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Abstracts of Plenary and Invited Lectures

Section:

12. Probability and Statistics

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Inverse Problems in Quantitative Financial Modeling

A key issue in modern quantitative finance is the *calibration* of asset pricing models. In order to correctly reflect market conditions, asset pricing models are required to price correctly a given set of "reference" securities. Accordingly, the parameters of the model must be adjusted as prices change. Mathematically, the calibration problem can be formulated as searching

for a (multi-dimensional) diffusion measure for which the expected values of certain functions are known. This is a *moment problem* in path-space, which may be formulated as an inverseproblem for a parabolic PDE. I shall

describe a solution to this type of problem which uses the technique of *minimization of relative entropy.* This method has the advantage of bieng numerically tractable and stable with respect to perturbations in the inputs. Furthermore, the output of the model has strong financial significance. The mathematical tools used to solve this problem are nonlinear

Hamilton-Jacobi-Bellman-PDEs(quasi-linear as well as fully non-linear) and numerical optimization algorithms, such as L-BFGS. I will present some of applications for hedging the volatility risk of options and hedging the yield-curve risk of fixed-income portfolios. I will also like to point out some open problems in this field that I find mathematically interesting.