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The ratio of expectations distribution as an alternative to quasi-stationarity in stochastic biological models

Many stochastic systems, including biological applications, use Markov chains in which there is a set of absorbing states. It is then needed to consider analogues of the stationary distribution of an irreducible chain. In this context, quasi-stationary distributions play a fundamental role to describe the long-term behavior of the system. The rationale for using quasi-stationary distribution is well established in the abundant existing literature. The aim of this study is to reformulate the ratio of means approach which provides a simple alternative. We have a two-fold objective

- i) to view the quasi-stationarity and ratio of expectations as two different approaches for understanding the dynamics of the system before absorption, and
- ii) to investigate the possibility of using the ratio of expectations distribution as an approximation to the quasi-stationary distribution.

Both distributions are compared for some selected scenarios, which are mainly inspired in stochastic epidemic models. Previously, the rate of convergence to the quasi-stationary regime is taken into account in order to make meaningful the comparison.