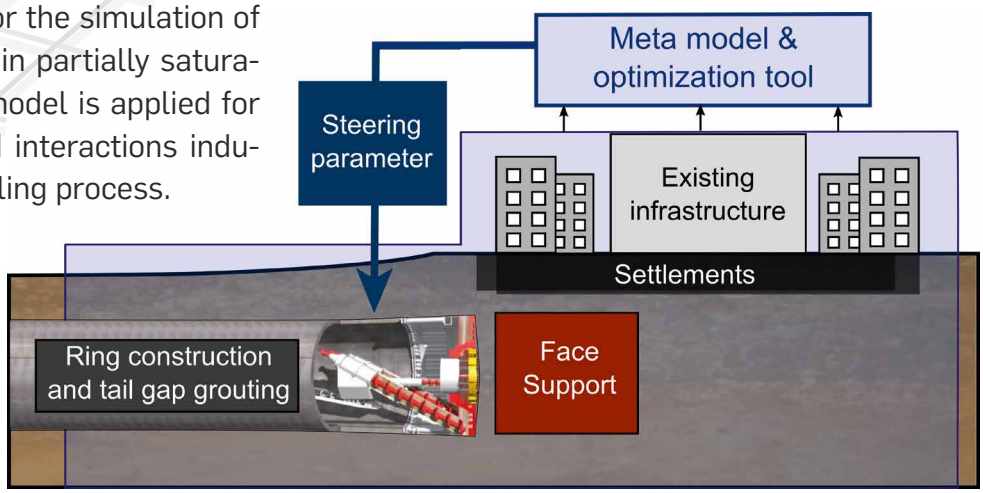
COMPUTATIONAL STRATEGIES FOR PREDICTIONS OF SOIL-STRUCTURE INTERACTIONS DURING MECHANIZED TUNNELING

Doctoral defense by JELENA NINIĆ

Tuesday, March 31st – 13:00 - 13:30 – IC 03 / 112
changed location

Mechanized tunneling is a well-established construction technology that allows for tunnel advances in a wide range of geological environments, high ground water pressures or small cover depths as often met in urban tunneling. During the design and construction of shield-driven tunnels, a reliable prognosis of the tunneling-induced effects as well as constant process control and real-time countermeasures are required to enable safe construction and to prevent failures. To this end, computational strategies for the holistic prognosis of soil-structure interaction effects caused by mechanized tunneling in the design phase as well as in real time during the tunnel construction are proposed:
In the first part, the components of a processoriented finite element model for the simulation of the shield tunneling process in partially saturated soil are presented. The model is applied for the evaluation of effects and interactions induced by the mechanized tunneling process.

The second part presents an embedded beam formulation for discretization-independent FE analyses of interactions between pile foundations and the surrounding soil. The proposed formulation allows consideration of piles and pile groups with arbitrary orientation, independently from the discretization of the surrounding soil.
In the third part, a method for simulation-based steering of the mechanized tunneling process in real time during the construction is proposed. To this end, meta models are used to substitute computationally expensive finite element simulations. The proposed simulation-based model update and computational steering procedure is demonstrated with the example of real project data of the metro Wehrhahn-Line in Düsseldorf.



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