Efficient pricing algorithms for exotic derivatives

Since the Nobel-prize winning papers of Black and Scholes and Merton in 1973, the derivatives market has evolved into a multi-trillion dollar market. Structures which were once considered as exotic are now commonplace, appearing in retail products such as mortgages and investment notes. At the same time, new and more complex structures are invented on a regular basis. To price and risk manage such products, a financial engineer will typically: (1) choose a model which is both economically plausible and analytically tractable, (2) calibrate the model to the prices of traded options, and (3) price the exotic option with the calibrated model, using appropriate numerical techniques. This thesis mainly deals with the second and third steps in this process. For the analytically tractable class of affine models, containing among others the Black-Scholes model and Heston's stochastic volatility model, it deals with topics such as the robust pricing of European options via Fourier inversion, the pricing of Bermudan options using convolution based methods, the simulation of stochastic volatility models and the pricing of Asian options. A separate chapter deals with a completely different topic, the mathematical properties of the principal components of term structure data.

Roger Lord (1977) holds cum laude Master's degrees in both Applied Mathematics (Eindhoven University of Technology) and Econometrics (Tilburg University). After graduating he joined Cardano Risk Management in 2001 as a financial engineer. Deciding to pursue a PhD degree, he joined Erasmus University Rotterdam as a PhD candidate in 2003. Throughout his PhD he held a part-time position as a quantitative analyst at the Derivatives Research & Validation team of Rabobank International. He has published articles in Applied Mathematical Finance, the Journal of Computational Finance, Mathematical Finance, Quantitative Finance and SIAM Journal on Scientific Computing, and presented his research at several international conferences. Since October 2006 he joined Rabobank International's Financial Engineering team in London as a quantitative analyst, developing front-office pricing models for interest rate derivatives.