Variance component estimation in linear inverse ill-posed models

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Regularization has been applied by implicitly assuming that the weight matrix of measurements is known. If measurements are assumed to be heteroscedastic with different unknown variance components, all regularization techniques may not be proper to apply, unless techniques of variance component estimation are directly implemented. Although variance component estimation techniques have been proposed to simultaneously estimate the variance components and provide a means of regularization, the regularization parameter is treated as if it were also an extra variance component. In this paper, we assume no prior information on the model parameters and do not treat the regularization parameter as an extra variance component. Instead, we first analyze the biases of estimated variance components due to the regularization parameter and then propose bias-corrected variance component estimators. The results have shown that they work very well. Finally we propose and investigate through simulations an iterative scheme to simultaneously estimate the variance components and the regularization

parameter in order to eliminate the effect of regularization parameter on variance components and the effect of incorrect prior weights or initial variance components on the regularization parameter.