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ERRATA

THERMAL RADIATION: AN INTRODUCTION

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NOTE: The recent update to the International System of Units has changed some values for constants used in Example Problems and Homework. These are updated in the Errata to use the latest SI values. The recently updated SI constant values are noted at the end of this Errata listing.

Page Correction

37,38 In Examples 2.1 and 2.2, the revised value of C_1 (see page 429, below) changes the results slightly. In Example 2.1, the first equation results in 2747 W/(m^2.μm.sr), and the final result is 8629 rather than 8627 W/(m^2·μm). In Example 2.2, replace the result of 0.256 x 10^8 with 0.259 x 10^8.

42 At end of paragraph preceding Eq. (2.28), replace the parenthetical expression with: (assuming n is independent of wavelength):

Eq. (2.29) should read*: $\lambda_{max}T = C_3 = 2897.7720$ μm·K

43* Eq. (2.30), replace the value of C_4 with 4.095 68 x 10^{-12} and in the line below, with 4.095 68 x 10^{-12}

44* In Eq. (2.33) replace the value of σ with 5.670 374 419 x 10^{-8} (W/m^2·K) (This affects the value of σ shown in some later examples, but does not affect the results since usually rounded to at most 6 sig figs).

47 In Eqs. (2.38) and (2.39), make the dummy variable explicit by using the forms:

$$F_{0\to\lambda T} = \frac{2\pi C_1}{\sigma T^4}\int_0^{\lambda}\frac{d\lambda}{\lambda^5\left(e^{\frac{C_2}{\lambda T}}-1\right)} = \frac{2\pi C_1}{\sigma C_2^4}\int_{\zeta}^{\infty}\frac{\zeta^{*3}}{e^{\zeta^*}-1}d\zeta^* \qquad (2.38)$$

$$F_{0\to\lambda T} = 1 - \frac{15}{\pi^4}\int_0^{\zeta} \frac{\zeta^{*3}}{e^{\zeta^*}-1}\, d\zeta^* \qquad (2.39)$$

49 Example 2.9: The result should read = 0.083053 – 0.002134 = 0.0809, giving an efficiency of about 8 %.

63 For clarity, reword the paragraph starting with "We start the analysis…" with:

We start the analysis with the radiative intensity $I_\lambda(\theta,\phi)$ leaving surface element *dA* as in Figure 1.18a.. The projected area is formed by taking the area that the energy is leaving and projecting it normal to the direction of the radiation, $dA\cos\theta$.

To analyze the radiative exchange between two finite surfaces, we need to carry out integration over the entire area of each surface. For this, consider radiative energy leaving a small area element dA_1 and traveling in a nonparticipating medium as in Figure 1.18b. Assume that this energy is incident on a second small area element dA_2 on finite area A_2, at distance S_{12} from dA_1. The projected areas are formed by taking the area that the energy is passing through and projecting it normal to the direction of the radiation; therefore, $dA_1\cos\theta_1$ and $dA_2\cos\theta_2$ are the normal components of the infinitesimal areas along direction S_{12}. The elemental solid angle is centered about the direction of the radiant path and has its origin at *dA*. Using the definition of spectral intensity $I_{\lambda,1}$ as the rate of energy passing through dA_1 per unit projected area per unit solid angle and per unit wavelength interval, the energy $dQ_{\lambda,1}$ from *dA* passing through dA_1 in the direction of S_{12} is

67 In Problem 2.10, the answer should be 0.809 h

78-80 In Figure 3.4, change the cosine function to 0.850 cos(θ). Use this function in the solution of Example 3.3, and round the result to 3 significant figures to give a final result of 32,200 W/m^2.

90 In the equation at the top of the page, all upper limits in the integrals should be ∞, not N (3 places).

91 In Example 3.6, all upper limits in the integrals in the first equation should be ∞, not N (3 places). Also, due to the revised constants*, the final answer should read:

$$\alpha = 0.90 \times 0.32639 + 0.37832 + 0.25(1 - 0.88375) = 0.7015.$$

109 In Homework Problem 3.5, the answer to part (a) should be 0.764.

111 The answer to HW Problem 3.10 should be 30.4 min.

128 Example 4.1: Answer for perpendicular compnent should be 0.299, and reflectivity for unpolarized incident intensity should be 0.251.

132 Table 4.2. in the values for Normal Spectral Reflectivity for Aluminum, from Eq. (4.51), the values should be 0.916 and 0.979 instead of 0.883 and 0.970.

137 Example 4.4: Replace the third equation with:

$$\alpha_n(T = 250\text{ K}) = \frac{\varepsilon_n(T = 500\text{ K})}{\sqrt{2}} = \frac{\sqrt{1/2}\int_0^\infty \varepsilon_{\lambda,n}(T = 500\text{ K})I_{\lambda,b}(500\text{ K})\,d\lambda}{\int_0^\infty I_{\lambda,b}(500\text{ K})\,d\lambda}$$

and replace the fourth equation with

$$\varepsilon_n(T = 500\text{ K}) = 0.0348T\sqrt{r_{e,273}} = 0.0348T\sqrt{r_{e,273}}\sqrt{\frac{273}{298}T}$$

$$= 0.0348\sqrt{10\times10^{-6}}\sqrt{\frac{273}{298}}\times 500 = 0.053$$

147 Last equation: Replace q_{sol} with G_{sol}.

149 In first line of the final paragraph in Example 4.6, replace 15 μm with 1.5 μm

150 Example 4.7: The result of the first equation should be 1150 W/m^2. The result of the second equation should be 68.3 W/m^2. The final result should be 1150-68 = 1082 W/m^2.

151 In HW Problem 4.1, the answers should be 0.9797 and 0.9405.

152 In HW 4.6, the answers should be 645 K; 0.0329; 1.31

In HW 4.8, The answers should be: *Answer:* $\varepsilon_{\lambda,Al}(\lambda = 0.484\mu m) = \underline{0.086}$; $\varepsilon_{\lambda,\text{Al}}(\lambda = 8.06\ \mu\text{m}) = \underline{0.014}$; $\varepsilon_{\lambda,\text{Ti}}(\lambda = 0.484\ \mu\text{m}) = \underline{0.678}$; $\varepsilon_{\lambda,\text{Ti}}(\lambda = 8.06\ \mu\text{m}) = \underline{0.043}$.

In HW 4.9, add "…when exposed to the sun." to the problem statement.

428* The speed of light, c_o, should read c_o = 2.997 924 58 x 10^8 m/s

The reduced Planck's constant should read $\hbar = h/2\pi$ = 1.054 571 817 x 10^{-34} J·s

The value for the Boltzmann constant should read k = 1.380 649 x 10^{-23} J/K

The value for the classical electron radius should read:

2.817 940 3262(+/- 13) x 10^{-15} m

The value for the electron volt should read: 1 eV = 1.602 176 634 x 10^{-19} J

429* The value of the radiation constant C_1 in SI should read

C_1 = 0.595 521 49 x 10^{8} W•μm^4/(m^2•sr)

C_1 = 0.595 521 49 x 10^{-16} W•m^2/s

The value of the Stefan-Boltzmann constant in SI should read

σ = 5.670 374 419… x 10^{-8} (W/m^2•K)

**Most of these changes result from a recent fundamental revision in the International System of Units. See Appendix N in the on-line Appendices at:*

http://www.thermalradiation.net/appendix.html

or the video at

http://www.thermalradiation.net/videos.html