

Corrections to:
Turbulent Flows

by

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(Last updated November 19, 2017)

There have been eleven printings of *Turbulent Flows*. Here, first the corrections to the ninth printing are given, then corrections to earlier printings.

Please report any further corrections to the author at `s.b.pope@cornell.edu`.

Corrections that apply to the 9th 2012 printing.

- p.128, Ex. 5.22: The RHS of the second equation should be “ $\frac{1}{4}\text{Ma}^2(\gamma - 1)$ ”.
- p.287, Ex.7.6: The text between Eqs. (7.70) and (7.71) should be replaced by:

“From this expression for \mathcal{P} , show that, at high Reynolds number, the peak production occurs close to the location \check{y} where the viscous and Reynolds stresses are equal. Show that $\check{\mathcal{P}}$, the production at \check{y} is”

Corrections that apply to the 8th 2011 printing.

- p.12, Eq.(2.5): “ $(U_k - u_k^{(i)})^n$ ” should be “ $(U_k - u_k^{(i)})$ ”.
- p.57, above Eq.(3.94): “Cauchy-Schwartz” should be “Cauchy-Schwarz”.
- p.59, Ex.3.16: “Cauchy-Schwartz” should be “Cauchy-Schwarz”.
- p.122, Ex.5.13: “Cauchy-Schwartz” should be “Cauchy-Schwarz”.
- p.124, Eqs.(5.122) and (5.123) should be:

$$2S_{ij}S_{ij} = \frac{\partial U_i}{\partial x_j} \frac{\partial U_i}{\partial x_j} + \frac{\partial U_i}{\partial x_j} \frac{\partial U_j}{\partial x_i} \quad (122)$$

$$2\Omega_{ij}\Omega_{ij} = \frac{\partial U_i}{\partial x_j} \frac{\partial U_i}{\partial x_j} - \frac{\partial U_i}{\partial x_j} \frac{\partial U_j}{\partial x_i} \quad (123)$$

- p.133, Eq.(5.164): “ \overline{Dk} ” should be “ $\overline{D}k$ ”.
- p.234, Eq.(6.251): in the middle part, $\Gamma(\frac{3}{2})$ should be in the numerator, not the denominator.
- p.246, The second sentence of Section 6.5.8 should be “In these cases the shear-stress spectrum $E_{12}(\kappa_1)$ is zero.”
- p.320, Eq.(7.199): “ $-\frac{2}{3}k \left(\frac{\partial \langle U_i \rangle}{\partial x_j} + \frac{\partial \langle U_j \rangle}{\partial x_i} \right)^n$ ” should be “ $-\frac{2}{3}k \left(\frac{\partial \langle U_i \rangle}{\partial x_j} + \frac{\partial \langle U_j \rangle}{\partial x_i} \right)$ ”.
- p.374, Ex.10.5: “Cauchy-Schwartz” should be “Cauchy-Schwarz”.
- p.534, Eq.(12.275): “ $\mathbf{U}(t)$ ” should be “ $\mathbf{U}^*(t)$ ”.
- p.551, last line: “ $\langle \Gamma \nabla^2 \phi^s \psi \rangle$ ” should be “ $\langle \Gamma \nabla^2 \phi^s | \psi \rangle$ ”
- p.567, Ex.13.5: the first line should be “Show that the second moment of the filter function (if it exists) is”
- p.576, Eq.(13.64): “ $H \left(\frac{1}{\Delta_{(i)}} \right)$ ” should be “ $\frac{1}{\Delta_{(i)}} H$ ”.
- p.623, last line: “Eq.(13.25)” should be “Eq.(13.258)”.
- p.627, Eq.(13.274): “ $\overline{\mathcal{S}}_{ij}$ ” should be “ \overline{S}_{ij} ”.
- p.706, Eq.(H.24): on the left-hand side, the vertical line is much too big: the expression should be “ $\langle \nu \nabla^2 u_i | \mathbf{v} \rangle$ ”.
- p.725, line below Eq.(J.69): “ e^{-isV_1} ” should be “ e^{isV_1} ”.
- p.755: “Cauchy-Schwartz” should be “Cauchy-Schwarz”.

Corrections that apply to earlier printings.

The corrections are listed here in the following order:

Corrections that apply only to the 2005 printing.

Corrections that apply only to the 2003 printing.

Corrections that apply only to the 2001 printing.

Corrections that apply to all printings, 2000, 2001 and 2003.

Corrections that apply only to the 2000 and 2001 printings.

Corrections that apply only to the 2000 printing.

Please report any further corrections to the author at `s.b.pope@cornell.edu`.

Corrections that apply only to the 2005 printing.

- p.12, Eq.(2.5): “ $(U_k - u_k^{(i)})^n$ ” should be “ $(U_k - u_k^{(i)})$ ”.

Corrections that apply only to the 2003 printing.

- p.211, line below Eq.(6.126): “ $\langle u \rangle_{\mathcal{L}}$ ” should be “ $\langle \mathbf{u} \rangle_{\mathcal{L}}$ ”.

Corrections that apply only to the 2001 printing.

- p.23, last line: “ ∂_{ij} ” should be “ δ_{ij} ”.
- Back cover, in review from JFM: “tubulence” should be “turbulence”.

Corrections that apply to all printings, 2000, 2001 and 2003.

- p.12, Eq.(2.5): “ $(u_k^{(i)} - U_k)$ ” should be “ $(U_k - u_k^{(i)})$ ”.
- p.51, Eq.(3.68): replace “.” by “,” and add “where the last expression applies for integer n and α .”
- p.57, above Eq.(3.94): “Cauchy-Schwartz” should be “Cauchy-Schwarz”.
- p.59, Ex.3.16: “Cauchy-Schwartz” should be “Cauchy-Schwarz”.
- p.122, Ex.5.13: “Cauchy-Schwartz” should be “Cauchy-Schwarz”.
- p.124, Eqs.(5.122) and (5.123) should be:

$$2S_{ij}S_{ij} = \frac{\partial U_i}{\partial x_j} \frac{\partial U_i}{\partial x_j} + \frac{\partial U_i}{\partial x_j} \frac{\partial U_j}{\partial x_i} \quad (122)$$

$$2\Omega_{ij}\Omega_{ij} = \frac{\partial U_i}{\partial x_j} \frac{\partial U_i}{\partial x_j} - \frac{\partial U_i}{\partial x_j} \frac{\partial U_j}{\partial x_i} \quad (123)$$

- p.133, Eq.(5.164): “ $\frac{\bar{D}k}{Dt}$ ” should be “ $\frac{Dk}{Dt}$ ”.
- p.154, Eq.(5.257): “ $-S(\xi f + \dots)$ ” should be “ $-S(2\xi f + \dots)$ ”.
- p.167, line below Eq.(5.293) “Exercise 5.36” should be “Exercise 5.37”.
- p.213, Eq.(6.143): “ δ_{ij} ” should be “ δ_{jk} ”.
- p.234, Eq.(6.251): in the middle part, $\Gamma(\frac{3}{2})$ should be in the numerator, not the denominator.
- p.246, The second sentence of Section 6.5.8 should be “In these cases the shear-stress spectrum $E_{12}(\kappa_1)$ is zero.”
- p.320, Eq.(7.199): in place of “ $-\frac{4}{3}k \frac{\partial \langle U_i \rangle}{\partial x_j}$ ”, the first term on the right-hand side should be “ $-\frac{2}{3}k \left(\frac{\partial \langle U_i \rangle}{\partial x_j} + \frac{\partial \langle U_j \rangle}{\partial x_i} \right)$ ”.
- p.374, Ex.10.5: “Cauchy-Schwartz” should be “Cauchy-Schwarz”.
- p.379, Eq.(10.75): “ $C_\mu^{3/4}$ ” should be “ $C_\mu^{-3/4}$ ”.
- p.425, Eq.(11.133): “ ε ” should be “ \mathcal{P} ”.
- p.488, Ex.(12.19), penultimate line: “Eqs.(12.101) and (12.102)” should be “Eqs.(12.101) and (12.103)”.
- p.493, Eq.(12.121): “ $+\frac{1}{2}C_0$ ” should be “ $-\frac{1}{2}C_0$ ”.
- p.493, Eq.(12.122): “ $-\frac{1}{2}C_0$ ” should be “ $+\frac{1}{2}C_0$ ”.
- p.534, Eq.(12.275): “ $\mathbf{U}(t)$ ” should be “ $\mathbf{U}^*(t)$ ”.
- p.538, Eq.(12.288): “ $(2k^{1/2})$ ” should be “ $(2k)^{1/2}$ ”.
- p.548, Eq.(12.338): “ $b(\mathbf{x}, t)$ ” should be “ $b(\mathbf{x}, t)^2$ ”.
- p.548, Eq.(12.339): “ b ” should be “ b^2 ”.
- p.549, Eq.(12.341): “ $b(\mathbf{x}, t)$ ” should be “ $b(\mathbf{x}, t)^2$ ”.
- p.551, last line: “ $\langle \Gamma \nabla^2 \phi^s \rangle$ ” should be “ $\langle \Gamma \nabla^2 \phi^s | \psi \rangle$ ”

- p.563, Table 13.2: in the equation defining the transfer function, “ $e^{i\kappa r}$ ” should be “ $e^{-i\kappa r}$ ”.
- p.567, Ex.13.5: the first line should be “Show that the second moment of the filter function (if it exists) is”
- p.568, Eq.(13.34): the right-hand side should be multiplied by the factor $(1/\mathcal{L})$.
- p.570, Eq.(13.39): on the first line, the right-hand side should be: “ $\langle \bar{u}(x+r)\bar{u}(x) \rangle$ ”.
- p.576, Eq.(13.64): on the right-hand side, within the product, the Heaviside function should be multiplied by the factor $(1/\Delta_{(i)})$.
- p.581, Eq.(13.94) should be: $\bar{p} \equiv \bar{p} + \frac{2}{3}\rho k_r$.
- p.582, first line: “Eq.(13.91)” should be “Eq.(13.89)”.
- p.592, Eq.(13.143): The numerator on the right-hand side should be $18C\nu_r$.
- p.605, Eq.(13.195): “ $\hat{u}_k(\boldsymbol{\kappa}, t)$ ” should be “ $\hat{u}_k(\boldsymbol{\kappa}', t)$ ”.
- p.607, Eq.(13.200), “ $H(\kappa_c - \boldsymbol{\kappa}'')$ ” should be “ $H(\kappa_c - \kappa'')$ ”.
- p.623, last line: “Eq.(13.248)” should be “Eq.(13.258)”.
- p.627, Eq.(13.274): “ S_{ij} ” should be “ \bar{S}_{ij} ”.
- p.675, Eq.(C.25): “ $g^m(a)$ ” should be “ $g^{(m)}(a)$ ”.
- p.686, Eq.(E.25): “ $\langle |c_n| \rangle^2$ ” should be “ $\langle |c_n|^2 \rangle$ ”.
- p.703, line 6: “Eq.(12.4)” should be “Eq.(12.6)”.
- p.706, Eq.(H.24): on the left-hand side, “ $\langle \nu \nabla^2 u_i \rangle$ ” should be “ $\langle \nu \nabla^2 u_i | \mathbf{v} \rangle$ ”.
- p.706, Ex. H.5: “Eq.(H.18)” should be “Eq.(H.14)”.
- p.725, line below Eq.(J.69): “ e^{-isV_1} ” should be “ e^{isV_1} ”.
- p.755: “Cauchy-Schwartz” should be “Cauchy-Schwarz”.

Corrections that apply only to the 2000 and 2001 printings.

- p.xxviii: The definition of u_τ should be $\sqrt{\tau_w/\rho}$.
- p.64: in item (iii) “ $\{\hat{u}_1, \hat{u}_2, \dots, \hat{u}_3\}$ ” should be “ $\{\hat{u}_1, \hat{u}_2, \dots, \hat{u}_D\}$ ”.
- p.76, line 22 “for the circumferential coordinate” should be “of the circumferential coordinate”.
- p.90, Ex. 4.5 (a): “ a_{ij} ” should be “ a_{ij}/k ”.
- p.91, Ex. 4.5 (e): “ $\langle u_i u_j \rangle$ ” should be “ $\langle u_i u_j \rangle/k$ ”.
- p.112: The four horizontal arrows towards the right of Fig. 5.14(b) are spurious and should be removed.
- p.122, Eq.(5.104): “ ν_T ” should be “ $\hat{\nu}_T$ ”.
- p.198, 2nd line of Eq.(6.55): “ e_1 ” should be “ \mathbf{e}_1 ”.
- p.203, Eq.(6.83): At the start of the equation “ $\frac{3}{r^5}$ ” should be “ $\frac{3}{r^4}$ ”.
- p.204, Eq.(6.87): At the start of the equation “ $\frac{3}{r^5}$ ” should be “ $\frac{3}{r^4}$ ”.
- p.211, Ex.6.16: The line below Eq.(6.126) should be: “For a periodic velocity field with $\langle \mathbf{u} \rangle_{\mathcal{L}} = 0$, show that ϕ is uniform, and obtain a . . .”
- p.206, Eq.(6.97) should be:

$$a_1 + 3a_2 + 9a_3 + 10a_4 + 12a_5 = 0.$$

- p.238, Eq.(6.258): Instead of “ $4/3$ ”, the exponent should be “ $3/4$ ”.
- p.336, line 21: “(Reynolds-averaged Navier–Stokes)” should be “Reynolds-averaged Navier–Stokes”.
- p.394, Table 11.1: In the last column of the table, the entries in the fourth and fifth rows should be commuted. That is, the fourth entry should be “axi, $\xi > 0$ ” and the fifth should be “axi, $\xi < 0$ ”.
- p.394, Footnote 2: “none” should be “only one”.

- p.415, Table 11.2: the middle three entries in the last row (corresponding to axisymmetric contraction, axisymmetric expansion and plain strain) should be:

$$\sqrt{3}\mathcal{S}_\lambda \quad 2\sqrt{3}\mathcal{S}_\lambda \quad 2\mathcal{S}_\lambda.$$
- p.427, Table 11.4: under SSG, the second entry “ $C_3 = 0.8$ ” should be replaced by “ $C_3^* = 1.3$ ”.
- p.449 above Eq.(11.216): “sames” should be “same”
- p.586, Eq.(13.124) should be: $\langle E_f \rangle \approx \langle E \rangle$.
- p.586, line below Eq.(13.124): $\langle \bar{E} \rangle$ should be $\langle E_f \rangle$
- p.591, The right-hand side of Eq.(13.139) should be $\ell_s \left(1 + \frac{\nu}{\nu_r}\right)^{1/2}$.
- p.594, The right-hand side of Eq.(13.149) should be $\ell_s \left(1 + \frac{\nu}{\nu_r}\right)^{1/2}$.
- p.599, in Eq.(13.166): “ y^+ ” should be “ $-y^+$ ”
- p.623, Ex.(13.42): in the penultimate line “expansion;” should be “expansion,”.
- p.629, Below Eq.(13.282), “Lesieur and Métais (1998)” should be “Lesieur and Métais (1996)”.
- p.652, Eq.(A.52): “ \mathbf{e}_k ” should be “ $\mathbf{e}_k \cdot$ ”.
- p.697, Eq.(G.9): “ $(-1)^{n+1}$ ” should be “ $(-1)^n$ ”.
- p.737, “Lesieur and Métais (1998)” should be “Lesieur and Métais (1996)”.
- p.742, The reference “Reynolds, O. (1894)” should be:
 Reynolds, O. (1895) “On the dynamical theory of incompressible viscous fluids and the determination of the criterion.” *Philos. Trans. R. Soc. London Ser. A* 186, 123-164.

Corrections that apply only to the 2000 printing.

- In the paperback version the acknowledgement for the cover illustration has, unfortunately, been omitted. It should read:
Vortex structure and dynamics in the near field of a coaxial jet (courtesy of W.J.A. Dahm, C.E. Frieler and G. Tryggvason)
- In the Author index, several page numbers are off by one or two pages.
- p. 7, l.4: “wing” should be “wings”
- p.23, below Eq.(2.71), add the parenthetic sentence:
(For variable-density flow, S_{ij} is defined as $S_{ij} \equiv \frac{1}{2}(\partial U_i/\partial x_j + \partial U_j/\partial x_i) - \frac{1}{3}\Delta\delta_{ij}$.)
- p. 374: Eq.(10.48) should be

$$\frac{|\langle uv \rangle|}{k} = \left(C_\mu \frac{\mathcal{P}}{\varepsilon} \right)^{1/2}$$

- p. 426, in items(ii) and (iii): “ \mathcal{M}_{ijkl} ” should be “ M_{ijkl} ”
- p. 427, l.10: “ \mathcal{M}_{ijkl} ” should be “ M_{ijkl} ”
- p. 426, in Ex.11.22: “ \mathcal{M}_{ijkl} ” should be “ M_{ijkl} ”
- p. 565, below Eq.(13.11): “transfer” should be “transform”
- p. 577, line above Eq.(13.67): “0.1” should be “0.2”
- p. 742: The reference to Porté-Agel *et al.*(2000) is: J. Fluid Mech. 415, 261–284.
- p. 749: In the Author index, the page numbers for the latter part of the book are incorrect. For page numbers 557-639 (i.e., Chapter 13) add 1 to the given page number. For page numbers greater than 641 (i.e., Appendices) add 2 to the given page number.
- p.750: under Gardiner, “861” should be “713”.

The following are minor corrections, of little consequence to the reader.

- Paperback first page, l. 15: “appendixes” should be “appendices”

- Paperback back cover, l.5: “appendixes” should be “appendices”
- Paperback back cover, l.13: “tur-bulent” should be “turbulent”
- p. 26, above Eq.(2.78): “(Eq.2.42)” should be “Eq.(2.42)”
- p. 751, under Launder, B. E.: “425, 426, 427, 428” should be “425–428”