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

April 27, 2011

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* $\overset{\text{ifa}}{\simeq}$ *and limit by* $\overset{\text{ifa}}{=}$, *where* $g(w, t)$".
- Pages 48-51, starting with Eq. (2.43): Replace multiple occurrences of "$\overset{\text{ims}}{=}$" by "$\overset{\text{ifa}}{=}$" and "$\xrightarrow{\text{ims}}$" by "$\xrightarrow{\text{ifa}}$".
- Page 70, Th. 3.12: Replace "kth jump of Poisson" by "kth jump-time of Poisson".
- Page 89, line -12, Th. 3.12: Replace "$d\left(e^{-aw}G\right)_w$" by "$\left(e^{-aw}G\right)_w$".

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

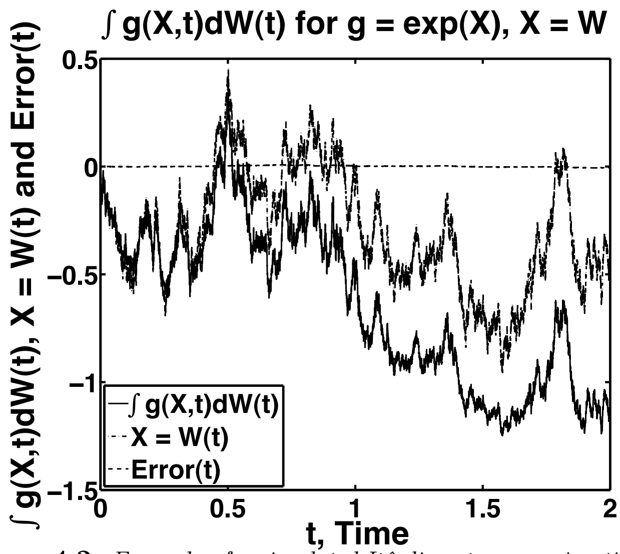

Figure 4.2. *Example of a simulated Itô discrete approximation to the stochastic diffusion integral* $I_n[g](t_{i+1}) = \sum_{j=0}^{i} g_j \Delta W_j$ *for* $i = 0 : n$*, using MATLAB* **randn** *with sample size* $n = 10,000$ *on* $0 \le t \le 2.0$*. Presented are the simulated Itô partial sums* S_{i+1}*, the simulated noise* W_{i+1} *and the error* E_{i+1} *relative to the exact integral,* $I^{(\mathrm{ims})}[g](t_{i+1}) \overset{\mathrm{ims}}{=} \exp(W_{i+1} - t_{i+1}/2) - 1$*, 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 “$h(t, Q)$”.
- 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 “$\int_{\mathcal{Q}} h(t, q)\widetilde{\mathcal{P}}(\mathbf{dt}, \mathbf{dq})$” by “$\int_0^t \int_{\mathcal{Q}} h(t, q)\widetilde{\mathcal{P}}(\mathbf{dt}, \mathbf{dq})$”.
- Page 142, lines 6: Replace “$\stackrel{\mathrm{sym}}{=}$” by “$=$”.
- Page 142, eqs. (5.42) and (5.43): Also, replace both “$\stackrel{\mathrm{dt}}{=}$” by “$\underset{\mathrm{zol}}{\stackrel{\mathrm{dt}}{=}}$”.
- Page 141, Eq. (5.34); p. 142, Eqs. (5.42) and (5.43): Replace “$\stackrel{\mathrm{dt}}{=}$” by “$\underset{\mathrm{zol}}{\stackrel{\mathrm{dt}}{=}}$”.
- 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 "$\mathrm{E}\left[(1+\nu_0(Q))^{\Delta P_i}\right] = \mathrm{E}\left[e^{Q\Delta P_i}\right]$"
  by "$\mathrm{E}\left[\Pi_{j=1}^{\Delta P_i}(1+\nu_0(Q))\right] = \mathrm{E}\left[\exp\left(\sum_{j=1}^{\Delta P_i} Q_j\right)\right]$",
  "$= e^{-\lambda_i \Delta t_i}\sum_{k=0}^{\infty}(\lambda_i\Delta t_i)^k \mathrm{E}_Q\left[e^{kQ}\right]$"
  by "$= \mathrm{E}_{\Delta P}\left[\mathrm{E}_Q\left[\exp\left(\sum_{j=1}^{\Delta P_i} Q_j\right)\middle| \Delta P_i\right]\right]$"
  and "$= e^{-\lambda_i \Delta t_i}\sum_{k=0}^{\infty}(\lambda_i\Delta t_i)^k \left(\mathrm{E}_Q\left[e^{Q}\right]\right)^k$"
  by "$= e^{-\lambda_i \Delta t_i}\sum_{k=0}^{\infty}\frac{(\lambda_i\Delta t_i)^k}{k!} \mathrm{E}_Q^k\left[e^{Q}\right]$".

- 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 "$\mathrm{E}[dX(s)/X(s)]ds$"
  by "$\mathrm{E}[dX(s)/X(s)]$".

- 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 "$\left(\sigma_d^2(t) + \lambda(t)\overline{\nu^2}(t)\right)dt$"
  and in the second equation replace "$\mathrm{Var}[dX(s)/X(s)]ds$"
  by "$\mathrm{Var}[dX(s)/X(s)]$".

- 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

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

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

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

- 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,

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

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

- Pages B37, replace the unnumbered equation

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

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),

$$\mathrm{E}[s_n^2] = \sigma^2, \qquad (B.111)$$

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

by

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

$$\mathrm{E}[\widehat{s}_n^2] = \sigma^2, \qquad (B.112)$$

- Page B69, Exercise 3, replace the unnumbered equation

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

by

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

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

$$\mathrm{E}[f(X)] \leq f(E[X]). \qquad (B.191)$$

by

$$\mathrm{E}[f(X)] \geq f(E[X]). \qquad (B.191)$$