

Title: Regularization Techniques Based on the Least Squares Method

Author: Marie Michenková

Department: Department of Numerical Mathematics

Supervisor: RNDr. Iveta Hnětynková, Ph.D.

Abstract: In this thesis we consider a linear inverse problem $Ax \approx b$, where A is a linear operator with smoothing property and b represents an observation vector polluted by unknown noise. It was shown in [Hnětynková, Plešinger, Strakoš, 2009] that high-frequency noise reveals during the Golub-Kahan iterative bidiagonalization in the left bidiagonalization vectors. We propose a method that identifies the iteration with maximal noise revealing and reduces a portion of high-frequency noise in the data by subtracting the corresponding (properly scaled) left bidiagonalization vector from b . This method is tested for different types of noise. Further, Hnětynková, Plešinger, and Strakoš provided an estimator of the noise level in the data. We propose a modification of this estimator based on the knowledge of the point of noise revealing.

Keywords: ill-posed problems, regularization, Golub-Kahan iterative bidiagonalization, noise revealing, noise estimate, denoising