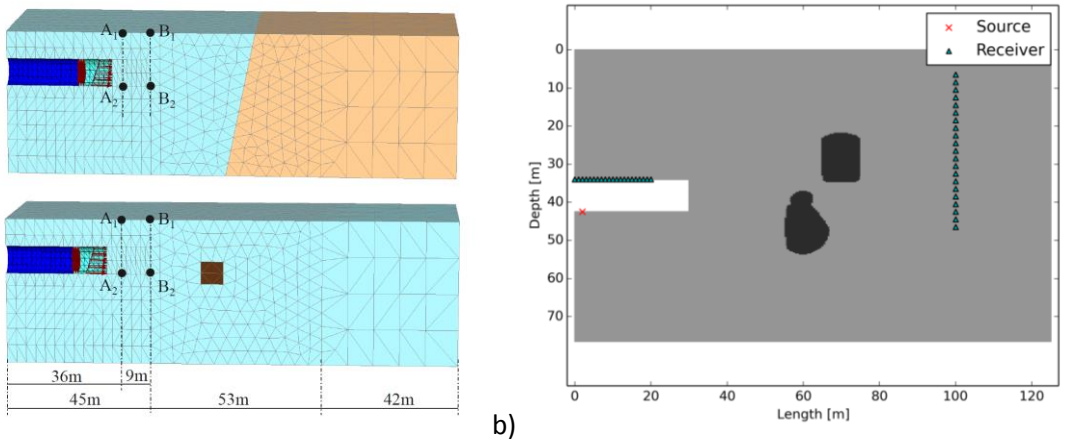
Art der studentischen Arbeit: ***Type of study work:***	Master's thesis
Teilprojekt: ***Sub-Project:***	**A2, C2**
Kategorie: ***Category:***	Simulation

Name des Betreuers: (Name, Raum, Telefon) ***Name of Supervisor/(s):*** *(Name, Room, phone number)*	L. T. Nguyen, K. Musayev, A. Lamert, R. Hölter, S. Rose Room ICFW 03-721, Phone +49(0)234-32-25879
Start:	Ab sofort/ As soon as possible

Aufgabenstellung/ *Task formulation:*

Identifying the geological scenario ahead of the tunnel face: The use of elastoplastic and elastodynamic responses

Uncertain soil conditions in front of an ongoing tunneling process can cause, amongst others, unexpected settlements. The problem of mitigating these risks and reducing the costs caused by tunnel boring machine (TBM) stoppage gains an increasing interest in the tunneling community. For this purpose, the methodology of nondestructive identification is preferred to conventional site investigation by drilling boreholes due to the reduced costs and time. The problem is conveniently formulated as updating the physics-based model to fit as much as possible the model response to the measured data using an optimization approach.



a) b)

Figure 1. Influence of geological alterations to model responses: a) Elastoplastic excavation model (Chapter 7 in Miro 2015), b) Elastic wave propagation model

References

1. Miro, S. (2015). Calibration of numerical models considering uncertainties. *PhD thesis*, Ruhr-University Bochum.
2. Lambrecht, L. (2015): Forward and inverse modeling of seismic waves for reconnaissance in mechanized tunneling, *PhD thesis*, Ruhr-University Bochum.
3. Musayev, K.; Hackl, K.; Baitsch, M. (2013). Frequency domain waveform inversion in a tunnel environment. *PAMM* 13 (1), 323-324.
4. Nguyen, L. T., & Nestorović, T. (2016). Unscented hybrid simulated annealing for fast inversion of tunnel seismic waves. *Computer Methods in Applied Mechanics and Engineering*, *301*, 281-299.

Zielstellung:
Aim of the work:
This Master's thesis is concerned with comparing and possibly combining the inversion based identification methods developed in the subprojects A2 and C2 to achieve the optimal reconstruction of the geological situation right ahead of the tunnel face.

Additionally, the influence of the uncertainty of the relevant soil parameters should be investigated by performing and comparing the methods under assumption of different levels of uncertainty

Arbeitspakete/Umfang:
Working packages/Scope of the work:
The tasks will be delivered as below:

- Creation of a tunnel model in the methodical framework of the elastic wave propagation according to the existing work of subproject A2, using the soil and geometry parameters provided by subproject C2
- Back-analysis (use of the tunnel-induced settlements) and waveform inversion (use of elastic waves) of the prescribed tunneling process
- Comparison and evaluation of the gained results
- Combination of the two separate inverse analyses to minimize as efficiently as possible the uncertainty of the upcoming soil conditions