

## Numerical Methods of Second Order for Stochastic Differential Equations

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**Abstract:** Ordinary differential equations and their numerical analysis aim to model numerous real-world phenomena. While numerical analysis is well-established in the deterministic context, the introduction of stochastic terms allows us to capture the inherent randomness present in natural processes, unlocking characteristics unattainable in deterministic problems.

The numerical resolution of the stochastic systems required tailored development of methods, along with a comprehensive understanding of error analysis, convergence rates, and other related concepts. This approach is crucial for comprehending the stochasticity and can be supported by the extensive literature devoted to numerical analysis in the deterministic case.

In this talk, our focus is the development and numerical examination of the stochastic version of the TR-BDF2 method. We delve into its performance characteristics, focusing on preserving the second-order accuracy of the deterministic counterpart and conduct stability analysis in the presence of stochastic terms. Additionally, we present validation tests in academic scenarios to assess the practical applicability of the theoretical results obtained.