
**Applied Stochastic
Processes and Control
for Jump-Diffusions:
Modeling, Analysis, and Computation**

Floyd B. Hanson, University of Illinois at Chicago, Chicago, Illinois

Post Publication Errata

December 6, 2009

*Negative numbered lines imply lines counted up from the bottom,
designated as line -1.*

- Page 1, line -5: Replace “**continuous-time stochastic processes**” by “**stochastic processes in continuous-time**”.
- Page 3, line 19: Replace “**time-interval** $[t_j, t_j + \Delta t_j]$ ” by “**time-interval** $[t_i, t_i + \Delta t_i]$ ”.
- Page 12, line -5: Replace “*is independent of t .*” by “*is independent of t with constant jump-rate λ .*”.
- Page 16, line 2: Replace “*Poisson process,*” by “*Poisson process with constant jump-rate λ ,*”.
- Page 19, Defn. 1.18: Replace “ $dt \geq 0$ ” by “ $dt > 0$ ”.
- Page 25, Ex. 2a: Replace “*with μ and*” by “*with μ_0 and*”.
- Page 48, Remark 2.16. line 4: Replace “*where $g(w, t)$ ” by “*i.e., the Itô forward approximation (IFA) denoted by $\stackrel{\text{ifa}}{\simeq}$ and limit by $\stackrel{\text{ifa}}{=}$, where $g(w, t)$ ”.**
- Pages 48-51, starting with Eq. (2.43): Replace multiple occurrences of “ $\stackrel{\text{ims}}{=}$ ” by “ $\stackrel{\text{ifa}}{=}$ ”.
- Page 70, Th. 3.12: Replace “ *k th jump of Poisson*” by “ *k th jump-time of Poisson*”.
- Page 89, Th. 3.12: Replace “ $d(e^{-aw}G)_w$ ” by “ $(e^{-aw}G)_w$ ”.

- Page 93, Fig. 4.2: Replace the figure (a copy of Fig. 4.3) by the correct figure:

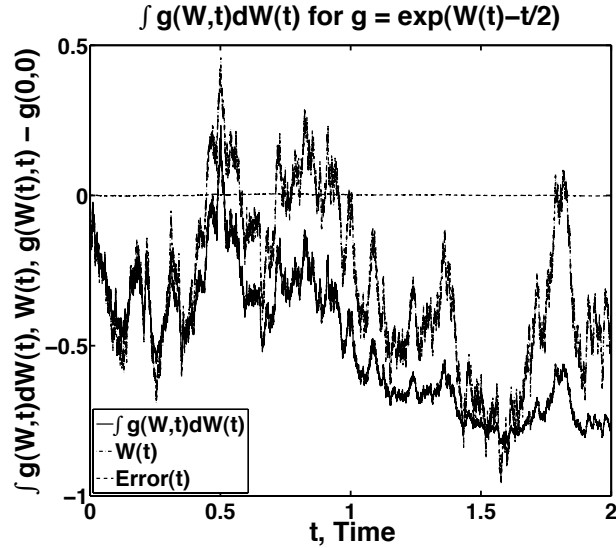


Figure 4.2. Example of a simulated Itô discrete approximation to the stochastic diffusion integral $I_n[g](t_{i+1}) = \sum_{j=0}^i g_j \Delta W_j$ for $i = 0 : n$, using MATLAB `randn` with sample size $n = 10,000$ on $0 \leq t \leq 2.0$. Presented are the simulated Itô partial sums S_{i+1} , the simulated noise W_{i+1} and the error E_{i+1} relative to the exact integral, $I^{(\text{ims})}[g](t_{i+1}) \stackrel{\text{ims}}{=} \exp(W_{i+1} - t_{i+1}/2) - 1$, in the Itô mean square sense.

- Page 97, Eq. (4.37): Replace “ $\ln(x_0)\mu_n(t)$ ” by “ $\mu_n(t)$ ”.
- Page 103, Lemma 4.22: Insert equal sign in “ $[X](t)h(X(t), t)dP(t)$ ” to get “ $[X](t) = h(X(t), t)dP(t)$ ” in unnumbered equation.
- Page 107, line 5: Replace “at jumps” by “at jump-time”.
- Page 108, line 11: Replace “two-term” by “second-order”.
- Page 109, line 1 in Subsect. 4.3.3: Replace “jump-diffusion” by “jump and diffusion”.
- Page 111, lines 5 & 4 prior to Eq. (4.83): Replace “which in turn is the time integral of” by “whose time integral yields” and “ $((\mu_0 + \lambda_0\nu_0)t)$ ” by “ $(2(\mu_0 + \lambda_0\nu_0)t)$ ”, respectively.
- Page 115, lines 7 & 8: Delete both occurrences of “the example” referring to Eqs. (4.24) and (4.56), respectively.
- Page 116, Figure 4.5 Caption: Replace “`randn`” by “`rand`”.

-
- Page 118, line 11 : Replace “stochastic diffusion integral” by “stochastic jump integral”.
 - Page 118, line -5 : Replace “ $\lambda_i \Delta t$ ” by “ $(\lambda_i \Delta t)^k$ ” for correct Poisson distribution power.
 - Page 119, line 6 : Replace “algebraic exercise” by “optional algebraic exercise”.
 - Page 130, line -10 : Replace “ $h(t, Q) = 1$ ” by “ $h(t, Q) = 1$ ”.
 - Page 130, line -6, Eq. (5.2) : Replace “ $\mathcal{P}(\mathbf{dt}, \mathbf{dq})dt$ ” by “ $\mathcal{P}(\mathbf{dt}, \mathbf{dq})$ ”.
 - Page 132, lines -11 & -7 : Replace “ $(t, t+dt)$ ” by “ $[t, t+dt)$ ” on both lines, “ $(q, q+dq)$ ” by “ $[q, q+dq)$ ” and “ $(t, t+\Delta t)$ ” by “ $[t, t+\Delta t)$ ”, corresponding to right-continuity and Itô forward approximation.
 - Page 133, in first item: Replace “ $(t_i, t_i + \Delta t_i)$ ” by “ $[t_i, t_i + \Delta t_i)$ ” in two occurrences, “ $(q_k, q_k + \Delta q_k)$ ” by “ $[q_k, q_k + \Delta q_k)$ ” in two occurrences, “ $(t_j, t_j + \Delta t_j)$ ” by “ $[t_j, t_j + \Delta t_j)$ ” in two occurrences, “ $(q_\ell, q_\ell + \Delta q_\ell)$ ” by “ $[q_\ell, q_\ell + \Delta q_\ell)$ ” in two occurrences, and “ $(t_i, t_i + \Delta t_j)$ ” by “ $[t_i, t_i + \Delta t_i)$ ”.
 - Page 133, in second item: Replace “ $(q, q + dq)$ ” by “ $[q, q + dq)$ ” and “ $(t, t + dt)$ ” by “ $[t, t + dt)$ ”.
 - Page 134, lines 8: Replace “ $\mathcal{P}\delta_{k,1}$ ” by “ $\overline{\mathcal{P}}\delta_{k,1}$ ”.
 - Page 136, Eq. (5.23): Replace “ $\int_{\mathcal{Q}} h(t, q)\tilde{\mathcal{P}}(\mathbf{dt}, \mathbf{dq})$ ” by “ $\int_0^t \int_{\mathcal{Q}} h(t, q)\tilde{\mathcal{P}}(\mathbf{dt}, \mathbf{dq})$ ”.
 - Page 140, lines 6: Replace “ $\stackrel{\text{sym}}{=}$ ” by “ $=$ ”.
 - Page 141, Eq. (5.34); p. 142, Eqs. (5.42) and (5.43): Replace “ $\stackrel{\text{dt}}{=}$ ” by “ $\stackrel{\text{dt}}{\text{zol}}{=}$ ”.
 - Page 143, Eq. (5.47): Replace “ $(1 + \nu_0(Q))^{\Delta P_i}$ ” by “ $\exp\left(\sum_{j=1}^{\Delta P_i} Q_j\right)$ ”.
 - Page 143, lines -10 to -8: Replace “ $\mathbb{E}[(1 + \nu_0(Q))^{\Delta P_i}] = \mathbb{E}[e^{Q\Delta P_i}]$ ” by “ $\mathbb{E}[\prod_{j=1}^{\Delta P_i} (1 + \nu_0(Q))] = \mathbb{E}\left[\exp\left(\sum_{j=1}^{\Delta P_i} Q_j\right)\right]$ ”.

“ $= e^{-\lambda_i \Delta t_i} \sum_{k=0}^{\infty} (\lambda_i \Delta t_i)^k \mathbf{E}_Q [e^{kQ}]$ ”
 by “ $= \mathbf{E}_{\Delta P} \left[\mathbf{E}_Q \left[\exp \left(\sum_{j=1}^{\Delta P_i} Q_j \right) \middle| \Delta P_i \right] \right]$ ”
 and “ $= e^{-\lambda_i \Delta t_i} \sum_{k=0}^{\infty} (\lambda_i \Delta t_i)^k (\mathbf{E}_Q [e^Q])^k$ ”
 by “ $= e^{-\lambda_i \Delta t_i} \sum_{k=0}^{\infty} \frac{(\lambda_i \Delta t_i)^k}{k!} \mathbf{E}_Q^k [e^Q]$ ”.

- Page 144, Eq. (5.51): Delete “ ν_0 ” appearing in summand “ $\nu_0 Q_k$ ”.
- Page 146, line 5–6: Replace all “ $\overline{\mathcal{P}}_{i,j}$ ” by “ $\overline{\mathcal{P}}_{i,j}$ ”.
- Page 146, Eq. (5.54): In first line replace “ $(\mu_d(s)\lambda(s)\overline{\nu}(s))ds$ ”
by “ $(\mu_d(s) + \lambda(s)\overline{\nu}(s))ds$ ”
and in second line replace “ $\mathbf{E}[dX(s)/X(s)]ds$ ”
by “ $\mathbf{E}[dX(s)/X(s)]$ ”.
- Page 148, line -2: Replace “ $= (n+1)M^{(4)} + 3(n+1)((n+1) - 1)(M^{(2)})^2$.” by “ $= (n+1)(M^{(4)} + 3n(M^{(2)})^2)$.”, for simplicity only.
- Page 153, Eq. (5.69): Replace “ $\sum_j^{\Delta P(t;Q)}$ ” by “ $\sum_{j=1}^{\Delta P(t;Q)}$ ”.
- Page 153ff, Eqs. (5.70)-(5.75): Replace all “ $\sum_{k=1}^{\infty}$ ” by “ $\sum_{k=0}^{\infty}$ ”.
- Page 155, line -2: Replace “ $\sigma_d(t)\Delta t$,” by “ $\sigma_d^2(t)\Delta t$,”.
- Page 166, Exercise 5: In the first equation replace “ $\sigma_d^2(t) + \overline{\nu^2}(t)$ ”
by “ $(\sigma_d^2(t) + \lambda(t)\overline{\nu^2}(t)) dt$ ”
and in the second equation replace “ $\text{Var}[dX(s)/X(s)]ds$ ”
by “ $\text{Var}[dX(s)/X(s)]$ ”.
- Page 190, line -6: Delete “dps”.
- Page 228, Eq. (8.35): Replace “ $0.5|F_{j,k+0.5}|$ ” by “ $0.5|F_{j,k+0.5}|\Delta X$ ”.
- Page 290, Eq. (10.8), line -13: Insert “ $S^2(t)$ ” before “ $\frac{\partial^2 F''}{\partial S^2}$ ” so equation is

$$dV^*(t) = N_F^* \left(dF - \frac{\partial F}{\partial S} dS \right) = N_F^* \left(\frac{\partial F}{\partial t} + \frac{1}{2} \sigma^2 S^2(t) \frac{\partial^2 F}{\partial S^2} \right) dt$$

- Page 290, Eq. (10.11), line -3: Insert “ s^2 ” before “ $\frac{\partial^2 F''}{\partial s^2}$ ”, changing all upper case S to lower case s , so equation is

$$\frac{\partial F}{\partial t}(s, t) + \frac{1}{2} \sigma^2 s^2 \frac{\partial^2 F}{\partial s^2}(s, t) = r \left(F(s, t) - s \frac{\partial F}{\partial s}(s, t) \right),$$

while replacing the preceding “independent stock variable S ” by “independent stock variable s ”.

- Page 291, line 1 to 5: Replace all occurrences of the stochastic variable “ S ” with the PDE variable “ s ”.
- Page 312, Eq. (10.101): Replace all 9 occurrences of the stochastic variable “ $N(T)$ ” with the variable “ $P(T)$ ”.
- Page 313, Eq. (10.103), line 2 of eq.: Insert the missing argument “ Q_k ” of the sum “ $\sum_{k=1}^{P(T)}$ ” in the exponent inside the max function, so the line of the equation is

$$\equiv e^{-rT} \mathbf{E} \left[\max \left[S_0 e^{(r - \lambda \mu_J - \sigma_d^2/2)T + \sigma_d W(T) + \sum_{k=1}^{P(T)} Q_k} - K, 0 \right] \right]$$

- Page 314, eq. unnumbered, line 14: Change the arguments of the functions A and B from “ $S_0 e^{\hat{S}_k - \lambda \mu_J T}$ ” to “ \hat{S}_k ”, so the line of the equation is

$$= \sum_{k=0}^{\infty} p_k(\lambda T) \mathbf{E}_{\hat{S}_k} \left[S_0 e^{\hat{S}_k - \lambda \mu_J T} A(\hat{S}_k) - K e^{-rT} B(\hat{S}_k) \right],$$

- Page 322, Eq. (10.129) and surrounding text: The material should read: “Here a modification Merton boundary condition correction in his 1990 text [203, Chap. 6] is used,

$$v^*(t, 0^+) = \mathcal{U}_f(0^+) e^{-\bar{\beta}(t, t_f)} + \mathcal{U}(0^+) \int_t^{t_f} e^{-\bar{\beta}(t, s)} ds, \quad (10.129)$$

since the consumption must be zero when the wealth is zero at $t = \tau_a$, the time of absorption, and remains there, $\tau_a \leq t \leq t_f$, provided $\mathcal{U}_f(0^+)$ and $\mathcal{U}(0^+)$ are bounded, otherwise asymptotic conditions may be needed.”

- Pages B37, replace the unnumbered equation

$$\text{Cov}[X_k, X_j] = \text{Var}[X_j] \delta_{k,j}.$$

by “the joint distribution is“

$$\Phi_{X_k, X_j}(x_k, x_j) = \Phi_{X_k}(x_k) \cdot \Phi_{X_j}(x_j).$$

Also, replace Equations (B.111) and (B.112),

$$E[s_n^2] = \sigma^2, \quad (B.111)$$

$$E[\hat{s}_n^2] = \frac{n}{n-1}\sigma^2, \quad (B.112)$$

by

$$E[s_n^2] = \frac{n-1}{n}\sigma^2, \quad (B.111)$$

$$E[\hat{s}_n^2] = \sigma^2, \quad (B.112)$$

- Page B69, Exercise 3, replace the unnumbered equation

$$\begin{aligned} \text{Var}[XY] &= \bar{X}^2 \text{Var}[Y] + 2\bar{X}\bar{Y} \text{Cov}[X, Y] + \bar{Y}^2 \text{Var}[X] - \text{Cov}^2[X, Y] \\ &\quad + 2\bar{X}E[\delta X(\delta Y)^2] + 2\bar{X}E[(\delta X)^2\delta Y] + E[(\delta X)^2(\delta Y)^2], \end{aligned}$$

by

$$\begin{aligned} \text{Var}[XY] &= \bar{X}^2 \text{Var}[Y] + 2\bar{X}\bar{Y} \text{Cov}[X, Y] + \bar{Y}^2 \text{Var}[X] - \text{Cov}^2[X, Y] \\ &\quad + 2\bar{X}E[\delta X(\delta Y)^2] + 2\bar{X}E[(\delta X)^2\delta Y] + E[(\delta X)^2(\delta Y)^2], \end{aligned}$$

- Page B70, Exercise 6, Jensen's inequality, replace Equation (B.191)

$$E[f(X)] \leq f(E[X]). \quad (B.191)$$

by

$$E[f(X)] \geq f(E[X]). \quad (B.191)$$