Minisymposium 5 - Finanznumerik (Computational Finance)

Valuation of Performance-Dependent Options using Sparse Grids

MARKUS HOLTZ (UNIVERSITÄT BONN)

The efficient and accurate valuation of financial derivatives is a central topic in computational finance. Performance-dependent options are an important class of derivatives whose payoff depends on the performance of one asset in comparison to other assets. The fair price of such options can be determined by the martingale approach as a multidimensional integral whose dimension is the number of assets under consideration. Usually, the integrand is discontinuous, though, which makes accurate solutions difficult to achieve by numerical approaches.
For performance-dependent options, we derive a representation of the solution which only involves the evaluation of several multivariate normal distributions. This solution uses novel tools from computational geometry which faciliate the fast enumeration of all cells in a hyperplane arrangement and its orthant decomposition. We show that the arising normal distributions can be efficiently computed using sparse grid quadrature methods. This way, the complexity and the dimensionality of the integration problem can be significantly reduced which allows the efficient pricing of performance-dependent options even for large benchmarks, which is illustrated in several numerical examples.