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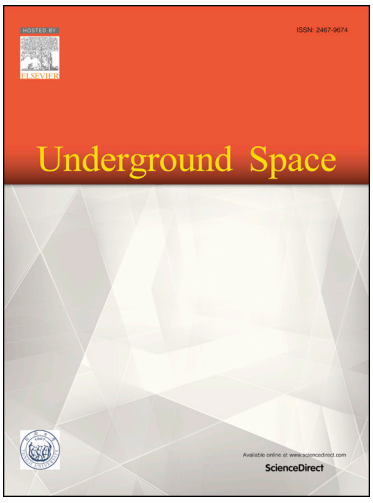

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Optimal measurement design for parameter identification in mechanized tunneling

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Abstract

When performing shallow tunnel construction, settlements on the ground surface often cannot be prevented. Anticipating these surface displacements is only possible with profound knowledge of the constitutive parameters of the surrounding soil. Performing inverse analysis on the basis of in situ settlement data is an efficient method for obtaining such information. However, during this process, considering which measurement arrangement can provide the most reliable results is generally neglected. This aspect is addressed in this study by applying the so-called "optimal experimental design" to the mechanized tunneling field. A global sensitivity analysis (GSA) is firstly performed to determine the most relevant model parameters to be identified via back analysis, by employing the considered numerical model and experimental data. Furthermore, the GSA results are utilized to determine where and when measurements should be performed to minimize uncertainty in the identified constitutive parameters. The optimal experimental design (OED) concept is further applied to evaluate the observation set-up efficiency for damage mitigation measures within a representative synthetic example of a tunneling project passing beneath an existing building. Parameter identification based on synthetic noisy experiments is performed to validate the presented method for optimal experimental design.

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