Signature stochastic volatility models: pricing and hedging with Fourier

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In this talk we will present some of our early work on a stochastic volatility model where the volatility is driven by a linear function of the signature of a (time extended) Brownian motion.
Our main motivation is to improve the pricing and hedging method of [1]. Their theory has the main advantage of being completely model-free and adapted to path dependent payoffs but at the cost of being much less tractable and to not realistically converge in practice to good approximations for non-smooth payoffs, e.g. European/Asian calls/puts. Our aim is to show that we can improve their results by restricting to a class of Sig-SDE models (inspired by [2] but with an additional correlation between the Brownians). We do so by using Fourier techniques: provided that some infinite-dimensional Riccati equation admits a solution, we can derive the joint characteristic function of the log-price and integrated variance which allows us to price and (quadratically) hedge certain European and path-dependent options using Fourier inversion techniques. We illustrate our method on numerical examples and compare it with [1].

 This is a joint work with Eduardo Abi Jaber.

[1] Lyons, T., Nejad, S., & Perez Arribas, I. (2020). Non-parametric pricing and hedging of exotic derivatives. *Applied Mathematical Finance*, *27*(6), 457-494.
[2] Arribas, I. P., Salvi, C., & Szpruch, L. (2020, October). Sig-SDEs model for quantitative finance. In *Proceedings of the First ACM International Conference on AI in Finance* (pp. 1-8).