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**Jian Geng\*** (jgeng@math.fsu.edu), **Michael I. Navon** and **Xiao Chen**. *Non-parametric calibration of the local volatility surface for European options.*

In this paper, we explore a robust method for calibration of the local volatility surface for European options across all strikes and maturities of the same underlying. Assuming the the volatility surface is smooth, we apply a second order Tikhonov regularization to the calibration problem. Additionally we propose a new approach for choosing the Tikhonov regularization parameter, which leads to an automatic convergence property. Automatic differentiation tool is employed as an efficient way to obtain the gradient of cost function with respect to the local volatility surface. Finally we perform numerical tests with respect to both theoretical volatility models with known analytic solutions of European option prices and true options data from the market. For all the theoretical models, we can successfully recover the true volatility surface. For the real market data, which includes equity index options and options in the FX market, the proposed method works equally well. (Received September 23, 2012)