Principles of geometric numerical integration for stochastic differential equations

Raffaele D'Ambrosio (University of L'Aquila - Department of Information Engineering and Computer Science and Mathematics)

This talk aims to outline some recent advances on structure-preserving numerical methods for stochastic differential equations, highlighting the basic principles of the so-called geometric numerical integration by its history. The talk moves towards the following two tracks:

- *track 1: geometric numerical integration of stochastic Hamiltonian problems*. For these problems, two different scenarios are clarified: if the noise is driven in the Ito sense, the expected Hamiltonian function exhibits a linear drift in time; in the Stratonovich case, the Hamiltonian is pathwise preserved. In both cases, the talk aims to highlight the attitude of selected numerical methods in preserving the aforementioned behaviors. A long term investigation via backward error analysis is also presented;
- *track 2: structure-preserving numerics of stochastic PDEs*. In this case, the attention is focused on the stochastic Korteweg-de Vries equation, characterized by certain invariance laws for the exact dynamics. The talk focuses on their long-term conservation along the numerical dynamics provided by stochastic θ-methods for the time integration of the spatially discretized system.

For all tracks, numerical evidence supporting the theoretical inspection will be provided. The investigation of above tracks is based on the joint research in collaboration with Chuchu Chen (Chinese Academy of Sciences), David Cohen (Chalmers University of Technology & University of Gothenburg), Stefano Di Giovacchino and Annika Lang (Chalmers University of Technology & University of Gothenburg).

References

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