Errata for Dixon and Hall: *Fluid Mechanics and Thermodynamics of Turbomachinery (7th ed.)*

October 18, 2016

Chapter 1

Page 12, Eq. (1.26b)

$$Tds = dh - \nu dp$$

Page 15:

$$C_v = \left(\frac{\partial u}{\partial T}\right)_v$$

Chapter 2

Page 47, Page 47, Eq. (2.10a)

$$\eta_c = \frac{\left[(p_{02}/p_{01})^{(\gamma-1)/\gamma} - 1\right]}{\Delta T_0/T_{01}}$$

Eq. (2.10b)

$$\eta_t = \frac{\Delta T_0/T_{01}}{\left[1 - (p_{02}/p_{01})^{(\gamma-1)/\gamma}\right]}$$

Chapter 3

Page 81, Eq. (3.13a)

$$Y = \rho s c_x (c_{y1} - c_{y2})$$

Page 83, first paragraph - *Comment: It is written that the stagnation pressure loss coefficient is defined. It is really the energy loss coefficient. These terms corresponds to Y_p and ζ, respectively.*

Page 90, Figure 3.16 - Figure text from Figure 3.17

Page 91, Figure 3.17 - Figure text from Figure 3.18

Page 92, first paragraph

> Figure 3.17 shows the surface Mach number distribution ...

Third paragraph

> Figure 3.18 is a diagram showing the mean-line flow through ...

Figure 3.18 - Figure text from Figure 3.19
...
Figure 3.19 - Figure text from Figure 3.20
...
Page 93, Eq 3.43, sixth paragraph

... compressor cascade with a minimum flow area, A^*, as picture in Figure 3.19.

...
Eq (3.43), RHS:

$$\frac{\dot{m}\sqrt{C_p T_{01}}}{A^* P_0^*} \frac{p_0^*}{p_{01}} \times \frac{A^*}{H_1 s \cos\alpha_1}$$

...

$$\frac{\dot{m}\sqrt{C_p T_{01}}}{A^* P_0^*} \frac{p_0^*}{p_{01}} = Q(1) = constant$$

Page 94, Figure 3.20 - Figure text is not correct, rather: Typical variations in loss coefficients and exit angle for a compressor cascade as a function of the inlet incidence angle and inlet Mach number.

Page 95, first sentence and in the middle of the paragraph

To conclude this section, Figure 3.20 ...
The results plotted in Figure 3.20 clearly show ...

Page 100, Eq. (3.47b)

$$1 + \zeta_1 = (1 + \zeta^*)\,(0.975 + 0.075 b/H)$$

Page 113, Problem 3.2: where $\tan\alpha_m = \frac{1}{2}(\tan\alpha_2 - \tan\alpha_1)$
...
If the blade load ratio Z defined by Eq. (3.51)

Chapter 4

Page 127:

$$\eta_{tt} = \frac{actual\ work\ output}{ideal\ work\ output\ when\ operating\ to\ same\ back\ pressure}$$

...
Comment: Last equation on page is not consistent with Eq. 3.7 which instead implies that $h_2 - h_{2s} = 1/2\zeta c_{2is}^2$. This is a matter of definition, however as c_{2is} is generally known while c_2 isn't the definition that makes sense is the one using the isentropic velocity. Thereby, the recommendation is to not use the equation on this page in combination with Soderberg's on page 100.

Chapter 5

Chapter 6

Page 217, Eq. (6.4)

$$\frac{dh_0}{dr} = \frac{dh}{dr} + c_x \frac{dc_x}{dr} + c_\theta * \frac{dc_\theta}{dr}$$

...
Now if the flow is incompressible, instead of eqn. (6.3) use $p_0 = p + \frac{1}{2} * \rho \left(c_x^2 + c_\theta^2\right)$ ...

Page 230: From Eq. (6.1). noting that at constant entropy the acoustic velocity $a = \sqrt{dp/d\rho}$
Page 231, (6.30a)

$$h_{03} - h_{02} = U(c_{\theta 2} + c_{\theta 3})$$

Page 258, problem 5

$$\Psi = \Delta W / {U_m}^2$$

Chapter 7

Page 273: where $k = 1 - (r_{h1}/r_{s1})^2$.
...
First equation of 7.5

$$H_s = (p_0 - p_v)/(\rho g)$$

...
Thus, just upstream of the impeller entry at cavitation inception we have

$$p_1 = p_{01} - \frac{1}{2}\rho c_{x1}^2$$

Page 284, second paragraph after eq (7.22)

... are shown in Figure 7.17 and may also ...

Page 285, Eq. (7.24b)

$$\sigma = 1 - \frac{\sqrt{cos\beta_2'}}{Z^{0.7}(1 - \phi_2 tan\beta_2')}$$

Page 305, Eq. (7.51a)

$$h_2 - h_1 = \frac{1}{2}(c_1^2 - c_2^2)$$

Page 311, problem 1

... from Stanitz's expression, Eq. (7.23b), determine ...

Page 313, Problem 7.8: The impeller is designed for the optimum flow condition to resist cavitation (see Eq. (7.9a))...
Page 315, problem 14

... assuming that $r_1/r_2 = \epsilon$ in Eq. (7.24d)) determine ...

Chapter 8

Chapter 9

Page 369 , Eq. (9.5):

$$\eta_R \text{ max} = 0.5(1 - k\cos\beta_2)$$

Page 391, Eq. (9.24)

$$\sigma = \frac{H_S}{H_E} = \frac{(p_a - p_v)/(\rho g) - z}{H_E}.$$

Chapter 10

Page 434-455

The mass flow, $\dot{m}$ has been misprinted as $\neq m$ in: page 434, Eq. (10.2), Eq. (10.3), Eq. (10.4), Eq. (10.5), Eq. (10.6), Eq. (10.13), Example 10.2, Eq. (10.16a), Eq. (10.30) and page 455.

Appendix F: Answers to Problems

Problem 6.5:

$$c_{x1}^2 = \text{constant}_1 - 2a^2[(r^2-1) - 2(b/a)\ln r];$$
$$c_{x2}^2 = \text{constant}_1 - 2a^2[(r^2-1) + 2(b/a)\ln r];$$

Or

$$c_{x1}^2 = \text{constant}_2 - 2a^2[r^2 - 2(b/a)\ln r];$$
$$c_{x2}^2 = \text{constant}_2 - 2a^2[r^2 + 2(b/a)\ln r];$$

Problem 6.7: (a) 61.3°, (b) 54.64°, 1.42°, (c) 55.2°, 65.9°

Problem 7.1: (a) 29.7 m/s, (b) 0.64 m, (c) 206.7 W, (d) 0.334 (rad)

Problem 7.11

$$M_1 = 0.930 \text{ and moved to (a)}$$

Problem 7.14: 382.8 J/kgK, 49.2 kW, $D_s = 5.16$, $\Omega_s = 0.454$

Problem 9.17: at mean radius $\alpha_2 = 35.0°$, $\beta_2 = 65.9°$, at tip, $\alpha_2 = 26.4°$, and $\beta_2 = 74.7$