text{read,}[F_1, F_2] = [1.0933, 1.3791]$.

p.350. Third text line below Eq. (8.10.16), instead of, “$\rho_{TM} = \rho_{TE}$ at all angles of incidence”, read, “$\rho_{TM} = \rho_{TE}$ at all angles of incidence in the multilayer case – see for example, Eq.(8.13.3)”

p.368. Eq. (9.1.24) should read,

$$
\begin{align*}
E_\rho &= -j \beta \kappa \left( \vartheta_\rho E_z + \eta_{TE} \frac{1}{\rho} \vartheta_\phi H_z \right) \\
E_\phi &= -j \beta \kappa \left( \varrho \vartheta_\phi E_z - \eta_{TE} \varrho_\rho H_z \right)
\end{align*}
$$

$$
\begin{align*}
H_\rho &= -j \beta \kappa \left( \vartheta_\rho H_z - \frac{1}{\eta_{TM} \rho} \vartheta_\phi E_z \right) \\
H_\phi &= -j \beta \kappa \left( \varrho \vartheta_\phi H_z + \frac{1}{\eta_{TM}} \varrho_\rho E_z \right)
\end{align*}
$$
p.377. In line 4 below Eq. (9.5.8), instead of $\sin k_x$, read, $\sin k_x x$. And, in the last equation below Eq. (9.5.9), the expression for $H_2$ should be corrected to read,

$$H_2 = \frac{1}{\eta \tau_m} E_1 = -\frac{j \omega k_x}{\omega c k_c} \frac{1}{\eta} E_0$$

p.396. In Eq. (9.11.37), instead of $\sin \theta^2 c$, read, $\sin^2 \theta c$.

p.600. Replace $\zeta - 2$ by $\zeta - 2 - \frac{1}{\zeta}$ in the denominator of the second term of the first equation in Eq. (12.2.1).

p.606. Eq. (12.4.6) should read,

$$[a_1(z) \quad a_2(z)] = e^{-j \beta z} \begin{bmatrix} \cos \sigma z - j \frac{\delta}{\sigma} \sin \sigma z & -j \frac{\kappa}{\sigma} \sin \sigma z \\ -j \frac{\kappa}{\sigma} \sin \sigma z & \cos \sigma z + j \frac{\delta}{\sigma} \sin \sigma z \end{bmatrix} \begin{bmatrix} a_1(0) \\ a_2(0) \end{bmatrix}$$

p.609. The factor $U_{12}$ in the numerator of Eq. (12.5.12) should be conjugated, $U_{12}^*$.

p.647. In the third formula from the top, the right-hand-side should be, $g_2 L \frac{e_{\text{max}}}{e - 1}$. Similarly, the right-hand-side of Eq. (13.10.6) should be, $g_2 L \frac{e_{\text{max}}}{e_{\text{min}} - 1}$. And, the expression for $b$ in Eq. (13.10.7) should be,

$$b = \cot \beta l_2 \pm g_L \sqrt{\frac{e_{\text{max}}}{e_{\text{min}} - 1}}$$

p.650. In the penultimate paragraph of Example 13.11.1, $X_2 = 1/j \omega C$ and $X_1 = j \omega L$, should be replaced by, $X_2 = -1/j \omega C$ and $X_1 = \omega L$.

And in the last paragraph, $X_2 = j \omega L$ and $X_1 = 1/j \omega C$, should be replaced by, $X_2 = \omega L$ and $X_1 = -1/j \omega C$.

p.656. In Example 13.12.3, the solution for $Q_{\text{min}}$ should be, $Q_{\text{min}} = \sqrt{200/50} - 1 = 1.73$.

p.670. In Eq. (14.4.5), the expression, $S_{22}a_1 + S_{22} \Gamma_L b_2$, should read, $S_{21}a_1 + S_{22} \Gamma_L b_2$.

p.672. In Eq. (14.5.8), the bottom equation should be corrected to read,

$$\Gamma_{\text{out}} = S_{22} + \frac{S_{12} S_{21} \Gamma_G}{1 - S_{11} \Gamma_G} = \frac{S_{22} - \Delta \Gamma_G}{1 - S_{11} \Gamma_G}$$

The same correction also applies to Eq. (14.8.1) on p.687.

p.673. The first line of the equation below Eq. (14.5.9) should read,

$$1 - |\Gamma_{\text{in}}|^2 = 1 - \left| \frac{S_{11} - \Delta \Gamma_L}{1 - S_{22} \Gamma_L} \right|^2 = \frac{|1 - S_{22} \Gamma_L|^2 - |S_{11} - \Delta \Gamma_L|^2}{|1 - S_{22} \Gamma_L|^2}$$

p.694. In Example 14.10.1, the numerical values of $Z_G$ and $Z_L$ should be interchanged, that is,

$$Z_L = 69.21 + 14.42 j \Omega, \quad Z_G = 23.15 - 24.02 j \Omega$$

p.698. In second paragraph from the top, instead of “corresponding matched load”, read, “corresponding matched generator”.

p.704. The two-line MATLAB code above Fig. 14.12.2 should read,
gG = smatch(S);
F = nfig(Fmin, rn, gopt, gG);

p.723. In lines 3 & 4 below Eq. (15.6.2), the term, $k_x \hat{z}$, should be changed to, $k_x \hat{x}$.

p.755. After Eq. (16.7.1), the Boltzmann constant should read, $k = 1.3806 \times 10^{-23}$ W/Hz K.

p.765. In the last line of Example 16.8.3, the calculated value of $G/T$ should be, 24.2082 dB.

p.782. In line 3 from the top, instead of “Appendix F”, read, “Appendix G”.

p.852. The last equation should have a double integral, i.e.,

$$E(x, y, z) \approx 2jk \cos \theta \frac{e^{-jkr}}{4 \pi r} \int_{-\infty}^{\infty} E(x', y', 0) e^{k_x x' + k_y y'} dx' dy'$$

p.855. The first of Eqs. (19.4.7) should read, $\hat{E}(k_x) = \int_{-\infty}^{\infty} E(x, 0) e^{jk_x x} dx$.

p.1021. In the text line before Eq (20.22.13), instead of $\lambda_0 \leq \lambda_1 \leq \cdots \leq \lambda_M$, read, $\lambda_0 \geq \lambda_1 \geq \cdots \geq \lambda_M$.

p.1049. In line 1 below Eq. (21.3.3), instead of, $F_1(v, s)$, read, $F_1(v, \sigma)$.

p.1050. Inside the integral of the equation preceding Eq. (21.3.5), instead of, $e^{jmv\xi}$, read, $e^{jmv\xi}$.

p.1051. In Eq. (21.3.15), instead of, $f_0(v, \sigma_a)$, read, $f_0(v, \sigma_b)$.

p.1062. In the second equation of Eq. (21.6.5), instead of, $\pm$, read, $\mp$. And, in the equation below the fourth text paragraph, instead of, $F_{m,24} = \hat{x} \cdots$, read, $F_{m,24} = -\hat{x} \cdots$. Moreover, in Eq. (21.6.7), instead of $F_{m,12}$, read, $F_{m,13}$.

p.1071. In last line of third paragraph of Section 21.9, instead of, $\hat{x}' = -\hat{z}$, read, $\hat{z}' = -\hat{z}$.

p.1100. Line 2 of Sec. 22.4, instead of “see Fig. 22.3.4”, read, “see Fig. 22.1.1”.

p.1143. The first line of the MATLAB code at the bottom of the page should be,

$$[a, dph] = \text{binomial}(0.5, 90, 7);$$

p.1148. Example 23.9.1 shows the case of a 5-element array. The 7-element case corresponds to the following changes in the code, table, and weights,

$$[a, dph] = \text{dolph}(0.5, 90, 7, 20);$$

<table>
<thead>
<tr>
<th>i</th>
<th>$x_i$</th>
<th>$\psi_i$</th>
<th>$Z_i$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.9659</td>
<td>1.0826</td>
<td>0.4691 + 0.8832j</td>
</tr>
<tr>
<td>2</td>
<td>0.7071</td>
<td>1.7852</td>
<td>-0.2127 + 0.9771j</td>
</tr>
<tr>
<td>3</td>
<td>0.2588</td>
<td>2.6782</td>
<td>-0.8945 + 0.4470j</td>
</tr>
<tr>
<td>4</td>
<td>-0.2588</td>
<td>3.6050</td>
<td>-0.8945 - 0.4470j</td>
</tr>
<tr>
<td>5</td>
<td>-0.7071</td>
<td>4.4980</td>
<td>-0.2127 - 0.9771j</td>
</tr>
<tr>
<td>6</td>
<td>-0.9659</td>
<td>5.2006</td>
<td>0.4691 - 0.8832j</td>
</tr>
</tbody>
</table>

$x_0 = 1.1270, \quad w = [1, 1.2764, 1.6837, 1.8387, 1.6837, 1.2764, 1]$.

In penultimate line of Example 23.9.2, instead of $R = 20$, read, $R = 25$.

p.1149. Line 4 below the table, instead of $kd < \pi/2$, read, $kd < \pi$.  

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p.1158. Line 6 above Eq. (23.10.10), instead of \( y = \sinh(x) x \), read, \( y = \sinh(x) / x \). Line 2 above Eq. (23.10.11), instead of “is \( \psi \)-space”, read, “in \( \psi \)-space”.

p.1168. and p.1169, the MATLAB function, multbeam, should be, multibeam.

p.1197. Line 5 from bottom, “Then, Eq. (24.9.3)”, should read, “Then, Eq. (24.8.9)”.

p.1210. In the bottom integral of Eq. (24.12.15), instead of \( dy \), read \( dz \).

p.1237. Line 2, instead of, Appendix F, read, Appendix G.
Line 4, instead of, range \([-h_1, h_1]\), read, range \([-h_2, h_2]\).
Upper limit of the integral in Eq. (25.3.14) should be \( h_2 \) instead of \( h_1 \).
In the equation below Eq. (25.3.14), \( u_1 \) should read,
\[
u_1 = k \left[ \sqrt{d^2 + (h_2 - z_0)^2} + s(h_2 - z_0) \right]
\]
Eq. (25.3.16) should be read,
\[
\int_{-h_2}^{h_2} F(z) \, dz = \sum_{i=1}^{12} c_i G(z_i, s_i)
\]
and the table below it should read,

<table>
<thead>
<tr>
<th>( i )</th>
<th>( z_i )</th>
<th>( s_i )</th>
<th>( c_i )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>( h_1 - b )</td>
<td>1</td>
<td>( c_1 )</td>
</tr>
<tr>
<td>2</td>
<td>(-h_1 + b)</td>
<td>1</td>
<td>( c_1 )</td>
</tr>
<tr>
<td>3</td>
<td>(-h_1 - b)</td>
<td>1</td>
<td>( c_1 )</td>
</tr>
<tr>
<td>4</td>
<td>( h_1 + b )</td>
<td>1</td>
<td>( c_1 )</td>
</tr>
<tr>
<td>5</td>
<td>( b )</td>
<td>1</td>
<td>(-2c_1 \cos k h_1 )</td>
</tr>
<tr>
<td>6</td>
<td>(-b )</td>
<td>1</td>
<td>(-2c_1 \cos k h_1 )</td>
</tr>
<tr>
<td>7</td>
<td>( h_1 - b )</td>
<td>-1</td>
<td>( c_1^* )</td>
</tr>
<tr>
<td>8</td>
<td>(-h_1 + b )</td>
<td>-1</td>
<td>( c_1^* )</td>
</tr>
<tr>
<td>9</td>
<td>(-h_1 - b )</td>
<td>-1</td>
<td>( c_1^* )</td>
</tr>
<tr>
<td>10</td>
<td>( h_1 + b )</td>
<td>-1</td>
<td>( c_1^* )</td>
</tr>
<tr>
<td>11</td>
<td>( b )</td>
<td>-1</td>
<td>(-2c_1^* \cos k h_1 )</td>
</tr>
<tr>
<td>12</td>
<td>(-b )</td>
<td>-1</td>
<td>(-2c_1^* \cos k h_1 )</td>
</tr>
</tbody>
</table>

The function imped2.m contained in ewa.zip has been updated accordingly.

p.1244. In the three equations between Eq. (25.5.8) and (25.5.9), \( \cos(kh_p \cos \theta) \), should read, \( \cos(kh_p \cos \theta) \).

p.1273. Eq. (D.6) in Appendix D should read,
\[
\nabla \times \nabla \times [p \, G(r)] = \frac{2}{3} p \, \delta^{(3)}(r) + \left[ (jk + \frac{1}{r}) \frac{3f(\hat{r} \cdot p) - p}{r} + k^2 \hat{r} \times (p \times \hat{r}) \right] G(r)
\]

p.1285. In Eq. (F.28) of Appendix F, the quantity \( I(\phi, k \rho) \) should be replaced by \( I(\phi) \).