Stochastic Volterra equations: theory, numerics and control

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Abstract

I will give an overview of stochastic convolution equations of Volterra type (with jumps). These equations are in general neither Markovian nor semimartingales, and include the fractional Brownian motion and Hawkes processes as special cases. They are highly flexible as they can account for long/short memory, delay, roughness of sample paths . . . they have recently gained in popularity in mathematical finance in the context of rough volatility modeling.

I will present: (i) general weak existence and stability results for stochastic convolution equations with jumps under mild regularity assumptions, allowing for non-Lipschitz coefficients and singular kernels (ii) representations of the Fourier-Laplace transform in terms of a Riccati-Volterra equation for the case of affine coefficients (iii) an infinite dimensional Markovian structure and multifactor approximations for efficient numerical implementation (iv) Linear-Quadratic Volterra control problems and their explicit solutions in terms of infinite dimensional Riccati equations.

The talk will be mainly based on:

- Abi Jaber, E. (2021). Weak existence and uniqueness for affine stochastic Volterra equations with L1-kernels. *Bernoulli, 27(3), 1583-1615.*
- Abi Jaber, E., Cuchiero, C., Larsson, M., & Pulido, S. (2019). A weak solution theory for stochastic Volterra equations of convolution type. *arXiv:1909.01166, Annals of Applied Probability, to appear.*
- Abi Jaber, E., & El Euch, O. (2019). Multifactor approximation of rough volatility models. *SIAM Journal on Financial Mathematics, 10(2), 309-349.*
- Abi Jaber, E., Larsson, M., & Pulido, S. (2019). Affine Volterra processes. *Annals of Applied Probability, 29(5), 3155-3200.*
- Abi Jaber, E., Miller, E., & Pham, H. (2019). Linear–Quadratic control for a class of stochastic Volterra equations: solvability and approximation. *arXiv:1911.01900, Annals of Applied Probability, to appear.*