Bayesian model updating of a tunnel in soft soil with settlement measurements

Monitoring is an essential element of modern tunneling construction. The most common monitoring method is measuring displacements, for example convergence of the tunnel opening or surface settlements. Measurement outcomes can be used to update the knowledge on material properties of the soil or other parameters that enter numerical models of the structural behavior of the tunnel. In probability theory, this process can be formalized in the concept of Bayesian updating. In this paper, we apply the Bayesian concept to update the numerical model of a tunnel in soft soil conditional on settlement measurements. The tunnel is constructed by means of the conventional tunneling method and modeled with 2D finite elements applying the stress reduction method. We assume that settlement measurements are taken at full excavation and utilize the measurements to update the material properties of the soil as well as the the relaxation factor of the stress reduction method. Updating is performed by means of BUS, a recently proposed method for Bayesian updating of mechanical models with structural reliability methods.

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