Errors in the Third Edition of
Handbook of Differential Equations

LAST UPDATED: November 22, 2000

1. Section 11, **Fixed Point Existence Theorems**, page 54

   (a) The name "Schrauder" should be "Schauder"

   (b) The following reference should be added:

   > J. Schauder, "Der Fixpunktsatz in Funktionalräumen," **Studia Math.**, 2, (1930), 171–180.

   (Thanks to G. Friesecke for these corrections.)

2. Section 27, **Canonical Forms**, page 118, reference number 2 is now

   > Bateman, H. *Partial Differential Equations of Mathematical Physics*, Dover Publications, New York, 1944.

   Which is incorrect. The reference should have been

   > Bateman, H. *Differential Equations*, Longmans, Green and Co., New York, 1926, pages 75–79.

   (Thanks to Ali Nejadmalayeri for this correction.)

3. Section 44.1.3, **Look-Up Technique**, page 172, last equation before section 44.2, presently has

   $y^{(m)} = axy^{-m/2}$

   This is incorrect, it should have been

   $y^{(m)} = ayx^{-m/2}$

   (Thanks to Flavio Noca for this correction.)

4. Section 79, **Integrating Functions**, page 326, note number 10, the following should be added:

   > The general solution to $u_x = yu_y$ is $u = f(x + \log y)$, where f is an arbitrary function.

   (Thanks to Alain Moussiaux for this observation.)

5. Section 80, **Interchanging Dependent and Independent Variables**, page 327, note number 2, the reference to Bender and Orszag should be section 1.5, not 1.6.

   (Thanks to James Dare for this observation.)

6. Section 85, **Reduction of order**, page 354, note number 2, presently contains

   > More generally, if $\{z_1(x), \dots, z_p(x)\}$ are linearly independent solutions of equation (85.6), then the substitution
   >
   > $$y(x) = \begin{bmatrix} z_1 & \dots & z_p & v \\ z_1' & \dots & z_p' & v' \\ \vdots & & \vdots & \vdots \\ z_1^{(p)} & \dots & z_p^{(p)} & v^{(p)} \end{bmatrix}$$
   >
   > reduces equation (85.7) to a linear ordinary differential equation of order $n - p$ for $v(x)$.

This should be changed to

> More generally, if $\{z_1(x), \dots, z_p(x)\}$ are linearly independent solutions of equation (85.6), then the substitution
>
> $$y(x) = \begin{bmatrix} z_1 & \dots & z_p & z \\ z_1' & \dots & z_p' & z' \\ \vdots & & \vdots & \vdots \\ z_1^{(p)} & \dots & z_p^{(p)} & z^{(p)} \end{bmatrix} \phi(x)$$
>
> where $\phi(x)$ need not be specified, reduces equation (85.6) to a linear ordinary differential equation of order $n-p$ for $y(x)$.
> Here $y(x)$ can be written in the form
>
> $$y(x) = A(x)z^{(p)} + B(x)z^{(p-1)} + \dots, \qquad A(x) \neq 0$$
>
> and its derivatives have the form
>
> $$y'(x) = A(x)z^{(p+1)} + \dots, \qquad y''(x) = A(x)z^{(p+2)} + \dots,$$
>
> These equations can be used to eliminate $\{z^{(p)}, \dots, z^{(n)}\}$ and (85.6) will take the form
>
> $$b_0 y^{(n-p)} + \dots + b_{n-p} y + V = 0$$
>
> where V is linear in the $\{z, z', \dots, z^{(p-1)}\}$

(Thanks to Unal Goktas for this correction.)

7. Section 106, **Inverse Scattering**, page 416, the **Applicable to** statement should have at the end

   > having the form of (106.2)

   (Thanks to G. Friesecke for this observation.)

8. Section 93, **Inverse Scattering**, page 373, the last line contains the equation

   $L[y] = y'' + a(x)y' + b(x) = f(x)$

   Which is incorrect. This should have been (note the missing y)

   $L[y] = y'' + a(x)y' + b(x)y = f(x)$

   (Thanks to Young Kim for this correction.)

9. Section 118, **Chaplygin's Method**, page 465, equations (118.5) and (118.6) and the surrounding text are now

   > Then define $u_1(x)$ to be the solution of
   >
   > $$y' = M(x)y + N(x), \qquad y(x_0) = y_0. \tag{118.5}$$
   >
   > and define $v_1(x)$ to be the solution of
   >
   > $$y' = \widehat{M}(x)y + \widehat{N}(x), \qquad y(x_0) = y_0. \tag{118.6}$$

   Which is incorrect. This should have been (note that the definitions have been switched):

Then define $v_1(x)$ to be the solution of

$$y' = M(x)y + N(x), \qquad y(x_0) = y_0. \tag{118.5}$$

and define $u_1(x)$ to be the solution of

$$y' = \widehat{M}(x)y + \widehat{N}(x), \qquad y(x_0) = y_0. \tag{118.6}$$

(Thanks to Bruno Van der Bossche for these corrections.)

10. Section 145, **Picard Iteration**, page 561, note number one, the following should be added:

    However, the successive approximations are guaranteed to converge to the true solution for all x sufficiently close to zero provided f is a continuously differentiable function.

    (Thanks to G. Friesecke for this observation.)

11. Section 148, **Soliton-Type Solutions**, pages 567–569
    (a) In equation (148.3) the term cv_ζ should be $-cv_\zeta$.
    (b) In equation (148.4) the term $(v_\zeta)^2$ should be $\frac{1}{2}(v_\zeta)^2$.
    (c) An additional note should be added on page 569 to state
    With the standard choice of $A = B = 0$, the solution to (148.4) can be solved in terms of elementary functions:

$$v(x) = \frac{3c}{\sigma}\left(\operatorname{sech}\left(\frac{\sqrt{c}x}{2}\right)\right)^2$$

    (Thanks to G. Friesecke for these corrections.)

12. Section 172, **Pseudospectral Method**, page 772 presently has:

$$\left.\frac{\partial u}{\partial x}\right|_{x=x_k} \simeq \frac{1}{3h}(u_{k+1} - u_{k-1}) - \frac{1}{6h}(u_{k+2} - u_{k-2}).$$

and

$$\left.\frac{\partial u}{\partial x}\right|_{x=x_k} \simeq \frac{1}{2h}(u_{k+1} - u_{k-1}) - \frac{1}{3h}(u_{k+2} - u_{k-2}) + \frac{1}{30h}(u_{k+3} - u_{k-3}).$$

and

$$\left.\frac{\partial u}{\partial x}\right|_{x=x_k} = \sum_{j=1}^{\infty} \frac{2(-1)^{j+1}}{jh}(u_{k+j} - u_{k-j}).$$

Which are all incorrect. They should have been:

$$\left.\frac{\partial u}{\partial x}\right|_{x=x_k} \simeq \frac{2}{3h}(u_{k+1} - u_{k-1}) - \frac{1}{12h}(u_{k+2} - u_{k-2}).$$

and

$$\left.\frac{\partial u}{\partial x}\right|_{x=x_k} \simeq \frac{3}{4h}(u_{k+1} - u_{k-1}) - \frac{3}{20h}(u_{k+2} - u_{k-2}) + \frac{1}{60h}(u_{k+3} - u_{k-3}).$$

and

$$\left.\frac{\partial u}{\partial x}\right|_{x=x_k} = \sum_{j=1}^{\infty} \frac{(-1)^{j+1}}{jh}(u_{k+j} - u_{k-j}).$$

(Thanks to Didier Clamond for these corrections.)