On the Approximation of Jump-Diffusion Processes

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In finance key quantities are often described by stochastic differential equations (SDEs) of jump-diffusion type. The class of jump-diffusion SDEs that admits explicit solutions is rather limited. Consequently, there is a need for the systematic use of discrete time approximations in corresponding simulations. We propose several strong and weak numerical schemes for SDEs of jump-diffusion type. The strong schemes provide pathwise approximations and therefore can be employed in scenario analysis, filtering or hedge simulation. The weak schemes are appropriate for problems such as derivative pricing and evaluation of risk measures, where only an approximation of the probability distribution of the jump-diffusion process is needed. We provide some convergence theorems for the construction of approximations of any given order of convergence $\gamma \in \{0.5, 1, \ldots\}$ for SDEs driven by Wiener processes and Poisson random measures. We consider also derivative free, implicit and jump adapted approximations. For the commutative case particular schemes are obtained. Finally, a numerical study on the accuracy of the proposed schemes will be presented.

Joint work Eckhard Platen