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Michaelis-Menten kinetics at high enzyme concentrations. (English) Zbl 1334.92185
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Summary: The total quasi-steady state approximation (tQSSA) for the irreversible Michaelis-Menten scheme is derived in a consistent manner. It is found that self-consistency of the initial transient guarantees the uniform validity of the tQSSA, but does not guarantee the validity of the linearization in the original derivation of *J. A. M. Borghans* et al. [*Bull. Math. Biol.* 58, No. 1, 43–63 (1996; [Zbl 0866.92010](#))]. Moreover, the present rederivation yielded the noteworthy result that the tQSSA is at least roughly valid for any substrate and enzyme concentrations. This reinforces and extends the original assertion that the parameter domain for which the tQSSA is valid overlaps the domain of validity of the standard quasi-steady state approximation and includes the limit of high enzyme concentrations. The criteria for the uniform validity of the original (linearized) tQSSA are corrected, and are used to derive approximate solutions that are uniformly valid in time. These approximations overlap and extend the domains of validity of the standard and reverse quasi-steady state approximations.

MSC:

[92C45](#) Kinetics in biochemical problems (pharmacokinetics, enzyme kinetics, etc.) Cited in 44 Documents

Keywords:

[Michaelis-Menten kinetics](#); [enzyme](#); [total quasi-steady state approximation](#); [approximate solutions](#)

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