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Total Least-Squares Adjustment of Condition Equations

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The usual least-squares adjustment within an Errors-in-Variables (EIV) model is often described as Total Least-Squares Solution (TLSS), just as the usual least-squares adjustment within a Random Effects Model (REM) has become popular under the name of Least-Squares Collocation (without trend). In comparison to the standard Gauss-Markov Model (GMM), the EIV-Model is less informative whereas the REM is more informative. It is known under which conditions exactly the GMM or the REM can be equivalently replaced by a model of Condition Equations or, more generally, by a Gauss-Helmert-Model (GHM). Such equivalency conditions are, however, still unknown for the EIV-Model once it is transformed into such a model of Condition Equations. In a first step, it is shown in this contribution how the respective residual vector and residual matrix would look like if the Total Least-Squares Solution is applied to condition equations with a random coefficient matrix to describe the transformation of the random error vector. The results are demonstrated using numeric examples which show that this approach may be valuable in its own right.