Known errata for *Stochastic Processes for Physicists*, as of Nov 25, 2015:

Errata for all versions printed to-date:

Eq. (3.69): Should be

$$\frac{dV_x}{dt} = -2(\gamma - \beta^2)\langle x^2\rangle + 2\gamma\langle x\rangle^2 = -2(\gamma - \beta^2)V_x + 2\beta^2\langle x\rangle^2.$$

Eq. (3.94) should be

$$\begin{aligned} I &= \frac{1}{2}\lim_{\Delta t\to 0}\sum_{n=0}^{N-1}(Z_n + f_n\Delta W_n)^2 - Z_n^2 - (f_n\Delta W_n)^2 \\ &= \frac{1}{2}\lim_{\Delta t\to 0}\sum_{n=0}^{N-1}\Delta(Z_n^2) - f_n^2\Delta W_n^2 = \frac{1}{2}\left(\int_0^T d(Z_n^2(t)) - \int_0^T f^2(t)(dW)^2\right) \\ &= \frac{1}{2}\left(Z^2(T) - \int_0^T f^2(t)dt\right). \end{aligned} \tag{1}$$

Eq.(2.9) should be

$$d\begin{pmatrix} x \\ p \end{pmatrix} \equiv \begin{pmatrix} dx \\ dp \end{pmatrix} = \begin{pmatrix} p/m \\ -kx \end{pmatrix} dt = \begin{pmatrix} 0 & 1/m \\ -k & 0 \end{pmatrix}\begin{pmatrix} x \\ p \end{pmatrix} dt.$$

Eq.(5.39) should be

$$\bar{a}(\Delta t) = \frac{1}{m}\left(\frac{\Delta p}{\Delta t}\right) = \frac{1}{m}\left(-\gamma p + \beta\frac{\Delta W}{\Delta t}\right)$$

Eq.(7.28): remove the factor of "2" in front of the J.

Eq.(7.29): remove the factor of "2" on the bottom line.

Eq.(7.30): replace the minus sign with a plus sign.

Eq.(7.33): In the second line of this equation, the expression $\gamma\partial P/\partial p$ should be $\gamma\partial/\partial p$.

Section 7.8: The definition given for the diffusion coefficient D is non-standard. This definition makes D equal to twice the value of the standard definition. That is, the standard definition is to write the diffusion equation without the factor of 1/2.

Errata for the first and second printings:

(these have been corrected in the newer print-on-demand version)

Ch 1

The heading of section 1.5 should be "Adding independent random variables together".

The first line of section 1.5: "When we have two continuous random variables ..." should be "When we have two independent continuous random variables ..."

Eq.(1.15) should be

$$P_Z(z) = \int_{-\infty}^{\infty} P_X(z-s)P_Y(s)ds \equiv P_X * P_Y$$

The first sentence of section 1.6: "... it can be useful to know how calculate..." should be "... it can be useful to know how to calculate..."

In section 1.9: the text "is defined as the nth derivative of the log of the characteristic function, also evaluated at zero." should be replaced with "is also given by Eq.(1.42), but with χ replaced with $\log(\chi)$".

Ch 2

Eq.(2.4) should be

$$\frac{dx}{dt} = \frac{p}{m} \qquad \text{and} \qquad \frac{dp}{dt} = -kx.$$

Eq.(2.5) should be

$$\frac{d}{dt}\begin{pmatrix} x \\ p \end{pmatrix} \equiv \begin{pmatrix} dx/dt \\ dp/dt \end{pmatrix} = \begin{pmatrix} p/m \\ -kx \end{pmatrix} = \begin{pmatrix} 0 & 1/m \\ -k & 0 \end{pmatrix}\begin{pmatrix} x \\ p \end{pmatrix}.$$

Eq.(2.5) should be

$$A = \begin{pmatrix} 0 & 1/m \\ -k & 0 \end{pmatrix},$$

The minus sign in front of the γ in Eq.(2.50) should be plus.

Eq.(2.53) should be

$$e^{\lambda\sigma} = \cosh(\lambda)I + \sinh(\lambda)\sigma,$$

Ch 3

Eq.(3.28) should be

$$P(Z_n) = \frac{e^{-Z_n/(2\Delta t)}}{\sqrt{2\pi\Delta t Z_n}}.$$

Eq.(3.32) should be

$$\frac{1}{\sqrt{1-x}} \approx 1 + x/2,$$

Eqs. (3.39) and (3.40): all occurrences of f should be replaced by y.

Eq. (3.46): last line should be

$$= g^2 \int_0^t e^{2\gamma s} ds = \frac{g^2}{2\gamma} \left(e^{2\gamma t} - 1 \right).$$

Second line after Eq.(3.50): "Section 1.2" should be "Section 2.4"

Eq. (3.62): The "dt" on the right hand side should be deleted.

Eq. (3.67): Should be

$$d\langle x^2 \rangle = -(2\gamma - \beta^2)\langle x^2 \rangle dt.$$

Eq. (3.68): Should be

$$\frac{dV_x}{dt} = \frac{d\langle x^2 \rangle}{dt} - \frac{d\langle x \rangle^2}{dt} = \frac{d\langle x^2 \rangle}{dt} - 2\langle x \rangle \frac{d\langle x \rangle}{dt}.$$

Last paragraph of section 3.7: "... will include the third moments, and so." should be "... will include the third moments, and so on.".

Eq. (3.74): the second line should be

$$= \left\langle M \begin{pmatrix} dW_1 \\ dW_2 \end{pmatrix} \; (dW_1 \, , dW_2) \; M^{\mathrm{T}} \right\rangle$$

Eq. (3.76): the second line should be

$$= M \begin{pmatrix} dW_1 \\ dW_2 \end{pmatrix} \; (dW_1 \, , dW_2) \; M^{\mathrm{T}}$$

Eq. (3.75): should be $C = 2\eta\sqrt{1-\eta^2}$

Eq. (3.89) Should be

$$I = \int_0^T \int_t^T ds \, f(t) \, dW(t) \; = \; \int_0^T (T-t) f(t) \, dW(t)$$

Eq. (3.90) should be

$$I = \int_0^T \left[(T-t) f(t) \right]^2 \, dt$$

Section 3.9, second paragraph: "equation drive by" should be "equation driven by"

Page 53, exercise 9, two lines below Eq. (3.127): "fist" should be "first"

Ch 4

Page 55, 4th line from the bottom: "pot" should be "plot"

Eq. (4.17) should be

$$X(t) = x' + \int_{t'}^{t} dW = x' + W(t) - W(t'),$$

Eq. (4.21) should be

$$P(x,t;x',t') = P(x,t|x',t')P(x',t') = \frac{e^{-(x-x')^2/[2(t-t')]-x'^2/[2t']}}{2\pi\sqrt{(t-t')t'}},$$

First line of section 4.5: the two occurrences of "Section 1" should replaced with "Section 1.8"

Eq.(4.35), last line: $h(t,\tau)$ should be replaced with $h(\tau)$

Eq.(4.36): $h(t,\tau)$ should be replaced with $h(\tau)$

Eq.(4.39): dt should be replaced with $d\nu$

Eq.(4.54): The lower limit of the integral is currently ∞. It should be replaced by $-\infty$

Ch 5

Eq. (5.12) should be

$$\begin{aligned} x(t) &= \int_0^t \frac{p(s)}{m} ds = \frac{p(0)}{m}\int_0^t e^{-\gamma s} ds + \frac{g}{m}\int_0^t \left[\int_0^s e^{-\gamma(s-s')} dW(s')\right] ds \\ &= \frac{p(0)}{m}\int_0^t e^{-\gamma s} ds + \frac{g}{m}\int_0^t e^{\gamma s'}\left[\int_{s'}^t e^{-\gamma s} ds\right] dW(s') \\ &= \frac{1}{m\gamma}(1-e^{-\gamma t})p(0) + \frac{g}{m\gamma}\int_0^t (1-e^{-\gamma(t-s')}) dW(s') \\ &= \frac{1}{m\gamma}(1-e^{-\gamma t})p(0) + \frac{g}{m\gamma}\int_0^t (1-e^{-\gamma s}) dW(s) \end{aligned}$$

Ch 6

All occurrences of "Milstien's method" (pages 95 and 98) should be replaced by "Milstein's method"

In the heading of section 6.5, "Runge-Kutter" should be "Runge-Kutta".

Ch 7

Eq.(7.2): The RHS should be dh, not df.

Just after Eq.(7.2): "... equation for the mean of f ..." should be "... equation for the mean of h ..."

Just before Eq.(7.22): "differential equation for h" should be "differential equation for ξ"

Eq.(7.23) should have a "2" inserted before the $f(u)$.

Eq.(7.28) should have a "2" inserted before the $f(u)$.

Ch 8

In the paragraph before Eq.(8.4), the expression $(\lambda\Delta t)^m(1-\Delta t)^{M-m}$ should be $(\lambda\Delta t)^m(1-\lambda\Delta t)^{M-m}$.

In Eqs. (8.35) and (8.36), all occurrences of λ^n should be replaced with $(\lambda t)^n$.

Ch 9

In Eq.(9.16), $f(t)$ should be $f(s)$.

In Eq.(9.17), $[f(t)]^\alpha dt$ should be $[f(s)]^\alpha ds$.

In Eq.(9.44), $g(x,t)$ should be $g^2(x,t)$.

Eq.(9.46) should be

$$\begin{aligned} dy(t) &= \left(\frac{\partial y}{\partial x}\right) dx_{\rm c}(t) + \left[\left(\frac{\partial y}{\partial t}\right) + \frac{g(x,t)}{2}\left(\frac{\partial^2 y}{\partial x^2}\right)\right] dt \\ &\quad + \left[y(x+\Delta J(t),t) - y(x,t)\right], \end{aligned}$$

$$\text{with} \quad \Delta J(t) = \begin{cases} \text{size of jump at } t_i, & t = t_i, \forall i \\ 0 & \text{otherwise} \end{cases}$$

Eq.(9.47) should be

$$\begin{aligned} dy(t) &= \left(\frac{\partial y}{\partial x}\right) dx(t) + \left[\left(\frac{\partial y}{\partial t}\right) + \frac{g(x,t)}{2}\left(\frac{\partial^2 y}{\partial x^2}\right)\right] dt \\ &\quad + \left[y(x+\Delta J(t),t) - y(x,t) - \frac{dy(x,t)}{dx}\Delta J(t)\right] \end{aligned}$$

First line after Eq.(9.47) should be: "In this expression the term $-\frac{dy}{dx}\Delta J(t)$, ..."

Ch 10

Three lines above Eq. (10.20): "... above exert in plan language" should be "... above excerpt in plain language"

Errata for the first printing only:

Ch 1

Page 2: Figure 1 illustrates summing the probabilities from 3 to 4, not 4 to 6 as implied in the text.

Appendix

Page 181, Eq.(A5): The last term on the second line should not have a minus sign.

Pages 181 and 182, Eqs. (A6) - (A11): Wherever the expression $-\beta^2/(4\alpha^2)$ appears in an exponential, it should be replaced with $+\beta^2/(4\alpha)$.

Eqs.(A.18) and (A19) should be

$$\begin{aligned} \int_0^\infty x^{2n} e^{-\alpha x^2}\, dx &= \frac{\sqrt{\pi}}{(2\sqrt{\alpha})^{2n+1}} \frac{(2n)!}{n!}, \\ \int_0^\infty x^{2n+1} e^{-\alpha x^2}\, dx &= \frac{n!}{2\alpha^{n+1}}. \end{aligned}$$

Ch 3

Eq. (3.78): $(M\mathbf{dV})$ should be replaced with $(M\mathbf{dW})$.