STOCHASTIC MODELLING APPROACH WITH IMPULSES: SCENARIOS AND ALGORITHMS

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Abstract

There are two popular approaches for modeling natural processes which are deterministic and stochastic modeling. The former uses Ordinary Differential Equations (ODEs) while the latter is based on the Chemical Master Equation (CME). If the system have abrupt changes at given specific times, the traditional deterministic approach models such systems with Impulsive Differential Equations (IDEs) which are constructed by ODEs together with jumps at state vectors at jump times. In this study, we propose models that include jumps in stochastic approach. In other words, while IDEs assume that the dynamical behavior of processes with jumps is deterministic and continuous, proposed models considers that their dynamics are stochastic and discrete. We define the the system with CME together with impulses at jump times. We use Gillespie's direct method to simulate the systems.

Keywords: Deterministic modeling stochastic modeling ordinary differential equation chemical master equation impulsive differential equations Gillespie's direct method.

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