

In this thesis we are going to deal with the inverse linear approximation problem  $\mathbf{Ax} \approx \mathbf{b}$ , where our goal is to find the best approximation  $\mathbf{x}$  of the unknown exact solution. We are going to especially focus on the so-called rank-deficient and ill-posed problems, which are very ill-conditioned and sensitive to possible random noise present in  $\mathbf{b}$ . To solve these problems, we must use regularization methods, which suppress this sensitivity. The main goal of this thesis is to get a comprehensive overview of direct methods T-SVD, T-TLS and Tikhonov regularization, and analyse their close connection with classical least squares methods. One possible approach is to formulate these regularization methods as so-called filtering. In this way we implement them for numerical experiments. This thesis will also include a numerical comparison of these methods for selected problems from the Regularization Toolbox and in the application problem of image reconstruction.