Delay chemical master equation: direct and closed-form solutions

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Abstract:

I will introduce the article *Delay chemical master equation: direct and closed-form solutions* written by A. Leier and T. T. Marquez-Lago [1]. The authors say, essentially, in chemical reaction kinetics, delays are used to lump complex processes consisting of many reactions and species, or even represent diffusion processes [2,3]. They consider that by incorporating all relevant information into a delayed model, computational simulations of relevant biochemical processes that would otherwise be computationally prohibitive can be performed. Likewise, they have also developed exact model reduction methodologies through the appropriate use of delays [4,5].

Hence, since such delayed models are governed by delay chemical master equations (DCMEs), a better understanding the DCME becomes essential. In this paper, the authors describe for the first time direct and closed solutions of the DCME for two very simple reaction schemes: (i) a single unimolecular delayed reaction and (ii) a simple gene expression model of transcription and translation with delayed mRNA maturation. From the “small-number effect” viewpoint different from the authors' discussion, I would like to briefly discuss about the conditions that have to be met such that such solutions can be derived.

References:

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5. Leier A, Barrio M, Marquez-Lago T T. 2014 Exact model reduction with delays: closed-form distributions and extensions to fully bi-directional monomolecular reactions. *J. R. Soc. Interface* **11**: 20140108.