On reproducing linear estimators within the GM-model with stochastic constraints

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Abstract

In a Gauss-Markov Model (GMM) with fixed constraints, all the relevant estimators do perfectly satisfy these constraints. As soon as they become stochastic, most estimators are allowed to satisfy them only approximately, thereby leaving room for non-vanishing residuals to describe the deviation from the prior information.

Sometimes, however, linear estimators may be preferred that are able to perfectly reproduce the prior information in form of stochastic constraints, including their variances and covariances. As typical example may be considered the case where a geodetic network ought to be densified without changing the higher-order point coordinates that are usually introduced together with their variances and (some) covariances. Traditional estimators are based on the "Helmert" or "S-transformation", respectively an adaptation of the fixed-constraints Least-Squares estimator.

Here, it will be shown that neither approach generates the optimal reproducing estimator which will be presented in detail and compared with the other reproducing estimators in terms of their MSE-risks.

Keywords

Gauss-Markov Model, Stochastic constraints, Variance/covariance preservation, Reproducing estimators.

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