THE UNIVERSITY OF HONG KONG

Institute of Mathematical Research
Department of Mathematics

Numerical Analysis Seminar

A kernel regression approach to local stochastic volatility models

Dr. Christian Bayer

Weierstrass Institute for Applied Analysis and Stochastics, Germany

Abstract

Perfect calibration of stochastic local volatility models can be achieved by the particle method due to Guyon and Henry-Labordère. Starting from a back-bone stochastic volatility model, a local volatility factor is computed on the fly to perfectly fit market prices. Mathematically, the local volatility factor is given as a conditional expectation, which is approximated by a local regression procedure. While this procedure is quite popular among practitioners, there are substantial gaps in the theoretical understanding. Indeed, even well-posedness of the resulting singular McKean-Vlasov system is not known.

We develop a novel regularization approach based on the reproducing kernel Hilbert space technique (kernel ridge regression) and show that the regularized model is, in fact, well-posed. Furthermore, we prove propagation of chaos and provide error estimates for the numerical scheme. We demonstrate numerically that a thus regularized model is able to perfectly replicate option prices due to typical local volatility models, and demonstrate excellent performance. Our results are also applicable to more general McKean--Vlasov equations. (Joint work with Denis Belomestny, Oleg Butkovsky, and John Schoenmakers.)

Date:	October 9, 2024 (Wednesday)
Time:	4:00 – 5:00 pm
Venue:	ZOOM: https://hku.zoom.us/j/ Meeting ID: 913 6532 3891 Password: 310656

All are welcome