

# Preface

In a previous textbook with similar title, the midterm results of the research group GEOTECH on the numerical and physical modeling of geotechnical installation processes have been presented. In this volume emphasis is given to the simulation strategies of the benchmark problems. The holistic simulation of geotechnical installation processes takes into account the entire installation of structural elements into the ground for foundation purposes and considers the serviceability of nearby structures such as excavation pit supporting systems or adjacent buildings. It refers to the nonlinear structure–soil–structure interaction.

From the engineering practice, it is well-known that the installation process itself may cause larger deformations than the excavation or dewatering of a construction pit on its shoring or the neighboring buildings. The assessment of the deformation is, on the one hand, required from the codes (EC 7) or regulations but on the other hand the high-quality prediction based on realistic and proven incrementally, highly nonlinear constitutive models for the soils under cyclic/dynamic conditions and the respective simulation tools do not offer up to now the required prediction quality.

The research group GEOTECH is dedicated to this challenging issue with the performance of fundamental and applied research starting from the modification of existing or even new development of constitutive modeling for the soil behavior, the development of new type contact elements for the cyclic/dynamic structure–soil–structure interaction and the provision of new simulation techniques or appropriate tools for the description of the vibro-installation of piles.

The research group is organized and operating at three levels:

- benchmarking projects with element-like and large-scale model tests for the calibration and validation of the developed numerical models
- theoretical fundamental research for the development of high-quality constitutive soil models and contact formulations in combination with efficient numerical implementations and algorithms
- application of the developed theoretical models to boundary value problems with parametric studies of respective geotechnical installation processes and

recommendations for further use of the numerical models in practice as well as for the practical optimization of these processes.

Furthermore the research group provides high-quality benchmarks using physical modeling and measurements on real construction sites where the installation processes of vibro-injected piles took place and produced unexpected large deformations on the shoring wall (diaphragm wall). The provision of real data from construction sites and those from experimental results on physical model tests related to the pure pile installation process in combination with the developed numerical tools offer to the interested readers a rich source of valuable information. The provided information can serve as a basis to test newly developed constitutive models or simulation tools developed elsewhere or as benchmark to check the validity or accuracy of further experimental investigations in future.

The young researches, who joined this group, obtained an incredible knowledge in testing and simulation techniques enabling them to achieve a higher level of education and to widen their view with the exchange of experience between the different disciplines. Therefore in this volume, the first authors in all contributions from the research group are not the principal investigators but the young well-educated researchers, who just obtained or are in a process to obtain their Ph.D. degree.

The editor likes to thank all his colleagues (Prof. Ehlers, Prof. Wriggers, Prof. Savidis, Prof. Rackwitz, Prof. Hettler) and coworkers (Dr. Niemunis, Dr. Osinov, Dr. Huber) for their engagement within the research group and their valuable contributions as well as their extreme efforts to make things possible within the different disciplines in order to achieve the high scientific targets within the different projects.

The contributions of our invited speakers (Prof. A. Wittle and Prof. T. Schanz) in the final GEOTECH Workshop (7 and 8 December 2015 in Karlsruhe) are very much appreciated and are also included in this volume due to their relevance to the scientific targets of the group.

Furthermore I would like to express my thanks to Mrs. Meininger for the organization of all the workshops of the research group GEOTECH and her engagement to make those events pleasant, as well as Mr. Vogelsang for the collection of the manuscripts and the help given to the editor prior to publication of this textbook.

Finally, all of us like to express our deep gratitude to German Research Council (DFG) for the generous financial support of this very interesting and challenging research topic in geotechnical engineering.

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