# Errata in "Stochastic Thermodynamics: An Introduction"

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# Chapter 2. Basics

#### 2.1 Thermodynamics

• Page 10, line 8. Read: we have  $1/T_1 > 1/T_2$ correct to: we have  $1/T_1 \ge 1/T_2$ 

### 2.4 Statistical mechanics

• Page 15, line 4 from bottom, eq.(2.41). Read:

$$k_{\rm B} \approx 1.384 \cdot 10^{-23} \,\mathrm{J/K.}$$
 (2.41)

correct to:

$$k_{\rm B} \approx 1.381 \cdot 10^{-23} \,\mathrm{J/K.}$$
 (2.41)

### 2.5 Stochastic dynamics

• Page 21, line 7, eq.(2.72. Read:

$$+ \int_{t_0}^t \mathrm{d}t_1 \int_{t'}^t \mathrm{d}t_0 \sum_{x_0} L_{xx_0}(t_1) L_{x_0x'}(t_0) + \cdots$$

correct to:

+ 
$$\int_{t'}^{t} \mathrm{d}t_0 \int_{t_0}^{t} \mathrm{d}t_1 \sum_{x_0} L_{xx_0}(t_1) L_{x_0x'}(t_0) + \cdots$$

# 2.6 Master equations

• P.22, fig.2.1. Interchange  $k_{32}$  and  $k_{23}$  in the figure.

### 2.7 Trajectories of master equations

• Page 25, line 8, eq. (2.90). Read:

$$\prod_{\ell \in \text{dwell}} p_{x_{\ell}; t_{\ell-1} + \text{d}t \mid x_{\ell}; t_{\ell-1}} = \prod_{\ell} \left( 1 - \text{d}t_{\ell} \, k^{\text{out}} \right) \approx e^{-\sum_{\ell} k_{x_{\ell}}^{\text{out}} \, \text{d}t_{\ell}} \approx e^{-\int \text{d}t \, k_{x(t)}^{\text{out}}(t)}.$$
(2.90)

correct to:

$$\prod_{\ell \in \text{dwell}} p_{x_\ell; t_{\ell-1} + \Delta t \mid x_\ell; t_{\ell-1}} = \prod_\ell \left( 1 - \Delta t \, k^{\text{out}} \right) \approx e^{-\sum_\ell k_{x_\ell}^{\text{out}} \Delta t} \approx e^{-\int dt \, k_{x(t)}^{\text{out}}(t)}.$$
(2.90)

• Page 25, line 6 from bottom, eq. (2.91). Read:

$$\mathcal{P}_{\boldsymbol{x}} = e^{-\int_{t_n}^{t_1} dt' \ k_n^{\text{out}}(t')} k_{x_n x_{n-1}}(t_n) e^{-\int_{t_n}^{t_{n-1}} dt' \ k_{x_{n-1}}^{\text{out}}(t')} \dots$$

$$\times e^{-\int_{t_2}^{t_1} dt' \ k_{x_1}^{\text{out}}(t')} e^{-\int_{t_1}^{t_0} dt' \ k_{x_0}^{\text{out}}(t')} p_{x_0}(t_0).$$
(2.91)

correct to:

$$\mathcal{P}_{\boldsymbol{x}} = e^{-\int_{t_n}^{t_1} dt' k_n^{\text{out}}(t')} k_{x_n x_{n-1}}(t_n) e^{-\int_{t_{n-1}}^{t_n} dt' k_{x_{n-1}}^{\text{out}}(t')} \cdots \times e^{-\int_{t_1}^{t_2} dt' k_{x_1}^{\text{out}}(t')} e^{-\int_{t_0}^{t_1} dt' k_{x_0}^{\text{out}}(t')} p_{x_0}(t_0).$$
(2.91)

# 2.12 Exercises

• p.36, line 12 from bottom. Read: Another sequence  $x = (x_0, x_{1,2}, ...)$ correct to: Another sequence  $x = (x_0, x_1, x_2, ...)$ 

### 2.10 Information

• Page 34, line 3 from bottom, eq. (2.141). Read:

 $+ D_{\mathrm{KL}}(p(\mathcal{S}_1|\mathcal{S}_2) \| q(\mathcal{S}_2\|\mathcal{S}_1)),$ 

correct to:

$$+ D_{\mathrm{KL}}(p(\mathcal{S}_1|\mathcal{S}_2) \| q(\mathcal{S}_2|\mathcal{S}_1)),$$

• Page 34, line last, eq. (2.142). Read:

$$D_{\mathrm{KL}}(p(\mathcal{S}_1|\mathcal{S}_2) \| q(\mathcal{S}_2\|\mathcal{S}_1)) =$$

$$D_{\mathrm{KL}}(p(\mathcal{S}_1|\mathcal{S}_2) \| q(\mathcal{S}_2|\mathcal{S}_1)) =$$

# Chapter 3. Stochastic thermodynamics

3.7 Stochastic entropy and entropy production in a manipulated two-level system

• Page 49, caption to fig. 3.3, line 6. Read: probability of occupation  $p_1(1)$ correct to: probability of occupation  $p_1(t)$ 

### 3.8 Average entropy production rate

• Page 50, line 3rd from bottom, eq. (3.37). Read:

$$\frac{\mathrm{d}s^{\mathrm{sys}}}{\mathrm{d}t} = -k_{\mathrm{B}}\frac{\mathrm{d}\lambda}{\mathrm{d}t}\frac{\partial}{\partial\lambda}\ln p_{x} = \frac{k_{\mathrm{B}}}{p_{x}}\frac{\mathrm{d}\lambda}{\mathrm{d}t}\frac{\partial p_{x}}{\partial\lambda}.$$

correct to:

$$\frac{\mathrm{d}s_x^{\mathrm{sys}}}{\mathrm{d}t} = -k_{\mathrm{B}}\frac{\mathrm{d}\lambda}{\mathrm{d}t}\frac{\partial}{\partial\lambda}\ln p_x = -\frac{k_{\mathrm{B}}}{p_x}\frac{\mathrm{d}\lambda}{\mathrm{d}t}\frac{\partial p_x}{\partial\lambda}$$

• Page 50, line last, eq. (3.38). Read:

$$\left\langle \frac{\mathrm{d}s^{\mathrm{sys}}}{\mathrm{d}t} \right\rangle = k_{\mathrm{B}} \sum_{x} p_{x} \frac{\mathrm{d}s_{x}^{\mathrm{sys}}}{\mathrm{d}t} = k_{\mathrm{B}} \frac{\mathrm{d}\lambda}{\mathrm{d}t} \sum_{x} \frac{\mathrm{d}p_{x}}{\mathrm{d}\lambda} = 0.$$

correct to:

$$\left\langle \frac{\mathrm{d}s^{\mathrm{sys}}}{\mathrm{d}t} \right\rangle = \sum_{x} p_{x} \frac{\mathrm{d}s_{x}^{\mathrm{sys}}}{\mathrm{d}t} = -k_{\mathrm{B}} \frac{\mathrm{d}\lambda}{\mathrm{d}t} \sum_{x} \frac{\mathrm{d}p_{x}}{\mathrm{d}\lambda} = 0.$$

#### 3.15 Exercises

 Page 65, line 5 from bottom. Read: *ϵ* and different values of the correct to: *ϵ*<sub>f</sub> and different values of the

#### 3.13 Continuous systems (\*)

• Page 64, line 7. Read: rule presented in eq. (2.127), obtaining correct to: rule presented in eq. (2.128), obtaining

# Chapter 4. Fluctuation relations

#### 4.1 Irreversibility and entropy production

• Page 68, line 6, eq. (4.2). Read:

$$\mathcal{P}_{\boldsymbol{x}|x_0}(\boldsymbol{\lambda}) = \mathrm{e}^{-\int_{t_n}^{t_f} k_{x_f}^{\mathrm{out}} \mathrm{d}t} k_{x_f x_{n-1}}(t_m) \, \mathrm{e}^{-\int_{t_{n-1}}^{t_n} k_{n-1}^{\mathrm{out}}(t)} \cdots$$

correct to:

$$\mathcal{P}_{\boldsymbol{x}|x_0}(\boldsymbol{\lambda}) = e^{-\int_{t_n}^{t_f} k_{x_n}^{\text{out}} dt} k_{x_n x_{n-1}}(t_n) e^{-\int_{t_{n-1}}^{t_n} k_{x_{n-1}}^{\text{out}}(t)} \cdots$$

# 4.5 Detailed fluctuation relation

• Page 78. Fig. 4.4 should be replaced by the following:



#### 4.7 Instantaneous quench

• Page 80, line 9 from bottom, eq.(4.56. Read:

$$S^{\text{tot}} = W - \Delta F = \sum_{x} [\epsilon_x(t_q) - \epsilon_x(t_0)] e^{(F(t_0) - \epsilon_x(t_0))/k_{\text{B}}T} - \Delta F, \qquad (4.56)$$

correct to:

$$S^{\text{tot}} = \frac{W - \Delta F}{T} = \frac{1}{T} \left\{ \sum_{x} [\epsilon_x(t_q) - \epsilon_x(t_0)] \, \mathrm{e}^{(F(t_0) - \epsilon_x(t_0))/k_{\mathrm{B}}T} - \Delta F \right\},\tag{4.56}$$

### 4.9 Adiabatic and nonadiabatic entropy production and the Hatano-Sasa relation

• P. 83, line 7, eq. (4.69). Read:

$$= -k_{\rm B} \sum_{k=0}^{n} \ln \frac{p_{x_j}^{\rm st}(t_{k+1})}{p_{x_k}^{\rm st}(t_j)} =$$

correct to:

$$= -k_{\rm B} \sum_{k=0}^{n} \ln \frac{p_{x_k}^{\rm st}(t_{k+1})}{p_{x_k}^{\rm st}(t_k)} =$$

### 4.14 Brownian motion with inertia (\*)

• Page 92, line 5, eq. (4.121) and the beginning of the following line. Read:

$$-\mu_{\rm P}\frac{\mathrm{d}r}{\mathrm{d}t} + \sqrt{2D}\xi(t),$$

where r is the particle position and  $\mu_{\rm P} dr/dt$  represents the effects of friction. correct to:

$$-\mu_{\rm P}^{-1}\frac{\mathrm{d}r}{\mathrm{d}t} + \sqrt{2\sigma^2}\xi(t),$$

where r is the particle position,  $\mu_{\rm P}^{-1} dr/dt$  represents the effects of friction, and  $\sigma^2$  is a measure of the noise amplitude.

• p.92, second line of eq. (4.122). Read:

$$-\mu_{\rm P}\frac{\mathrm{d}r}{\mathrm{d}t} + \sqrt{2D}\xi(t),$$

correct to:

$$-\mu_{\rm P}^{-1}\frac{{\rm d}r}{{\rm d}t}+\sqrt{2\sigma^2}\xi(t)$$

• p.92, second line of eq.(4.123). Read:

$$+\frac{\partial}{\partial r}\left[\left(\frac{\partial U}{\partial r}\frac{\mu_{\rm P}}{m}p_r\right)p(p_r,r;t)+D\frac{\partial p(p_r,r;t)}{\partial p_r}\right].$$

correct to:

$$+\frac{\partial}{\partial r}\left[\left(\frac{\partial U}{\partial r}\frac{1}{m\mu_{\rm P}}p_r\right)p(p_r,r;t)+\sigma^2\frac{\partial p(p_r,r;t)}{\partial p_r}\right].$$

• Page 92, line 10 from bottom. Read: Provided the Einstein relation (3.84) holds correct to: Provided the Einstein relation  $\sigma^2 = k_{\rm B}T/\mu_{\rm P}$  holds

# Chapter 5. Thermodynamics of Information

#### 5.3 Information in stochastic thermodynamics

- Page 108, line 12 from bottom. Read:  $p_x^{eq}(t_0) = p_x^{eq} p_y^0$ , where  $p_y^0$  is... correct to:  $p_{x,y}^{eq}(t_0) = p_x^{eq} p_y(t_0)$ , where  $p_y(t_0)$  is...
- Page 108, line 5 from bottom to eq. (5.9) included. Read: We write the final distribution... ... we obtain

$$\Delta S^{\text{sys}} = -k_{\text{B}}I(\text{obj}:\text{dev}) - \Delta S^{\text{dev}}.$$
(5.9)

We now subtract and add  $S^{\text{dev}}(t_{\text{m}}) = -k_{\text{B}} \ln \sum_{x.y} p_{x,y}(t_{\text{m}}) \ln p_y(t_{\text{m}})$ , and  $S^{\text{obj}}(t_{\text{m}}) = -k_{\text{B}} \ln \sum_{x.y} p_{x,y}(t_{\text{m}}) \ln p_x(t_{\text{m}})$ , obtaining

$$\Delta S^{\text{sys}} = -k_{\text{B}} \sum_{x,y} \left[ p_{x,y}(t_{\text{m}}) \ln \frac{p_{x,y}(t_{\text{m}})}{p_{x}(t_{\text{m}})p_{y}(t_{\text{m}})} + p_{x,y}(t_{\text{m}}) \ln \left( p_{x}(t_{\text{m}})p_{y}(t_{\text{m}}) \right) - p_{x,y}(t_{0}) \ln p_{y}(t_{0}) \right].$$
(5.8)

Since the object and the device are independent at  $t_0$ , and the state of the object is not affected by the measurement, we have  $p_{x,y}(t_0) = p_x(t_0)p_y(t_0) = p_x(t_m)p_y(t_0)$ . Therefore the contribution of  $\ln p_x(t_m)$  in the last two terms cancel out, and we obtain

$$\Delta S^{\rm sys} = -k_{\rm B}I(\rm obj:dev) + \Delta S^{\rm dev}, \qquad (5.9)$$

where  $\Delta S^{\text{dev}} = -k_{\text{B}} \sum_{x,y} [p_{x,y}(t_{\text{m}}) \ln p_y(t_{\text{m}}) - p_{x,y}(t_0) \ln p_y(t_0)].$ 

• Page 109, line 11. Read:  $k_{\rm B}I({\rm obj:dev}) = -\Delta S^{\rm dev}$ correct to:  $k_{\rm B}I({\rm obj:dev}) = \Delta S^{\rm dev}$ 

#### 5.4 The Sagawa-Ueda relation

• Page 110, line 16 from bottom. Read:  $s^{\text{tot}} = w - \Delta F$ correct to:  $s^{\text{tot}} = (w - \Delta F)/T$ 

#### 5.5 The Mandal-Jarzynski machine

• Page 112, line 10. Read:  $H(p) = H(p^{eq}),$ correct to: H(p) = H(p'), where p' is the probability distribution of the output,

### 5.6 Copying information

- Page 114, line 20. Read:  $\delta^{\text{stall}} = \epsilon_R + k_B T \ln(1 - \eta_{eq}).$ correct to:  $\delta^{\text{stall}} = \epsilon_r + k_B T \ln(1 - \eta^{eq}).$
- Page 114, line 23. Read:  $\delta \gg 1,$ correct to:  $\delta \gg k_{\rm B}T,$
- p.115, fig. 5.5. The figure should be replaced by the following one.



Figure 1: Error rate  $\eta$  vs. the elongation speed v in energetic and kinetic discrimination. We have  $\epsilon = \Delta \epsilon_{\rm w} - \Delta \epsilon_{\rm r} = 1.5 k_{\rm B}T$ . We set  $\omega_{\rm r}/\omega_{\rm w} = e^{\kappa/k_{\rm B}T}$ , with  $\kappa = \kappa_1 = 0.7 k_{\rm B}T$  for the energetic discrimination and  $\kappa = \kappa_2 = 2.7 k_{\rm B}T$  for the kinetic discrimination The asymptotic values of the error rate are  $\eta^{\rm eq} = 1/(1 + e^{\epsilon/k_{\rm B}T})$  for  $v \to 0$  and  $\eta_{1,2} = 1/(1 + e^{\kappa_{1,2}/k_{\rm B}T})$  for  $v \to \infty$ . Both axes are logarithmic.

#### 5.7 Information cost in sensing

• p.118, line 18 from bottom, first line of eq.(5.32). Read:

$$\ln \frac{p_{x|e_{\mathrm{i}},e_{\mathrm{f}}}p_{e_{\mathrm{i}},e_{\mathrm{f}}}(t)}{p_{x}(t)p_{e_{\mathrm{f}}}},$$

$$\ln \frac{p_{x|e_{\mathrm{i}},e_{\mathrm{f}}}(t)p_{e_{\mathrm{i}},e_{\mathrm{f}}}}{p_{x}(t)p_{e_{\mathrm{f}}}},$$

- Page 118, line 14 from bottom. Read:  $I(sys : env(t_0))$ correct to:  $I(sys(t_0) : env(t_0))$
- Page 118, line 7 from bottom. Read: 
  $$\begin{split} W &= \sum_{e_i, e_f} \langle \epsilon_{x, e_f} \rangle_{p_{x, e_i}^{eq}} p_{e_i, e_f} \geq 0. \\ \text{correct to:} \\ W &= \sum_{e_i, e_f} \langle \epsilon_{x, e_f} - \epsilon_{x, e_i} \rangle_{p_{x, e_i}^{eq}} p_{e_i, e_f} \geq 0. \end{split}$$
- Page 118, line 5 from bottom. Read:  $p_{x,e_{\mathrm{f}}}^{\mathrm{eq}}$ correct to:  $p_{x|e_{\mathrm{f}}}^{\mathrm{eq}}$

• Page 118, line last, eq.(5.34). Read:

$$\ldots - H(p_{x|e_i,e_f}(0))],$$

correct to:

$$\ldots - H(p_{x|e_{\mathbf{i}},e_{\mathbf{f}}}(t_0)) \rfloor,$$

#### 5.8 Information reservoirs

• Page 123, line 11f. Read: which is also the probability that the system is in state *u* immediately after an interaction, correct to: which is also the probability that the state swap takes place,

# Chapter 6. Large Deviations: Theory and Practice

### 6.7 Fluctuation relations in a model of kinesin

• Page 148, 12th line from bottom, eq. (6.84). Read:

$$A_{1} = k_{\mathrm{B}}T \ln \frac{k_{0}^{\checkmark}k_{1}^{\rightarrow}}{k_{0}^{\leftarrow}k_{1}^{\checkmark}} = -2fd + \Delta\mu;$$
  
$$A_{2} = k_{\mathrm{B}}T \ln \frac{k_{0}^{\rightarrow}k_{1}^{\rightarrow}}{k_{0}^{\leftarrow}k_{1}^{\leftarrow}} = -2fd.$$

$$A_{1} = k_{\rm B}T \ln \frac{k_{0}^{\nearrow}k_{1}^{\rightarrow}}{k_{0}^{\leftarrow}k_{1}^{\checkmark}} = 2fd + \Delta\mu;$$
$$A_{2} = k_{\rm B}T \ln \frac{k_{0}^{\rightarrow}k_{1}^{\rightarrow}}{k_{0}^{\leftarrow}k_{1}^{\leftarrow}} = 2fd.$$

- Page 149. Caption to fig. 6.4, third line. Read: where  $J^{(r)} > 0$  and  $J^{(n)} < 0$ , correct to: where  $J^{(r)} > 0$  and  $J^{(n)} > 0$ ,
- Page 149. 5th line of the text. Read:  $J^{(r)} < 0$  and  $J^{(n)} > 0$ . correct to:  $J^{(r)} < 0$  and  $J^{(n)} < 0$ .
- Page 149. 7th line from bottom. Read:  $\begin{array}{l} \Delta\mu\,J^{(n)}<0,\\ \text{correct to:}\\ \Delta\mu\,J^{(n)}>0, \end{array}$

• Page 149, 4th line from bottom, eq. (6.86). Read:

$$T\dot{S} = A_0 J_0 + A_1 J_1 + A_2 J_2 = -2fd J^{(r)} + \Delta \mu J^{(n)}.$$

correct to:

$$T\dot{S} = A_0 J_0 + A_1 J_1 + A_2 J_2 = 2fd J^{(r)} + \Delta \mu J^{(n)}.$$

# Chapter 8. Developments

#### 8.2 Uncertainty relations

• Page 176, line 9 from bottom. Eq. (8.15), second line. Read:

$$\cdots \delta \left( \mathcal{J} - \mathcal{J}(\boldsymbol{x}) \right) \, \mathrm{e}^{s^{\mathrm{tot}}} \, \mathcal{P}(\widehat{\boldsymbol{x}})$$

correct to:

$$\cdots \delta\left(\mathcal{J}-\mathcal{J}(oldsymbol{x})
ight)\,\mathrm{e}^{s^{\mathrm{tot}}/k_{\mathrm{B}}}\,\mathcal{P}(\widehat{oldsymbol{x}})$$

• p.177, l.12 from bottom, to the end of paragraph. For any nonnegative variable... take into account that  $\langle \mathcal{J}^2 \rangle = \langle \mathcal{J}^2 \rangle^+$ . correct to:

We have

$$\left\langle \tanh^2\left(\frac{s^{\text{tot}}}{2k_{\text{B}}}\right)\right\rangle_+ \le \tanh\left(\frac{\left\langle s^{\text{tot}}\right\rangle}{2k_{\text{B}}}\right),$$
(8.22)

where the first average is over the probability distribution  $p^+(s^{\text{tot}}, \mathcal{J})$  defined on the positive real half-line, and the second over  $p(s^{\text{tot}}, \mathcal{J})$ . This inequality follows from the chain of inequalities

$$\left\langle \tanh^2\left(\frac{s^{\text{tot}}}{2k_{\text{B}}}\right)\right\rangle_+ \le \left\langle \tanh\left[\frac{s^{\text{tot}}}{2k_{\text{B}}}\tanh\left(\frac{s^{\text{tot}}}{2k_{\text{B}}}\right)\right]\right\rangle \le \tanh\left(\frac{s^{\text{tot}}}{2k_{\text{B}}}\right)$$

Denote  $s^{\text{tot}}/k_{\text{B}}$  by  $\sigma$ . Define

$$\Delta(\sigma) = \frac{\sigma}{2} \tanh\left(\frac{\sigma}{2}\right) - \operatorname{atanh}\left[\tanh^2\left(\frac{\sigma}{2}\right)\right].$$

We then have  $\Delta(0) = 0$  and

$$\Delta'(\sigma) = \frac{\sigma - \tanh \sigma}{4\cosh^2(\sigma/2)},$$

which is positive for  $\sigma > 0$ . Thus  $\Delta(\sigma) \ge 0$  for  $\sigma \ge 0$ . Since  $tanh(\sigma)$  is a strictly increasing function, the first inequality follows. Now, since  $tanh \sigma$  is concave for  $\sigma \ge 0$ , by the Jensen inequality we obtain

$$\left\langle \tanh\left[\frac{\sigma}{2}\tanh\left(\frac{\sigma}{2}\right)\right]\right\rangle_{+} \leq \tanh\left[\frac{1}{2}\left\langle\sigma\tanh\left(\frac{\sigma}{2}\right)\right\rangle_{+}\right].$$

Now, by eq. (8.20) we have  $\langle \sigma \rangle = \langle \sigma \tanh(\sigma/2) \rangle_+$ , which implies the second inequality in the chain above. Summarizing, we have obtained

$$\langle \mathcal{J} \rangle^2 \leq \langle \mathcal{J}^2 \rangle_+ \left\langle \tanh^2 \left( \frac{s^{\text{tot}}}{2k_{\text{B}}} \right) \right\rangle_+ \leq \left\langle \mathcal{J}^2 \right\rangle_+ \tanh \left( \frac{\left\langle s^{\text{tot}} \right\rangle}{2k_{\text{B}}} \right)$$

From this inequality, by simple algebraic manipulations one obtains the following thermodynamic uncertainty relation

$$\frac{\sigma_{\mathcal{J}}^2}{\langle \mathcal{J} \rangle^2} \ge \frac{2}{\mathrm{e}^{S^{\mathrm{tot}}/k_\mathrm{B}} - 1},\tag{8.23}$$

where  $\sigma_{\mathcal{J}}^2 = \langle \mathcal{J}^2 \rangle - \langle \mathcal{J} \rangle^2$  and we take into account that  $\langle \mathcal{J}^2 \rangle = \langle \mathcal{J}^2 \rangle_+$ .

- Page 179, line 1. Read:  $J_{\alpha}^{\text{st}} = \lim_{\mathcal{T} \to 0^+} \langle \mathcal{J}_{\alpha} \rangle / \mathcal{T}$ correct to:  $J_{\alpha}^{\text{st}} = \langle \mathcal{J}_{\alpha} \rangle / \mathcal{T}$
- Page 179, line 2. Read:  $\tilde{\sigma}^2 = \left(\tilde{\sigma}^2_{\alpha\beta}\right) = \lim_{\mathcal{T}\to 0^+} C_{\alpha\beta}/\mathcal{T}$ correct to:  $\tilde{\sigma}^2 = \left(\tilde{\sigma}^2_{\alpha\beta}\right) = (C_{\alpha\beta})/\mathcal{T}$

#### 8.4 First-passage times

• Page 182, line last, eq.(8.50). Read:

$$\psi_{\pm}^{(\text{fp})}(q) = -\frac{1}{\psi_{\pm}^{(j)}(-q)}.$$
(8.50)

correct to:

$$\psi_{\pm}^{(\text{fp})}(q) = -\psi_{\pm}^{-1}(-q),$$
(8.50)

where  $\psi_{\pm}^{-1}(q)$  is the inverse function of  $\psi_{\pm}^{(j)}(q)$ .

#### 8.9 Population genetics

• Page 199. Add to last line:

For instance, in a Moran model with constant population size one has  $\Lambda = 0$  and

$$r_x = h_x - \frac{1}{\mathcal{T}} \ln\left(1 - p^{\text{chr}}(\text{ext}, \mathcal{T})\right),$$

where  $p^{chr}(ext, t)$  is the chronological probability that a lineage becomes extinct before time t. This is given by

$$1 - p^{\operatorname{chr}}(\operatorname{ext}, \mathcal{T}) = \left\langle 2^{-\rho} \right\rangle^{\operatorname{ret}},$$

where the average is taken over all lineages surviving to time  $\mathcal{T}$ . An example is shown in fig. 8.6.

• Page 200. Fig. 8.6 should be replaced by the following:



• Page 200. Caption to fig. 8.6. Read:

The dotted line is a fit to h = r + const. The average number of divisions per lineage in this run is 5.64.

# correct to:

The dotted line corresponds to h = r. The average number of divisions per lineage in this run is 9.01.

# Appendixes

## A.8 Ito formula and Stratonovich-Ito mapping

• Page 223, line 6 from bottom. Read: into the Ito convention, obtaining eq. (A.74). correct to: into the Ito convention, obtaining eq. (A.82).