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“Error analysis of tau-leap simulation  
methods”

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## Review

In this paper the authors consider time discretizations of continuous time Markov chains with applications in chemical kinetics. The forward Euler and explicit midpoint tau-leaping methods are analyzed in the sense of strong and weak errors under a certain scaling with respect to the system size. Intuitively, the midpoint method is expected to be more accurate than the forward Euler method. However, in the stochastic setting this is in general not true under the traditional scaling where the tau-leap size  $h$  independently tends to zero.

Technically, the analysis is performed by switching off the intensities outside a certain region away from the corresponding deterministic kinetics where the assumed scaling is no longer valid (see Section 2.2 of the paper). Through the subsequently derived error estimates, the authors show that the midpoint method generally is the most accurate method. Using known approximation results in terms of deterministic kinetics, asymptotic errors in the large system size limit  $V \rightarrow \infty$  are also considered. The paper is concluded by the corresponding weak error results and is illustrated with two numerical examples.

**MSC 2010 classification:** 60H35, 65C99 (primary); 92C40 (secondary).