

Complexity of Model Checking for Reaction Systems

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Reaction systems are a new mathematical formalism inspired by the living cell and driven by only two basic mechanisms: facilitation and inhibition. As a modeling framework, they differ from the traditional approaches based on ODEs and CTMCs in two fundamental aspects: their qualitative character and the non-permanency of resources. In this article we introduce to reaction systems several notions of central interest in biomodeling: mass conservation, invariants, steady states, stationary processes, elementary fluxes, and periodicity. We prove that the decision problems related to these properties span a number of complexity classes from P to NP- and coNP-complete to PSPACE-complete.