Univariate and Multivariate Models in Msplit Estimation in the Context of Vertical Deformation Analysis

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SUMMARY

The paper focuses on applying two approaches to Msplit estimation in deformation analysis. The methods under consideration are the squared Msplit estimation (SMS), which assumes the normality of the observation errors, and the absolute Msplit estimation (AMS), which is based on L1 norm condition. The main aim of the paper is to investigate such estimation types in the context of vertical displacement analysis with application of either of two models, namely univariate and multivariate models. The Crude Monte Carlo simulations are the basis for obtaining estimation accuracies (both root-mean-square deviation, RMSD, and standard deviation, SD) and empirical systematic biases, additionally. The results are obtained for several different variants of point displacements. Here, it should be noted that accuracy of Msplit estimates might depend on the values of such displacements. Generally, univariate model in Msplit estimation gives better accuracy if there are no gross errors in observation set. Considering such a model, one can say that SDs are lower for both SMS and AMS estimates. It is especially vivid for small displacements. This is very important from the practical point of view since small SDs result in smaller RMSDs. On the other hand, multivariate model in Msplit estimation might yield smaller systematic biases; however, smaller biases not always result in better accuracy. The variants which contains outliers show significant differences between application of the univariate or multivariate models. One can say that these two approaches simply supplement each other. Generally, the outcomes confirm that the choice of the model in Msplit estimation is important in deformation analysis because the appropriate approach allows to obtain superior accuracy. It is also confirmed that the accuracies and empirical biases of both Msplit estimates depend not only on occurrence of gross errors in observation set but also on the values of the point displacements. The application of the univariate model is especially advisable when such displacements are relatively small. Finally, it is also noteworthy that AMS estimates give generally better results than SMS estimates.