List of errata

Alternative formulations and moment estimates for the chemical Langevin equation

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More serious errors

1. Contrary to the claims of the dissertation it is not proven that the first two moments of the processes defined by the chemical master equation (CME) and the chemical Langevin equation (CLE) are the same. Under the Law of Mass Action, if there is at least one bimolecular reaction, then the mere formal matching of (2.0.1) with the first equation after (2.0.3) and (2.0.2) with (2.0.4) is not sufficient to match the first and second moments because the latter two are dependent on higher moments which we do not attempt to match. Such a choice of f and g can only guarantee that the first two moments for the CME and the CLE are the same when all reactions are at most first order (under the Law of Mass Action).[1] Accordingly, the following parts should be removed (and sometimes their immediate context and references to equations contained within them may need to be changed too):

   - On page 6 the last paragraph until the bottom of the page.
   - On page 7 the first sentence of the first paragraph.
   - On page 7 the second sentence of the first paragraph of Section 1.4.
   - On page 9 the last sentence of the first paragraph.
   - On page 10 Corollary 2.0.2.

   Further changes:

   - On page 9 in the first sentence of the second paragraph (*'Formally, we seek...'*) the requirement is really to be meant only formally.
   - On page 9 in the third paragraph *'(not only for matching the first moments but also for the second moments as we will see shortly)'* should read *'(not only for matching the first pair of moment equations but also for the second pair as we will see shortly)'*.
   - On page 10 after the end of the proof of Lemma 2.0.1 *'in order that the second moments match'* should read *'in order that the second pair of moment equations match'*.
   - On page 10 *'This means that although Corollary 2.0.2 allows for different gs to result in CLEs of which only the first two moments are the same, in fact, all their moments will be identical.'* should read *'This means that different gs will result in CLEs of which all the moments will be identical.'*
   - On page 34 replace the last two sentences of the second paragraph with *'We developed system size reduction techniques and consequent computational improvements.'*

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[1] Note that in this case, exactly because the moment equations are closed, the moments can be computed by the numerical integration of ODEs and no stochastic simulation is necessary.

2. On page 6 in the second sentence of Section 1.3 and on page 8 in the last two sentences it is incorrectly stated that a Taylor expansion of the propensity functions a_j is needed for the derivation of those formulæ.

   - On page 6 in the second paragraph of Section 1.3 delete *'Through a second-order Taylor series expansion of the propensity functions a_j'* and it should read *'The CME can be used...'*

   - In the same paragraph delete *'The approximation is in fact exact when the law of mass action dynamics is assumed and all reactions are at most second-order. (That is, at most two molecules interact in any reaction channel.)'*

   - On page 8, equation (2.0.2) is exact. Therefore *'the time evolution of the second moment is well approximated by'* should read *'the time evolution of the second moment is given by'*. Delete the last two sentences on this page.

Typos

3. On page 9, there is a dt integrator missing after the $\frac{\mathrm{d}u(t,X_t)}{\mathrm{d}t}$ from the first equation after (2.0.4) (in Itô's formula). It should read

$$\mathrm{d}u(t, X_t) = \frac{\mathrm{d}u(t, X_t)}{\mathrm{d}t}\,\mathrm{d}t + \sum_{i=1}^{n} \frac{\partial u(t, X_t)}{\partial x_i}\,\mathrm{d}X_{i,t} + \frac{1}{2}\sum_{i,j=1}^{n} \frac{\partial^2 u(t, X_t)}{\partial x_i \partial x_j}\,\mathrm{d}X_{i,t}\,\mathrm{d}X_{j,t}$$

4. On page A1 in the section on State space reduction for Construction 4, S_3 at the end of the second sentence is to be changed to S_2. It should read *'and finally S_4 is the collection of the column vectors which are constant multiples of any single column of S_2.'*

Last update on 24th September 2009.