Known Typographical Errors in the First Edition, First Printing of Basic Fluid Mechanics by D. C. Wilcox

These are all of the known typographical errors as of July 15, 2010.

1. Page 5, Table 1.1: Change "tetrachlorode" to "tetrachloride".
2. Page 13, Table 1.6: Change "tetrachlorode" to "tetrachloride".
3. Page 19, Problem 1.3: Change ".01 mm in size" to ".01 mm in diameter".
4. Page 20, Problem 1.17: Change the period after "ethyl alcohol" to a comma.
5. Page 20, Problem 1.20: The units of $\mathcal{R}$ should be ft·lb/(slug-mole·°R) and those of $\mathcal{M}$ should be slug/(slug-mole).
6. Page 20, Problem 1.21: The units of $\mathcal{R}$ and should be J/(kg-mole·K) and those of $\mathcal{M}$ should be kg/(kg-mole).
7. Page 21, Problem 1.29: Change "Appealing to Equation (1.4)" to "Appealing to Equation (1.17)".
8. Page 24, Problem 1.57: Change "Consider tape whose width" to "Consider tape whose width (out of the page)".
9. Page 50, Problem 2.65: Change "low-flying model" to "low-flying missile".
10. Page 69, Example 3.3, last line: Change "54.138" to "54.127".
11. Page 61, Equation (3.34): The appearance of $\sin\alpha$ and $\cos\alpha$ is inverted. The correct equation is
$$\mathbf{F} = \rho g \overline{z} A \sin\alpha\,(\mathbf{i}\sin\alpha + \mathbf{k}\cos\alpha)$$
12. Page 74, Problem 3.17: Change "$p_o + 3.3\rho g H$" to "$p_o + 3.3\rho g h$".
13. Page 92, Equation (4.15): Change "$w\partial/\partial x$" to "$w\partial/\partial z$".
14. Page 117, Problem 4.59: The second partial derivative on the right-hand side of the equation should be with respect to y rather than x in the definition of the Laplacian. The correct equation is
$$\nabla^2\mathbf{u} = \frac{\partial^2\mathbf{u}}{\partial x^2} + \frac{\partial^2\mathbf{u}}{\partial y^2}$$
15. Page 122, Figure 5.2: **f** is the body force "per unit mass" rather than "per unit volume".
16. Page 138, Problem 5.19: Change "U = 15 m/sec" to "U = 12 m/sec".

17. Page 151, Equation (6.6): Change the "+" to a "−" The correct equation is

$$p - \rho g z = \text{constant} = p_o$$

Also, the line just below the equation refers to Equation (3.10), which has a "+". The difference occurs because z is positive upwards in Equation (3.10) and positive downwards in Equation (6.6).

18. Page 159, line just above Equation (6.37): Change "cross-sectional area" to "diameter".

19. Page 160, Figure 6.9: Change "u_1" and "u_2" to "U_1" and "U_2", respectively.

20. Page 163, Figure 6.10: Change "ϕ" to "45^o".

21. Page 163, Equations (6.55) and (6.60): Change "ϕ" to "45^o".

22. Page 163, Line below Equation (6.55): Change "$\rho A \sin\phi$" to "$\rho A \sin 45^o$".

23. Page 164, Equations (6.61) and (6.62): Change "ϕ" to "45^o".

24. Page 164, Paragraph just below Equation (6.62): Delete the entire paragraph.

25. Page 170, Paragraph just above Equation (6.97), first line: Change "indicated integral" to "indicated integration".

26. Page 194, Problem 6.84(b): Change "Compute D" to "Compute F_D".

27. Page 195, Problems 6.86 and 6.87, first line below equation: Replace "Assuming fuel density, ρ_e, velocity, u_e, and exit area, A_e, are constant at the rocket exit plane, and that pressure at the rocket exit plane is negligibly small, determine" with "Fuel density, ρ_e, and velocity, u_e, are uniform at the rocket exit plane, which has area A_e. Also, pressure at the rocket exit plane is negligible. Determine".

28. Page 195, Problem 6.87, first line: Replace "Klingons" with "Romulans".

29. Page 203, Figure 7.1 Caption: Change "viscous force, $\mathbf{f}_s$" to "surface force, $\mathbf{F}_s$".

30. Page 212, sentence just below Equation (7.90): Change "pressure at is" to "pressure is".

31. Page 225, just above Equation (7.137): Replace "substitute Equations (7.134) and (7.135) into Equation (7.130)" with "combine Equations (7.130), (7.132) and (7.134), and let $d_2/d_1 = \sqrt{2}$". Also, the correct Equation (7.137) for h_L is

$$h_L = \left[\hat{R}_1 + \hat{R}_2 \left(\frac{d_1}{d_2}\right)^4\right] \overline{u}_1^2 = \left[\hat{R}_1 + \frac{1}{4}\hat{R}_2\right] U^2$$

32. Page 236, Equation (7.190): The dimensions of y are m, not m/sec. The correct equation is

$$\overline{u} = \frac{Q}{y^2} = \frac{5\ \text{m}^3/\text{sec}}{(2.61\ \text{m})^2} = 0.734\ \frac{\text{m}}{\text{sec}}$$

33. Page 241, paragraph 2, line 2 [just above Equation (7.220)]: Change "$Fr_2 = 2$" to "$Fr_1 = 2$".

34. Page 244, Problem 7.15: Add a question mark at the end of Part (b).

35. Page 244, Problem 7.17: In the figure, change "T_o" to "T_f".

36. Page 250, Problem 7.50: Add "$L/D = 100$".

37. Page 270, Paragraph above Equation (8.70), second sentence: Change "pressure and of" to "pressure of".

38. Page 283, Problems 8.67 and 8.68: Change p to p_o in the equation quoted in Part (a). The correct equation is

$$F = \frac{2\gamma}{\gamma - 1}\left[\left(\frac{p_t}{p_o}\right)^{(\gamma-1)/\gamma} - 1\right] p_o A_e$$

39. Page 307, Equation (9.82): The quantity "r" should not appear in the equation to the right. The correct equation is

$$\frac{d\Omega\tau}{dU} = 2\rho Q\left(V_j - 2U\right)$$

40. Page 309, Problem 9.3: In the last line, change "$\alpha = \pi/2$" to "$\alpha_2 = \pi/2$".

41. Page 310, Problems 9.12(b), 9.13(b) and 9.14(b): At the end of the first sentence, change "at the inlet" to "at the inlet and outlet".

42. Page 312, Problem 9.22: The working fluid is not specified. It is water with density ρ = 1.94 slug/ft^3.

43. Page 327, Problem 10.12, last line: Replace "ft^2/sec^2" with "ft^2/sec".

44. Page 327, Problem 10.13, last line: Replace "m^2/sec^2" with "m^2/sec".

45. Page 327, Problem 10.14, third line below equation: Replace "ft^2/sec^2" with "ft^2/sec".

46. Page 327, Problem 10.15, fourth line below equation (twice): Replace "m^2/sec^2" with "m^2/sec".

47. Page 347, paragraph 4, line 1: Change "one the" to "the one".

48. Page 358, Equation (11.140): The minus sign should be deleted. The correct equation is

$$\mathbf{F} = \rho\,\mathbf{U} \times \mathbf{\Gamma}$$

49. Page 359, First bulleted item in the home experiment description: "An $8\frac{1}{2}$ inch by $11\frac{1}{2}$ inch sheet of paper" should be changed to "An $8\frac{1}{2}$ inch by 11 inch sheet of paper".

50. Page 388, paragraph 1, line 2: Change "$v(0^+, y)$" to "$v(0^-, y)$".

51. Page 391, Problem 11.7: The equation quoted is missing "$= \mathbf{0}$". The correct equation is

$$\nabla \left[\frac{\partial \phi}{\partial t} + \frac{p}{\rho} + \frac{1}{2} \left(u^2 + v^2 \right) \right] = \mathbf{0}$$

52. Page 394, Problem 11.32: Change "sink strength" to "doublet strength".

53. Page 395, Problem 11.34: Add a question mark at the end of Part (c).

54. Page 396, Problem 11.39: Change "closed body at y = 0" to "closed body at x = 0".

55. Page 399, Problem 11.54: There are two Part (b)'s. The second should be Part (c).

56. Page 400, Problem 11.58: In the last line, change "$U = u_o$" to "$U = U_o$".

57. Page 400, Problem 11.59: Change "gravitational fluid" to "gravitational field".

58. Page 401, Problem 11.62: Change "sources" to "vortices".

59. Page 403, Problem 11.79: Add "with 101 grid points".

60. Page 403, Problem 11.80: Change "changes are less than 0.00001" to "changes are less than 0.0001".

61. Page 417, just below Equation (12.38): The strain-rate tensor does not vanish for the potential vortex. Thus, the entire paragraph should be replaced by the following.

    "where Γ is the circulation. Reference to Equation(12.33) shows that the vorticity vector, $\nabla \times \mathbf{u}$, vanishes for this velocity field. Because the vorticity is zero, fluid particles experience no local rotation, but rather, always retain their original orientation. Figure 12.5(a) shows a fluid particle at several points as it moves on one of the circular streamlines of a potential-vortex flow."

62. Page 417, just below Equation (12.39): The entire paragraph should be replaced by the following.

    "Reference to Equation (12.31) shows that every component of the strain-rate tensor, $[\mathbf{S}]$, is zero for this velocity field. Correspondingly, fluid particles experience no volume or angular distortion and all of the fluid rotates as a unit similar to a solid body. We noted earlier (Section 4.3) that the motion in the core of a hurricane is well approximated as a rigid-body rotation. For this flow, the vorticity is"

63. Page 421, Figure 12.8: $\mathbf{f}$ is the body force "per unit mass" rather than "per unit volume".

64. Page 433, Sentence between Equations (12.125) and (12.126): Change "since $\nabla \cdot \mathbf{u}$ for" to "since $\nabla \cdot \mathbf{u} = 0$ for".

65. Page 442, paragraph 2, line 4: Change "number if timesteps" to "number of timesteps".

66. Page 447, Problem 12.24: Change "$1/L$" to "1/time".

67. Page 447, Problem 12.25: Change "incompressible" to "compressible".

68. Page 448, Problem 12.27(c): Change "What are θ and $[\boldsymbol{\tau}]\ldots$" to "What are θ and $[\boldsymbol{\tau}']\ldots$".

69. Page 452, Problem 12.52: Change "$u(0) = 0, u'(h/2) = 0$" to "$u(\pm h/2) = 0$". In Parts (c) and (d), change "Δy" to "$\Delta y/(h/2)$". Also, in Part (c), change "dimensionless time, $\nu t/(h/2)^2$, of 0.10" to "dimensionless time, $\nu t/(h/2)^2$, of 3.0".

70. Page 453, Problems 12.53 and 12.54: In Parts (c) and (d), change "Δy" to "$\Delta y/h$". Also, change "dimensionless time, $\nu t/h^2$, of 0.10" to "dimensionless time, $\nu t/h^2$, of 1.0".

71. Page 472, Equation (13.90): The minus sign after the final equal sign should be omitted.

72. Page 487, Equations (13.180) and (13.182): Change "$\Delta t/(4\Delta x)$" to "$U\Delta t/(4\Delta x)$". It appears four times in each equation.

73. Page 487, Equation (13.183): Change "$\Delta t/\Delta x$" to "$U\Delta t/\Delta x$". It appears in both the numerator and the denominator.

74. Page 488, Equation (13.184): Change "$\Delta t/(2\Delta x)$" to "$U\Delta t/(2\Delta x)$". It appears in both the numerator and the denominator.

75. Page 488, Equations (13.187): Change "$\Delta t/(4\Delta x)$" to "$U\Delta t/(4\Delta x)$". It appears in the equations for A_j and C_j.

76. Page 488, Equation (13.187): The minus sign ahead of the terms in square brackets in the equation for D_j be a plus sign. The correct equation is

$$D_j = -A_j u_{j-1}^n + \left[B_j - 2\frac{\nu \Delta t}{(\Delta x)^2} \right] u_j^n - C_j u_{j+1}^n$$

77. Page 498, Problem 13.27: In Part (a), the correct equation is

$$2\rho \boldsymbol{\Omega} \times \mathbf{U}_g = -\nabla \left(p - \tfrac{1}{2}\rho \Omega^2 r^2 \right)$$

Also, in Part (b), change "$\pm(1+i)/2, \pm(1-i)/2$" to "$\pm(1+i)/\sqrt{2}, \pm(1-i)/\sqrt{2}$".

78. Page 502, Problem 13.43: Change "$f(0) = 5000$" to "$|f(0)| = 50$". Also, do the computations for $\alpha = 5^{\text{o}}$ and assume the initial velocity profile is $f(\theta) \approx \pm 10[1 - (\theta/\alpha)^2]$ for $K \gtrless 0$.

79. Page 503, Problem 13.45: The boundary conditions are missing. They are $F(0) = 0$, $G(0) = 1$, $H(0) = 0$, $P(0) = 0$, while $F(\zeta) \to 0$ and $G(\zeta) \to 0$ as $\zeta \to \infty$. Also, in Part (a), solve for P as a function of F and H before adding unsteady terms.

80. Page 513, Unnumbered equation in Point 2: Replace "$\partial u/\partial x$" with "$\partial v/\partial x$". The correct equation is

$$u\frac{\partial v}{\partial x} \sim v\frac{\partial v}{\partial y} \sim \nu \frac{\partial^2 v}{\partial y^2} \sim \frac{U^2 \delta}{x^2}$$

81. Page 558, Problem 14.2: Insert "(b)" after the semicolon.

82. Page 559, Problem 14.8: The second of the two equations should be $mdw/dt = -mg$.

83. Page 560, Problems 14.11(d) and 14.12: The differential equation for the pressure should be

$$\frac{d}{dx}\left(\frac{h^3}{\mu}\frac{dp}{dx}\right) = 6U\frac{dh}{dx}$$

84. Page 576, Problem 14.77: The second Part (a) should be Part (b) and Part (b) should be Part (c). Part (a) should read as follows: "(a) Using **SETEBL**, set the values of the following input parameters: PROVAL(1) = 0.150133, PROVAL(2) = 1.50133, SSTOP = 15.0133."

85. Page 576, Problem 14.78: Change "use SI units" to "use USCS units".

86. Page 578, Problem 14.82(a): Change "T_{t_∞} = 544° R" to "T_{t_∞} = 504° R".

87. Page 582, Figure 15.1: **f** is the body force "per unit mass" rather than "per unit volume".

88. Page 597, last paragraph, last line: Change "$[\boldsymbol{\tau}] = \mathbf{0}$]" to "$[\boldsymbol{\tau}] = [\mathbf{0}]$".

89. Page 632, Problem 15.6(a): The equation satisfied by $H(\eta)$ is

$$\frac{1}{Pr}\frac{d^2H}{d\eta^2} + 2\eta\frac{dH}{d\eta} = -\frac{4}{\pi}\frac{(\gamma-1)M_w^2}{(1-h_\infty/h_w)}e^{-2\eta^2}$$

90. Page 639, Problem 15.62: Change "μ_o" to "$\mu_o/T_o^{0.7}$".

91. Page 642, Problem 15.72, equation: In the first term, replace "$\frac{1}{2}\left(u_{i+1}^n - u_{i-1}^n\right)$" with "$\frac{1}{2}\left(u_{i+1}^n + u_{i-1}^n\right)$". The correct equation is

$$\frac{u_i^{n+1} - \frac{1}{2}\left(u_{i+1}^n + u_{i-1}^n\right)}{\Delta t} + a\,\frac{u_{i+1}^n - u_{i-1}^n}{2\Delta x} = 0$$

92. Page 643, Problem 15.78(a): Add the following: "Use 151 grid points (IEDGE)".

93. Page 644, Problem 15.79(a): Change "Δs = 0.001 ft" to "Δs = 0.01 ft".

94. Page 647, Table A.3: Change "deka" to "deca".

95. Page 672: Equation (D.24): The equation actually defines $-\nabla \times \mathbf{u}$. Also, in the radial direction term, the denominator should have $\sin\phi$ rather than $\sin\theta$. The correct equation is

$$\begin{aligned}\nabla \times \mathbf{u} &= \frac{\mathbf{e}_R}{R\sin\phi}\left[\frac{\partial}{\partial\phi}\left(u_\theta\sin\phi\right) - \frac{\partial u_\phi}{\partial\theta}\right] \\ &+ \frac{\mathbf{e}_\theta}{R}\left[\frac{\partial}{\partial R}\left(Ru_\phi\right) - \frac{\partial u_R}{\partial\phi}\right] \\ &+ \frac{\mathbf{e}_\phi}{R\sin\phi}\left[\frac{\partial u_R}{\partial\theta} - \frac{\partial}{\partial R}(Ru_\theta\sin\phi)\right]\end{aligned}$$

96. Page 672: Equation (D.25): The first term on the second line of the equation should have $R^2 \sin\phi$ in the denominator rather than $R^2 \sin^2 \phi$. The correct equation is

$$\begin{aligned}\nabla^2 \mathbf{u} &= \left[\frac{1}{R^2}\frac{\partial}{\partial R}\left(R^2\frac{\partial}{\partial R}\right) + \frac{1}{R^2 \sin^2\phi}\frac{\partial^2}{\partial\theta^2}\right. \\ &+ \left.\frac{1}{R^2\sin\phi}\frac{\partial}{\partial\phi}\left(\sin\phi\frac{\partial}{\partial\phi}\right)\right](u_R\mathbf{e}_R + u_\theta\mathbf{e}_\theta + u_\phi\mathbf{e}_\phi)\end{aligned}$$

97. Page 713, Problem 1.21: Change $\mathcal{M} = 44$ to $\mathcal{M} = 44$ kg/(kg-mole).

98. Page 713, Problem 1.25: The correct answer for water is $1.61 \cdot 10^{-5}$.

99. Page 714, Problem 2.21: Change "$[\nu_t]$" to "ν_t".

100. Page 715, Problem 4.11(b): The correct answer is $\mathbf{a} = -\Gamma^2/(4\pi^2 r^3)\,\mathbf{e}_r$.

101. Page 716, Problem 7.17: Change "T_o" to "T_f".

102. Page 716, Problem 7.37: The correct answer is $h_p = \Delta z + 1000\dot{m}^2/(\pi^2\rho^2 g D^4)$.

103. Page 719, Problem 11.47: The correct answer is $p_i = 14.63$ psi.

104. Page 719, Problem 11.53(a): The correct answer is $\mathbf{F} = \pi\rho\Omega D^2 H(V\mathbf{i} - U\mathbf{j})$.

105. Page 719, Problem 11.59: The correct answer is g.

106. Page 719, Problem 12.31: The correct answer for p is $p = p_\infty - \rho\Gamma^2/\left(8\pi^2 r^2\right)$. Also, change "$R \to 0$" to "$r \to 0$".

107. Page 720, Problem 13.9: The correct answer is $\psi = Uy\mathrm{erfc}(\eta) + 2U\sqrt{\nu t/\pi}(1 - e^{-\eta^2})$.

108. Page 720, Problem 13.25(d): The correct answers for p and Ω are $p = p_\infty - \frac{1}{2}\rho\Omega^2 R^4/r^2$ and $\Omega < \sqrt{2p_\infty/(\rho R^2)}$.

109. Page 720, Problem 14.7(d): The correct answer is 0.02 sec.

110. Page 721, Problem 14.57(c): The correct answers are 11.41 m/sec for (a) and 212.6 m/sec for (b).

111. Page 721, Problem 15.29: The correct answer for Mach number is $M_e = 2.56$.

112. Page 726, Peaceman and Rachford reference: The third line of the reference includes the reference to a separate book by Fay (1994), which should appear earlier (in alphabetical order).

113. Page 726, Reynolds and Perkins reference: "(9177)" should be changed to "(1977)".

114. Page 731, first column: Change "Curved-surface hydrodynamic force" to "Curved-surface hydrostatic force".

115. Page 742, paragraph 1, line 4: "singularity solutions" should be changed to "similarity solutions".