

ERRATA
 THERMAL RADIATION HEAT TRANSFER, 5TH Edition, 1ST Printing
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Page

7 line 5: 86,000 mile/s should be 186,000 miles/s

15 Three lines before Eq. (1.7), $I_{\lambda b}$ should be $I_{\lambda b,n}$ 17 In Eq. 1.12, $(\phi_2 - \phi_2)$ should be $(\phi_2 - \phi_1)$.

In last equation on page, central term should be
$$\frac{2 \times 0.59552 \times 10^8 (W \cdot \mu m^4 / m^2)}{(6 \mu m)^5 (e^{14,388/6 \times 1273} - 1) sr}$$

18 Example 1.2, in the equation, I_{λ} (0.55 μm) should be $I_{\lambda b}$ (0.55 μm)

19 On Figure 1.11, label on vertical axis should be

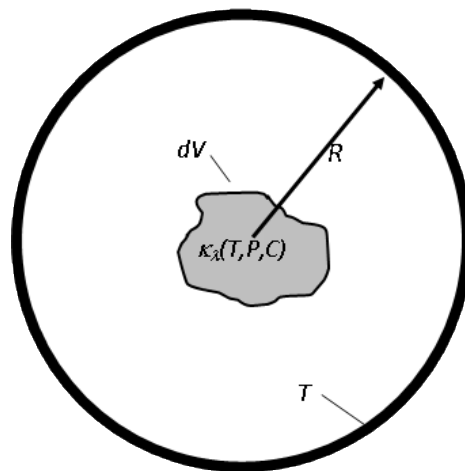
Spectral blackbody emissive power ($W / m^2 \cdot \mu m$)22 Line before Eq. (1.25), "(Equation 1.22)" should be "(Equation 1.24)"; two lines after Eq. (1.25), λ_{max} should be $I_{\lambda_{max}b}$ 24 Example 1.7, the units on s should be $W/m^2 \cdot K^4$ 26 Second line, $E_{\lambda_1 T \rightarrow \lambda_2 T}$ should be $F_{\lambda_1 T \rightarrow \lambda_2 T}$

31 Line before Eq. (1.36), "(Equation 1.35)" should be "(Equation 1.34)"

32 In footnote, "(Equation 11.3)" should be "(Equation 1.37)"

33 First sentence in Section 1.6.3: "(Equation 1.40)" should be "(Equation 1.37)"

34-5 Fig. 1.17 should be replaced with figure below:

36 Line 6, "intensity in direction (θ_i, ϕ_i) ..." should be changed to "intensity in direction (θ, ϕ) ..."

Line below Equation 1.57, reword as "...the scattering phase function, which is a measure of the amount of radiating energy propagating in $\Omega_i(\theta_i, \phi_i)$ that is redirected into $\Omega(\theta, \phi)$, and can be....."

In Equation 1.59, middle term, change $dI_\lambda(S)$ to $dI_{\lambda,s}(S)$, and change final term from

$$\frac{\sigma_{s,\lambda}}{4\pi} I_\lambda(S) dS \text{ to } -\sigma_{s,\lambda} \frac{\Phi_\lambda(\theta, \phi)}{4\pi} I_\lambda(S) dS$$

37 In equations (1.63) and (1.64), the last minus sign (on the integral terms) should be changed to plus.

38 First paragraph, second line, change "Equation 1.63" to "Equation 1.64"

39 First paragraph, last line: change $I_{\lambda,2} S_1^2 / I_{\lambda,2} S_2^2$ to $I_{\lambda,1} S_1^2 / I_{\lambda,2} S_2^2$

In Figure 1.18b, the dA_1 on the far right should be dA_2

In Figure 1.18c, the dA_1 on the surface of the sphere should be dA_2

48 In Figure 2.1, the label on the transmitted portion should be $d\Omega(\theta_t, \phi_t)$ and on the reflected portion should be $d\Omega(\theta_r, \phi_r, \theta_i, \phi_i)$

56 Label on vertical axis on Figure 2.3 should be $\epsilon_\lambda(T)$

58 In the integrals in first and second row, the upper limit on the second integral should be 2000, not 2; the lower and upper limits on the third integral should be 2000 and 6000, not 2 and 6; and the lower limit on the last integral should be 6000, not 6.

Label on vertical axis on Figure 2.6 should be $\epsilon_\lambda(650 \text{ K})$

59 Line above Eq. 2.10a, the sub I on the d^2Q term should be sub a.

60 In the caption to Figure 2.7, change dA_e to dA_i

65 In Example 2.7, the first equation should be

$$\alpha(T) = \frac{\int_{\cap} \left[\int_{\lambda=0}^{\infty} \epsilon_\lambda(T) C I_{\lambda b}(T_i) d\lambda \right] \cos \theta_i d\Omega_i}{\int_{\cap} \left[\int_{\lambda=0}^{\infty} C I_{\lambda b}(T_i) d\lambda \right] \cos \theta_i d\Omega_i} = \frac{1}{\sigma T_i^4} \int_{\lambda=0}^{\infty} \epsilon_\lambda(T) E_{\lambda b}(T_i) d\lambda$$

68 In heading of Section 2.4.1.3, Refelctivities should be Reflectivities

69 In the second integral equation: multiply the integral on the RHS by $dAd\lambda$

In Section 2.4.6.1, 4th line, delete the π from the middle term of the equation.

89 In Eq. (3.1), θ_i should be θ_i

90 Eq. (3.4a) should be:

$$\rho_{\parallel} = \left[\frac{\tan(\theta_i - \chi)}{\tan(\theta_i + \chi)} \right]^2$$

Eq. (3.7a) should be:

$$\rho(\theta_i) = \frac{1}{2} \frac{\sin^2(\theta_i - \chi)}{\sin^2(\theta_i + \chi)} \left[1 + \frac{\cos^2(\theta_i + \chi)}{\cos^2(\theta_i - \chi)} \right]$$

Eq. (3.7b) should be:

$$\rho_n = \rho(\theta = 0) = \left(\frac{n_2 - n_1}{n_2 + n_1} \right)^2 = \left[\frac{(n_2 / n_1) - 1}{(n_2 / n_1) + 1} \right]^2$$

93 In Eq. (3.8), the third term on the right should be

$$-\frac{n^2(n^2-1)^2}{(n^2+1)^3} \ln \left(\frac{n-1}{n+1} \right)$$

In Fig. (3.3b), label on vertical axis, emiss should be emissivity

94 In Eq. (3.10), θ should be θ_i

Eq. (3.11a) should be:

$$\rho_{\lambda,\parallel}(\theta_i) = \frac{a^2 + b^2 - 2a \sin \theta_i \tan \theta_i + \sin^2 \theta_i \tan^2 \theta_i}{a^2 + b^2 + 2a \sin \theta_i \tan \theta_i + \sin^2 \theta_i \tan^2 \theta_i} \rho_{\lambda,\perp}(\theta_i)$$

Eq. (3.12b) should be:

$$b^2 = \frac{1}{2} \{ [(n^2 - k^2 - \sin^2 \theta_i)^2 + 4n^2 k^2]^{1/2} - (n^2 - k^2 - \sin^2 \theta_i) \}$$

99 In Eq. (3.20), The + beginning the second line should be a minus sign.

102 Eq. (3.28) should be

$$\epsilon_n(T) = 0.0348T \sqrt{r_{e,273}}$$

132 First equation, replace $\epsilon_\lambda = \alpha_\lambda = 0$ with $\epsilon_\lambda = \alpha_\lambda = 1$

Last equation: replace q_i with q_{sol}

133 Line before Eq. (3.31), add sub i to all θ and ϕ ., and replace sub l on q to sub solar.

134 In Example 3.6 third equation, q_i should be q_{solar}

176 In first line, the c and c/2 should not be under the root sign.

218 First paragraph, "...Equation 6.28..." should be "... Equation 5.28...".

223 In Example 5.15, third equation should be:

$$-3000(0.3249) \frac{1-0.6}{0.6} + \frac{Q_3}{A_3} = \sigma [-0.3249T_1^4 - 0.6751T_2^4 + (550)^4]$$

226 In Eq. (5.41) replace G with Γ

229 Top equation, 4th line T_3 should be ϑ_3

231`Next to last line of Example 5.17: Replace G_{kj} with Γ_{kj}

234 In Example 5.18, 4th line of text, remove the star from the subscript on dF

268 In first line, replace kW with kW/m.

273 In the equation, in the second term on the RHS, first line, the F should be $F_{3T1 \rightarrow 5T1}$ and on the next line, F in first term should be $F_{3T2 \rightarrow 5T2}$

279 In last equation, second term, delete $= \epsilon_1$

281 In legend of Fig. 6.10, last entry, replace * with =

287 Third line of text, delete comma between ϵ and l

291 In Example 6.8, first line of solution, heat capacity should be given as $\rho_M V c T_1$ (i.e., c is not a subscript)

In line after second equation, T_1 should be T_i ; also in line before and 2 lines after last equation.

304 In second line of Eq. 6.35, A_1 should be A_2

308 In next to last line, $\epsilon_2=\epsilon_3=1$ should be $\epsilon_2=\epsilon_3=1$

325 In Problem 6.15, First line should read "In Figure 6.25,"

365 In Eq. 7.37, lower limit on integral should be $z=0$

366 In Eq. (7.38), on LHS, ϑ_1^4 should be ϑ_1^4

385 In Eq. (7.90), middle expression, replace + with –

391 Last expression in Table 7.2, replace final $d\theta$ with $d\lambda$

392 The third equation on the page should be

$$R_{\theta_2} = \frac{1}{\epsilon_2} \int_{\theta_2^*=0}^{\theta_2} \cos^2 \theta_2^* \sin \theta_2^* d\theta_2^*$$

423 In Example 8.1 third line, make ϑ to ϑ^4

427 Replace x-axis label with $X_{1,j}$

443 First line after Eq. (9.1), the relation $\lambda_0 = n_\lambda$ should be $\lambda_0 = n_\lambda \lambda$

In the first three lines of the second paragraph, all k symbols should be κ .

445 On vertical axis of Figs. 9.4 and 9.5, replace κ with α

450 Eq. (9.5) should be

$$\frac{\kappa_{\eta,ij}}{S_{ij}} = \frac{1}{\gamma_D} \sqrt{\frac{\ln 2}{\pi}} \exp \left[-(\eta - \eta_{ij})^2 \frac{\ln 2}{\gamma_D^2} \right]$$

458 On RHS of Eq. (9.25) in denominator move right square bracket to follow δ

463 Eq.(9.33a) should be

$$\alpha(T) = \alpha_0 \frac{1 - \exp\left(-\sum_{k=1}^m u_k \delta_k\right)}{1 - \exp\left(-\sum_{k=1}^m u_{0,k} \delta_k\right)} \left[\frac{\Psi(T)}{\Psi(T_0)} \right]$$

464 In Table 9.2, the α_0 values for CO_2 should be 2.47×10^{-9} and 2.48×10^{-9b}

465 Eqs. (9.33c,d) should be:

$$\Psi(T) = \frac{\prod_{k=1}^m \sum_{\nu_k=\nu_{0,k}}^{\infty} \left\{ (\nu_k + g_k + |\delta_k| - 1)! / [(g_k - 1)! \nu_k!] \right\} e^{-u_k \nu_k}}{\prod_{k=1}^m \sum_{\nu_k=0}^{\infty} \left\{ (\nu_k + g_k - 1)! / [(g_k - 1)! \nu_k!] \right\} e^{-u_k \nu_k}}$$

$$\Phi(T) = \frac{\left[\prod_{k=1}^m \sum_{\nu_k=\nu_{0,k}}^{\infty} \left\{ (\nu_k + g_k + |\delta_k| - 1)! / [(g_k - 1)! \nu_k!] \right\} e^{-u_k \nu_k} \right]^{1/2}}{\prod_{k=1}^m \sum_{\nu_k=\nu_{0,k}}^{\infty} \left\{ (\nu_k + g_k + |\delta_k| - 1)! / [(g_k - 1)! \nu_k!] \right\} e^{-u_k \nu_k}}$$

466 In Example 9.1, second paragraph of solution, first line, Equation 9.32c should be Equation 9.33c; next to last line, same paragraph, same correction; last line, Equation 9.32a should be Equation 9.33a.

In third paragraph of solution, last line, Equation 9.32d should be Equation 9.33d and Equation 9.32b should be Equation 9.33b.

4th paragraph in the solution, $\omega = \omega_0 \left(\frac{T}{T_0} \right)^2$ should be $\omega = \omega_0 \left(\frac{T}{T_0} \right)^{1/2}$

In fifth paragraph of solution, $u = \lambda \alpha / \omega$ should be $u = X \alpha / \omega$.

and, in 6th paragraph, $P_e = \left[\frac{P}{P_0} + \frac{P}{P_0} (b-1) \right]$ should be $P_e = \left[\frac{P}{P_0} + \frac{P}{P_0} (b-1) \right]^n$

467 First line in Section 9.3.3.1 should read: "To find solutions for total radiative energy transfer, the transfer equations described in Chapter 1"

468 In Eq. (9.44), the coefficient preceding the integral should be $2\pi\Delta\eta_l$, not $2\pi\Delta\kappa_l$

In Eq. (9.45), all a_η should be κ_η .

470 In column headings to Tables 9.3 and 9.4, η_1 should be η_l

In Table 9.3, α_0 for 10.4 band, the entry should be 2.58×10^{-9}

477 In Table 9.7, for the value for $l = -1$, $m = 2$, $n = 1$, delete the minus sign on 21.5003.

In the following paragraph, the units on R should be (kJ/kmol.K), and the value for N should be 12.2 mol/m^3 .

478 Caption to Fig. 9.13, T_h should be T_b

480 Eq. (9.61), insert right paren before the right bracket

481 In Table 9.9, all C_{nj} in third line should be lower case

In Fig. 9.14, In caption, bar/cm should be bar·cm

482 Fig. 9.15, In caption, bar/cm should be bar·cm

483 In Example 9.5, 4th line of solution, labels a_1 , a_2 , a_3 should be a_0 , a_1 , a_2 .

Third line from bottom, (bar·atm) should be (bar·cm)

- 485 In the line after Eq. (9.72), the k_λ should be κ_λ .
- 494 First line after Eq. (10.1), $D/D\tau$ should be D/Dt
- 495 First sentence in Section 10.3.1 should refer to (Equation 1.63) and not (Equation 1.24).
- 506 Line after Eq. 10.39, Equation 10.26 should be Equation 10.20.
- 507 In Eq. 10.44, first l_λ inside brackets should be \hat{I}_λ .
- 512 Lower limit on inner integral in Eq. (10.62) should be A_j not A_l
- 514 In Eq. 10.75b, in the next to last term, the $E_{\lambda b, g}$ should read $E_{\lambda b, 2}$ so the equation becomes:

$$-F_{2-1} \frac{1 - \epsilon_{\lambda, 1}}{\epsilon_{\lambda, 1}} \bar{t}_{\lambda, 2-1} q_{\lambda, 1} + \frac{1}{\epsilon_{\lambda, 2}} q_{\lambda, 2} = -F_{2-1} \bar{t}_{\lambda, 2-1} E_{\lambda b, 1} - F_{2-1} \bar{\alpha}_{\lambda, 2-1} E_{\lambda b, 2} + E_{\lambda b, g}$$

- 518 In Table 10.1, the final exponential integral term in the second and third table entries should be

$$E_3 \left[\kappa_\lambda h \sqrt{(R/h)^2 + 1} \right]$$

- 520 In Eq. (10.101), first term should be $G_{\lambda, k}$
- 527 Example 10.6, final equation should be

$$Q_i = GA = \epsilon_{CO_2} \sigma T_g^4 A = 0.170 \times 5.6704 \times 10^{-8} (1100)^4 \times 16\pi = 709 kW$$

- 536 Line before Equation 11.3a: in equation, replace $d\beta_\lambda$ with $d\tau_\lambda$
- 537 In Eq. (11.9a), the limits on the last integral should go from $\mu = 1$ to $\mu = 0$.
- 538 In Eq. (11.11), the final integral should be positive, not negative.
- 547 In Eq. (11.51b), delete subscript λ in integral limits.
- 563 In Eq. (11.98), third line, denominator, insert comma between x_o and 0
- 568 In Eq. (11.102) upper limit should be $\sin^{-1}(r/R)$

.....

- 581 In Eq. (12.1), in the integral in the exponential the argument should be $\beta_\lambda(S^{**}) dS^{**}$
- 588 In Eq. (12.19), the tem on the left should be negative.
- 590 In Eq. (12.30), delete the $d\lambda$.
- 597 In text line after Eq. 12.47, Equation 15.38 should be Equation 12.38
- 599 In Eq. (12.30), delete $d\lambda$
- 605 In Eq. (12.61), numerator on the LHS, delete the subscript 2.
- 626 Two lines after Eq. (13.29), the "l coordinate" should be "i coordinate".
- 629 In Eq. (13.45) and (13.46), replace κ_1 with τ_1
- 642 Eq. (13.90) should be $\sigma T^4(\tau) = \sigma T_1^4 - (\tau + 1/\epsilon_1 - 1/2) q_r$
- 650 Near center of page, line beginning "obtain ..." replace $P = 1$ with $P = 2$
- 651 Table 13,4, first line of data, insert S_2 under Approx. column
- 668 One line above Eq. (13.134: Equation 17.127 should be Equation 13.127.
- 675 Line below Eq. (13.156), Equation 17.49 should be Equation 13.156
- 740 Two lines after Eq. (14.45), the z inside the abs value should be bold.
- 745 In Homework Problem 14-4, ($\lambda = 0.514$ mm) should be $\lambda = 0.514 \mu m$)

751 Eq. (15.5) should be $C_\lambda = C_{\lambda,\kappa} + C_{\lambda,s}$ $Q_\lambda = Q_{\lambda,\kappa} + Q_{\lambda,s}$

753 Second paragraph, line 3, replace x with ξ .

755 First paragraph in Section 15.3.1, second line, replace x with ξ .

756 First paragraph, line 3: Replace "cross section" with coefficient.

765 In Eq. (15.24), top relation should be

$$C_{s,\lambda} = \frac{24\pi^3 V^2 \left[(n^2 - k^2 - 1)(n^2 - k^2 + 2) + 4n^2 k^2 \right]^2 + 36n^2 k^2}{\lambda^4 \left[(n^2 - k^2 + 2)^2 + 4n^2 k^2 \right]^2}$$

769 Second line, last symbol should be ζ_j , not x_j

771 Two lines above Eq. (15.37), replace "absorption efficiency..." with "absorption cross-section..."

773 Next to last line in Section 15.6.1, FDTD should be FDTD

776 In requirement (ii), line 2, replace "decrease" with "decreases"

768 In Eq. (15.29a) ρ should be ξ

785 Solutions to HW 15.1 should be:

$$\text{Answer: } 1.35 \times 10^{-5} \mu\text{m}^2; 3.90 \times 10^9 \text{ cm}^{-3}; 1.64 \times 10^{-8}; 31.6 \times 10^{-8} \text{ g.}$$

787 paragraph 1, line 6. Add "(RTE)" after "radiative transfer equation".

paragraph 3, lines 2 and 3. Should read "In addition, the RTE can be derived from [...]" instead of "In addition, the radiative transfer equation (RTE) can be derived from [...]"

paragraph 3, line 3. Change "EM" to "electromagnetic".

paragraph 3, line 4. Change "Section 14.5" to "Section 14.6".

788 paragraph 4, line 13. Should read "[...] by exciting surface waves having a high degree [...]" instead of "[...] by exciting surface waves a having a high degree [...]"

paragraph 5, line 3. Change "micro electro-mechanical systems" to "micro-electro-mechanical systems".

794 Equation (16.12). The left-hand side of Eq. (16.12) should be " $u(\omega, T)$ " and not " $u(\omega T)$ ".

795 paragraph 1, line 3. Remove "the" before "near-field thermal radiation".

802 Equation (16.26). There is an error in the last g -term on the right-hand side of Eq. (16.26). The subscript should be " $sl\rho\alpha$ " instead of " $sl\phi\alpha$ ". For clarity, the correct Eq. (16.26) is given below:

$$q_{\omega,sl}(z_c) = \frac{k_0^2 \Theta(\omega, T_s)}{\pi^2} \text{Re} \left\{ iK_s''(\omega) \int_0^\infty k_\rho dk_\rho \int_z dz' \left(\begin{array}{l} g_{sl\rho\alpha}^E(k_\rho, z_c, z', \omega) g_{sl\phi\alpha}^{H*}(k_\rho, z_c, z', \omega) \\ - g_{sl\phi\alpha}^E(k_\rho, z_c, z', \omega) g_{sl\rho\alpha}^{H*}(k_\rho, z_c, z', \omega) \end{array} \right) \right\}$$

810 paragraph 3, line 5. The reference should be "Kittel et al. (2005b)" and not "Kittel et al. (2005)".

815 Homework problem 16.7. The reference should be "Greffet et al. (2002)" and not "Greffet et al. (1998)".

834 Equation above Eq. (17.36) should be numbered (17.35)

848 In lines 3 above and 2 above, subscripts on T should have subscript 1, not /

854 Eq. (17.81c), make argument of E_2 into $[\beta_2(D_2 - x_2)]$

860 In HW 17.8, put subscript L after T in text, on Figure and in Answer..

885 In Factor 14, for Factor $F_{2,2}$, the term $-L/2R$ should be $-2/L\pi R$