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On numerical schemes for stochastic differential equations and the approximative pricing of financial derivatives

Abstract

In this lecture I intend to review a few selected recent results on numerical approximations for high-dimensional nonlinear parabolic partial differential equations (PDEs), nonlinear stochastic ordinary differential equations (SDEs), and high-dimensional nonlinear forward-backward stochastic ordinary differential equations (FBSDEs). Such equations are key ingredients in a number of pricing models that are day after day used in the financial engineering industry to estimate prices of financial derivatives. The lecture includes content on lower and upper error bounds, on strong and weak convergence rates, on Cox-Ingersoll-Ross (CIR) processes, on the Heston model, as well as on nonlinear pricing models for financial derivatives. We illustrate our results by several numerical simulations and we also calibrate some of the considered derivative pricing models to real exchange market prices of financial derivatives on the stocks in the American Standard & Poor's 500 (S&P 500) stock market index.