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Approaches to the Solution of Coupled Multiexponential Transient-State Rate Kinetic Equations: a critical Review

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Abstract. The transient-state kinetic approach has failed to reach its full potential despite its advantage over the steady-state approach in its ability to observe mechanistic events directly and in real time. This failure has been due in part to the lack of any rigorously derived and readily applicable body of theory corresponding to that which currently characterizes the steady-state approach. In order to clarify the causes of this discrepancy and to suggest a route to its solution we examine the capabilities and limitations of the various forms of transient-state kinetic approaches to the mathematical resolution of enzymatic reaction mechanisms currently available. We document a lack of validity inherent in their basic assumptions and suggest the need for a potentially more rigorous analytic approach.

Keywords: enzymes; transient-state kinetics; catalytic mechanisms