Errata in "Stochastic Thermodynamics: An Introduction"

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Chapter 2. Basics

2.7 Trajectories of master equations

- Page 25, line 8, eq. (2.90). Read:

$$\prod_{\ell \in \mathrm{dwell}} p_{x_\ell; t_{\ell-1}+\mathrm{d}t | x_\ell; t_{\ell-1}} = \cdots$$

correct to:

$$\prod_{\ell \in \mathrm{dwell}} p_{x_\ell; t_{\ell-1}+\mathrm{d}t_\ell | x_\ell; t_{\ell-1}} = \cdots$$

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

$$\mathcal{P}_{\boldsymbol{x}} = \mathrm{e}^{-\int_{t_n}^{t_\mathrm{f}} \mathrm{d}t'\, k_n^{\mathrm{out}}(t')} k_{x_n x_{n-1}}(t_n)\, \mathrm{e}^{-\int_{t_n}^{t_{n-1}} \mathrm{d}t'\, k_{x_{n-1}}^{\mathrm{out}}(t')} \dots \\ \times \mathrm{e}^{-\int_{t_2}^{t_1} \mathrm{d}t'\, k_{x_1}^{\mathrm{out}}(t')}\, \mathrm{e}^{-\int_{t_1}^{t_0} \mathrm{d}t'\, k_{x_0}^{\mathrm{out}}(t')} p_{x_0}(t_0).$$

correct to:

$$\mathcal{P}_{\boldsymbol{x}} = \mathrm{e}^{-\int_{t_n}^{t_\mathrm{f}} \mathrm{d}t'\, k_n^{\mathrm{out}}(t')} k_{x_n x_{n-1}}(t_n)\, \mathrm{e}^{-\int_{t_{n-1}}^{t_n} \mathrm{d}t'\, k_{x_{n-1}}^{\mathrm{out}}(t')} \dots \\ \times \mathrm{e}^{-\int_{t_1}^{t_2} \mathrm{d}t'\, k_{x_1}^{\mathrm{out}}(t')}\, \mathrm{e}^{-\int_{t_0}^{t_1} \mathrm{d}t'\, k_{x_0}^{\mathrm{out}}(t')} p_{x_0}(t_0).$$

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:

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

correct to:

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

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_{f} 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:

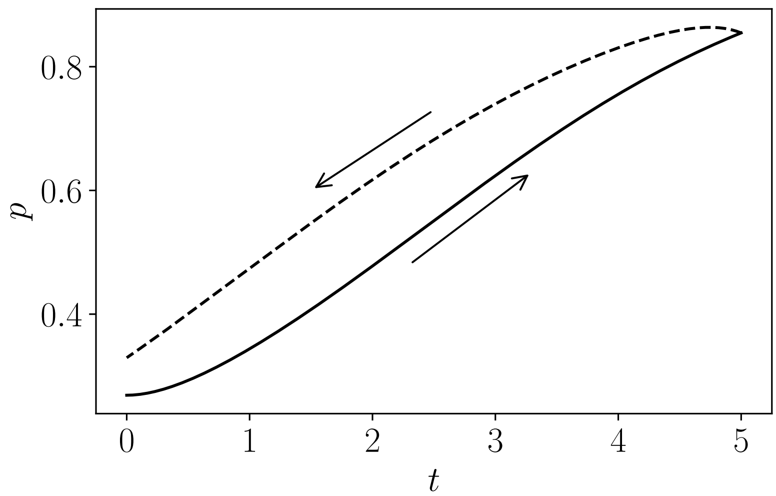
$$\mathcal{P}_{\boldsymbol{x}|x_0}(\boldsymbol{\lambda}) = \mathrm{e}^{-\int_{t_n}^{t_\mathrm{f}} k_{x_\mathrm{f}}^{\mathrm{out}}\,\mathrm{d}t} k_{x_\mathrm{f}x_{n-1}}(t_m)\,\mathrm{e}^{-\int_{t_{n-1}}^{t_n} k_{n-1}^{\mathrm{out}}(t)}\ldots$$

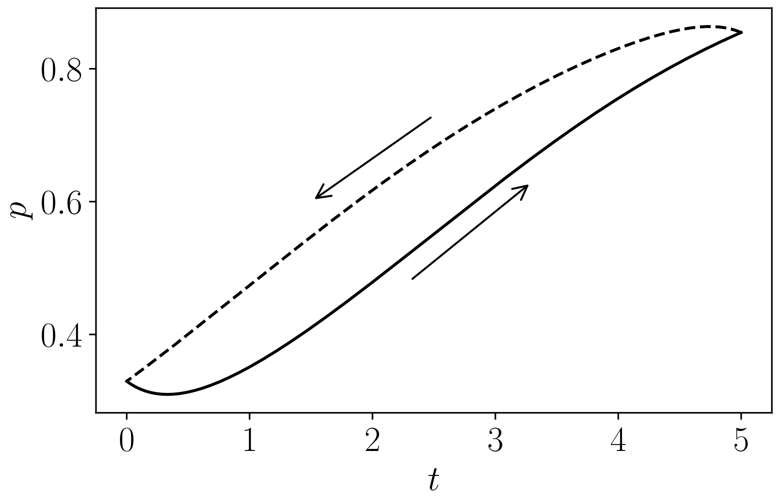
  correct to:

$$\mathcal{P}_{\boldsymbol{x}|x_0}(\boldsymbol{\lambda}) = \mathrm{e}^{-\int_{t_n}^{t_\mathrm{f}} k_{x_n}^{\mathrm{out}}\,\mathrm{d}t} k_{x_nx_{n-1}}(t_n)\,\mathrm{e}^{-\int_{t_{n-1}}^{t_n} k_{x_{n-1}}^{\mathrm{out}}(t)}\ldots$$

4.5 Detailed fluctuation relation

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





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

- P. 83, line 7, eq. (4.69). Read:

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

  correct to:

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

Chapter 5. Thermodynamics of Information

5.3 Information in stochastic thermodynamics

- Page 108, line 3 from bottom, eq. (5.8). Read:

$$\ln \frac{p_{x,y}(t_{\rm m})}{p_x(t_{\rm m})}$$

  correct to:

$$\ln \frac{p_{x|y}(t_{\rm m})}{p_x(t_{\rm m})}$$

5.6 Copying information

- Page 114, line 20. Read:
  $\delta^{\rm stall} = \epsilon_R + k_{\rm B}T \,\ln(1-\eta_{\rm eq})$.
  correct to:
  $\delta^{\rm stall} = \epsilon_{\rm r} + k_{\rm B}T \,\ln(1-\eta^{\rm eq})$.

- Page 114, line 23. Read:
  $\delta \gg 1$,
  correct to:
  $\delta \gg k_{\mathrm{B}}T$,

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:

$$A_1 = k_{\mathrm{B}}T \ln \frac{k_0^{\nearrow} k_1^{\rightarrow}}{k_0^{\leftarrow} k_1^{\swarrow}} = -2fd + \Delta\mu;$$
$$A_2 = k_{\mathrm{B}}T \ln \frac{k_0^{\rightarrow} k_1^{\rightarrow}}{k_0^{\leftarrow} k_1^{\leftarrow}} = -2fd.$$

  correct to:

$$A_1 = k_{\mathrm{B}}T \ln \frac{k_0^{\nearrow} k_1^{\rightarrow}}{k_0^{\leftarrow} k_1^{\swarrow}} = 2fd + \Delta\mu;$$
$$A_2 = k_{\mathrm{B}}T \ln \frac{k_0^{\rightarrow} k_1^{\rightarrow}}{k_0^{\leftarrow} k_1^{\leftarrow}} = 2fd.$$

- 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:
  $\Delta\mu\, J^{(n)} < 0$,
  correct to:
  $\Delta\mu\, J^{(n)} > 0$,

- 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:

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

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

8.9 Population genetics

- Page 199. Add to last line:
  For instance, in a Moran model with constant population size one has $\Lambda = 0$ and

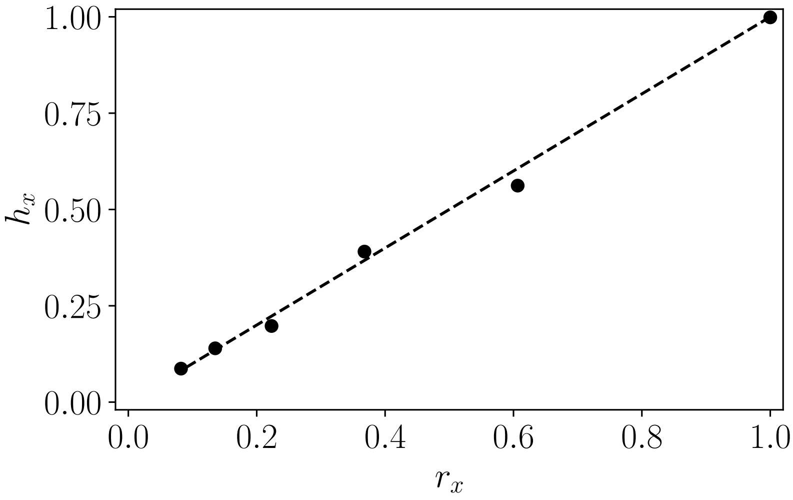
$$r_x = h_x - \frac{1}{\mathcal{T}} \ln\left(1 - p^{\mathrm{chr}}(\mathrm{ext}, \mathcal{T})\right),$$

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

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

  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 $h = r + \text{const}$. 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).