Inverse problems techniques for curve fitting, model calibration and parameter identification in computational finance applications

Herbert Egger
Johann Radon Institute for Computational and Applied Mathematics
Austrian Academy of Sciences
Altenbergerstr. 69, A-4040 Linz, Austria
herbert.egger@oeaw.ac.at

Abstract

During the last decades, mathematical methods and modeling have had a huge impact on the world of finance. All sorts of deterministic and stochastic models are used nowadays for prediction of market behavior, for valuation of financial strategies and transactions, for risk management, and for pricing (and even designing) of all sorts of financial assets. Usually, such models depend on certain parameters, which immediately give rise to the question of *model calibration*, i.e., how to choose parameters such that the current market prices can be reproduced. A second question is concerned with the *identification* of certain (interesting or interpretable) parameters, such as volatilities. The knowledge of such parameters is important, e.g., for a comparison of different models or for the determination of correct prices of financial assets.

Both topics, model calibration as well as parameter identification, are inverse questions and will in many instances lead to ill-posed problems, i.e., their solution is unstable. In order to obtain reasonable, stable approximations, one has to use regularization methods. We will discuss these aspects of inverse problems both, numerically and theoretically, for three examples of computational finance: the volatility identification in option pricing models, yield-curve fitting and the determination of interest rate models from market prices of liquid instruments.