Analysis of stochastic and deterministic quasi-steady-state approximation.

Yun Min SONG\textsuperscript{1} Hyukpyo HONG\textsuperscript{1} and Jae Kyoung KIM\textsuperscript{1}

\textsuperscript{1) Department of Mathematical Science, Korea Advanced institute of Science and Technology, Daejeon 34141, KOREA

Corresponding Author: Jae Kyoung KIM, jaekkim@kaist.ac.kr

ABSTRACT

The Quasi-Steady-State Approximation (QSSA) is commonly used to reduce deterministic biochemical reaction models with timescale separation. The resulting equations that have the form of non-elementary reaction functions provide a simplified description of the model. Such deterministic reductions are frequently a basis for heuristic stochastic reductions in which the non-elementary reaction functions are used to define reaction propensities. However, it is unclear when such stochastic reductions provide an accurate approximation of the original stochastic simulation. Though it is often assumed that the stochastic reduction is valid whenever its deterministic counterpart is valid, some examples show that it’s not necessarily true. Here we provide the complete analysis for these disparities between the accuracy of the deterministic and the stochastic QSSA.