Errata Sheet for *Fundamentals of Thermal-Fluid Sciences, Ed. 5* – Çengel, Cimbala, and Turner

Latest update: 02/28/2022

This is a list of errors (and *enhancements*) in the textbook. If you find any additional errors in the book, or have suggestions for improvement, please contact **John M. Cimbala** at **814-863-2739** or **jmc6@psu.edu** to report it. [By way of acknowledgment, the person (other than the authors) who first reports an error is listed in brackets, unless requested otherwise.]

We categorize the changes as *major errors*, *minor errors*, or *enhancements*:

- **Major errors** are important and significant (e.g., incorrect equations or numerical values) – *these must be changed*.
- **Minor errors** are spelling or typo errors and other minor changes – *these may be skipped without impacting understanding of the material*.
- **Enhancements** are changes that clarify something and/or help you to understand the material better (e.g., improvements to a figure or wording changes) – *these may be skipped since they are not really errors, but are useful changes that enhance understanding of the material*.

Note: The publisher reprints the books as inventory gets low, so if you have a newer printing, some of these errors may have already been fixed.

Major Errors:

- p. 60, line below Eq. 3-8: Change "is analogous to $m = \rho\dot{V}$ " to "is analogous to $m = \rho V$ " (there should be no overdot). [David Ibrahim and Joseph Schroeder]
- p. 91, Example 3-16, 2 lines above the equation above the Discussion: Change "5160 = $4520" to "5160 - $4520" [Weston Shipman]
- p. 95, Problem 3-50, Line 2: Change "70 km/s" to "70 km/h". [Christopher Alverson]
- p. 95, Problem 3-50, Line 2: Change "70 km/s" to "70 km/h". [Christopher Alverson]
- p. 129, 5th line: Change "Fig. A-15" to "Fig. A-28". [David Ibrahim]
- p. 149, Example 5-5, second equation (4th from bottom of page): The arrow crossing out the ΔU should be moved to cross out the PE instead. [David Ibrahim]
- p. 150, Example 5-5, second line before Discussion: Change "T_2 = 200°C" to "T_2 = 199.5°C ≅ **200°C**" [Charles Tritt]
- p. 214, First equation in left column: Both terms on the left side should have overdots. The correct equation is: $\dot{E}_{in} - \dot{E}_{out} = dE_{system} / dt$. [David Ibrahim]
- p. 301, Eq. 8-41: Swap subscripts 1 and 2 on the right side. The correct equation is: $\ln\frac{T_2}{T_1} = \ln\left(\frac{v_1}{v_2}\right)^{R/c_v}$. [David Ibrahim]
- p. 354, the work equations near the middle of the page: Change "$W_{out,0\text{-}1}$" to "$w_{out,0\text{-}1}$" and change "$W_{in,1\text{-}0}$" to "$w_{in,1\text{-}0}$" (these should both be lower case).
- p. 392, Fig. 9-57: Top figure: Change the label "3" on the left to "5"
- p. 470, Eq. 12-15: Change P in denominator to Greek rho, i.e., change "$V = \sqrt{\frac{2\left(P_{stag} - P\right)}{P}}$ " to "$V = \sqrt{\frac{2\left(P_{stag} - P\right)}{\rho}}$ ". [Christopher Hartemink]
- p. 489, Problem 12-31, line 3: Change "the minimum flow" to "the maximum flow". [David Ibrahim]
- p. 492, Problem 12-65, end of problem statement: Change the 1st answer from "39.2 kW" to "15.7 kW". [David Ibrahim]
- p. 506, Eq. 13-22: The labels "out" and "in" were somehow switched. Switch them back so that the correct equation looks like this: $\frac{d}{dt}\int_{CV}\rho dV = \sum_{in}\dot{m} - \sum_{out}\dot{m}$ or $\frac{dm_{CV}}{dt} = \sum_{in}\dot{m} - \sum_{out}\dot{m}$. [David Ibrahim]
- p. 539, Fig. 14-17: Change the diameter dimension from "2 cm" to "4 cm". [Vedat Oruc]
- p. 540, 1st and 2nd equations above the Discussion: IN TWO PLACES, change "1366" to "1513". [Vedat Oruc]
- p. 540, Equation just above the Discussion: Change "3.57" to "3.22". [Vedat Oruc]
- p. 540, Line 3 above the Discussion: Change "**5.6 percent**" to "**14.6 percent**". [Vedat Oruc]
- p. 540, Line 1 above the Discussion: Change "**5.6 percent**" to "**20.9 percent**". [Vedat Oruc]
- p. 540, Add to end of Discussion: Add "Finally, the answers for the inclined cases are only a first approximation since we assumed the same Reynolds number, friction factor, and head loss, regardless of inclination. In reality, since the volume flow rate changes with inclination angle, all three of these values also change, which in turn change the flow rate. An exact analysis requires simultaneous solution of all the equations; this is left as an exercise for the reader.". [Vedat Oruc]

- p. 559, Eq. 14-49, denominator on the far right: Change *h* to Greek eta, i.e., change "$\dot{W}_{\text{elect}} = \dfrac{\rho \dot{V} g h_{\text{pump, } u}}{h_{\text{pump-motor}}}$" to "$\dot{W}_{\text{elect}} = \dfrac{\rho \dot{V} g h_{\text{pump, } u}}{\eta_{\text{pump-motor}}}$". [David Ibrahim]
- p. 560, 9th line from top: Change "Fig. 14-39" to "Fig. 14-42". [David Ibrahim]
- p. 567, Problem 14-23C: [We discuss turbulent viscosity in our fluids book, but not in this FTFS book, so this problem really should not be there.] To temporarily "fix" it, add this statement at the end of the problem statement: "You will need to look this up somewhere other than this textbook.". [David Ibrahim]
- p. 569, Problem 14-61, end of problem statement: Change the answers from "432 kPa, 25.4 kPa" to "430. kPa, 27.0 kPa". [David Ibrahim]
- p. 619, Problem 15-83: 4th line: Change "Fig. 11-45" to "Fig. 15-45".
- p. 619, Problem 15-84: Add this to the end of the problem statement: "The air density at this elevation is 0.819 kg/m^3.". [David Ibrahim]
- p. 647, Problem 16-34, Line 2: Change "thin vertical" to "thin horizontal". [Christopher Alverson]
- p. 647, Problem 16-34, Line 4: Change "by both surfaces" to "by one surface". [Christopher Alverson]
- p. 684, last line (the "word" equation): Change the first "*convection*" to "*conduction*". [John Macy]
- p. 726, Sphere equation in Table 18-1 (last equation on page): IN TWO PLACES, change "x/L" to "r/r_0". [Christopher Alverson]
- p. 727, middle of Fig. 18-13: Change "$t = 0.2$" to "$\tau = 0.2$". [Christopher Alverson]
- p. 821: Delete 4th objective, "Examine…spacing.".
- p. 836, line 3 above Eq. 20-30: Change "<" to ">". (It should say "$T_{\text{surr}} > T_s$"). [Christopher Alverson]
- p. 840, Line 3 of the last paragraph: Change "<" to ">". [Christopher Alverson]
- p. 871, Eq. 21-14: Change "$\varepsilon_1(T)$" to "$\varepsilon(T)$". In other words, remove the first subscript 1; the other subscripts are okay.
- p. 919: Delete the last objective, "Know…exhchangers.".
- p. 925, 3rd line from bottom of Table 22-1: Change footnote for "400-850" from a single dagger to a double dagger. It should change from "400-850†" to "400-850‡" since the higher value is based on water- or steam-side. [Christopher Alverson]
- p. 941, The last equation on the page: Change "$T_2 - T_2$" to "$T_1 - T_2$". [Christopher Alverson]
- p. 1037, Table A-15E, 2nd row of data (at $T = 40^{\circ}$F), in the column for Dynamic Viscosity, Liquid (10th column from the left): Change "1.308" to "1.038".

Minor Errors:

- p. 352, Fig. 9-12*a*, left side (the plot): In the upper left part of that plot, move the point where we indicate "End of combustion" up and to the right (but still on the green curve) such that it is a little bit to the right of the maximum pressure.
- p. 438, Problem 10-23, 3rd line from bottom of problem statement: Change "velocity is zero and" to "velocity is zero (other than at the top wall) and". [David Ibrahim]
- p. 453, Figure caption of top figure: Change "**FIGURE 10-16**" to "**FIGURE 11-16**". [David Ibrahim]
- p. 438, Problem 10-23, 3rd line from bottom of problem statement: Change "velocity is zero and" to "velocity is zero (other than at the top wall) and". [David Ibrahim]
- p. 505, 1st line of the new major section: Change "aslo" to "also". [David Ibrahim]
- p. 619, Problem 15-86, 3rd line: Change "ground." to "ground by a rope (not shown).". [David Ibrahim]
- p. 722, 1st line of last paragraph before Example 18-1: Change "Recall that heat conduction" to "Heat conduction". [Joel Chapman]
- p. 726, Line 3 of caption for Table 18-1: Change "convention" to "convection". [Christopher Alverson]
- p. 729, 4th line after Eq. 18-20: Change "θ_0" to "θ". [Joel Chapman]

Enhancements: