Image Processing by Inverse Filtering Onboard ERS Spacecraft

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Abstract. Satellite images of the Earth of high resolution have blurring of small details and low contrast. This is due to the low values of the modulation transfer function of the large space-based optical Earth observation systems. The problems of image reconstruction by the inverse filtering method are considered in the article. Various ways of its implementation are suggested. The necessity of preliminary noise reduction of images before their restoration is revealed. A quantitative and qualitative analysis of the performance of the most well-known noise reduction algorithms has been performed. Adaptive algorithms of preliminary noise reduction are developed and tested. By the computer simulation of images and comparison of quality criteria, the optimal algorithm of preliminary noise reduction of images is discovered for this task. Regularization, an alternative solution to the problem of noise amplification in an image when performing inverse filtering is studied. A computer simulation of various regularization methods has been carried out. A visual analysis of the results of image simulation and comparison of quantitative criteria for their quality made it possible to determine the optimal parameters of the regularization function.

Keywords: noise reduction, inverse filtering, modulation transfer function