

Discretized Itô Formula and Stability of Stochastic Difference equations

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We discuss a new variant of Discretized Itô formula originally developed in [1]. This variant significantly relaxes the assumption on the rate of decay of the tails of the noise's density, presented in the result from [1]. It appears that in several cases this assumption is unnecessary restrictive and is not easy to check.

We demonstrate how this formula can be applied in the proofs of almost sure stability and almost sure instability of the solutions of a scalar nonlinear difference equation, a planar system of linear stochastic difference equations and a system of nonlinear stochastic difference equations. Most of our results are sharp.

References

- [1] Appleby, J. A. D., Berkolaiko, G. and Rodkina, A. Non-exponential stability and decay rates in non-linear stochastic difference equations with unbounded noise. *Stochastics: An International Journal of Probability and Stochastic Processes*. 81 (2009), no. 2, 99 -127.