

gernot beer (ed.)

numerical simulation in tunnelling



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Numerical Simulation In Tunneling

G Psacharopoulos



Numerical Simulation In Tunneling:

Numerical Simulation in Tunnelling Gernot Beer, 2003-04-14 This text presents the results of the joint research initiative Numerical Simulation in Tunneling In doing so it provides a thorough guide to improving the safety and economy of tunnels by discussing the application of numerical simulation methods to assist tunnel engineers Numerical simulation tools for the estimation of the required tunnel support and the required construction measures are described in this book By using them it is possible to study the impact on the construction and on the environment at the planning stadium and during construction This will result in an improvement of the safety and economy of tunnels *Numerical Simulation in Tunnelling*

Gernot Beer, 2012-12-06 For many years the Austrian tunneling industry has demanded that research is urgently required to establish a theoretical basis for the New Austrian Tunneling Method and to assist site engineers in the often difficult day to day decisions In particular it was felt that numerical models need to be improved considerably in order to be able to act as useful tools in predicting soil rock mass behavior during tunneling The required improvement not only refers to the quality of the models but also to their ease of use As long as an experienced modeler is required to spend days in preparing the input and in interpreting the results the models will not be useful at the tunnel site It is heartening therefore that a group of scientists in Austria has come together to attempt to tackle this challenging task The initiative has been supported in a number of ways by the Austrian tunneling industry All Austrian companies associated with tunneling sent representatives to the management advisory board which ensured that the research carried out in the project was of benefit to the industry The Austrian Geomechanics Society sponsored the project with a considerable amount which was mainly used to cover site costs HL AG and OSAG as well as the joint ventures allowed access to tunnel sites thereby making it possible to test new developments **Numerical Simulation of the Howard Street Tunnel Fire, Baltimore, Maryland, July 2001**, 2003

Proceedings of Geotechnical Challenges in Mining, Tunneling and Underground Infrastructures Amit Kumar Verma, Edy Tonnizam Mohamad, Ramesh Murlidhar Bhatawdekar, Avtar Krishen Raina, Manoj Khandelwal, Danial Armaghani, Kripamoy Sarkar, 2022-06-03 This book consists of selected papers presented at the International Conference on Geotechnical Challenges in Mining Tunneling and Underground Infrastructures ICGMTU held as a virtual conference on December 20 2021 The papers represent the research work in the related fields of underground mining ground control mining geotechnics geo instrumentation mine tunnelling and underground structures It focuses on the latest technology being implemented including artificial intelligence and machine learning applications to solve challenges in mining tunneling and geotechnical structure engineering It also highlights the state of the art technologies adopted by the civil and mining industry for their commercial as well as environmental benefits The papers are presented by an international pool of academics research scientist and industrial experts and therefore cater to the global audience from the field of underground engineering

Centrifuge Modeling of the BART Transbay Tube and Numerical Simulation of Tunnels in Liquefying Ground

Jui-Ching Chou, 2010 This thesis describes centrifuge model tests and numerical analyses of tunnels in liquefiable soil. The prototype of the centrifuge tests was the Bay Area Rapid Transit BART Transbay Tube TBT that connects Oakland to San Francisco, CA, USA. During the tunnel construction, much of the gravelly backfill material around this tunnel was placed loosely under water at a relative density less than 50%. Because of the low relative density of the backfill material around the tube and low unit weight of the tube, there were concerns that the tube might suffer large deformation due to buoyancy forces if the backfill material liquefied in an earthquake. BART engaged Fugro West Inc., Oakland, CA, to assess the need for ground improvement to mitigate seismically induced deformations of the tunnel, in particular the deformations due to uplift of the tunnel in the liquefied backfill. Fugro recommended that their numerical analyses and deformation mechanisms should be further verified using centrifuge model tests. Centrifuge model tests were performed: 1 to assess the stability of the BART Transbay Tube; 2 to confirm the uplift mechanisms of the BART Transbay Tube; and 3 to verify numerical methods. Test results indicated that the anticipated uplift during the design earthquake would be acceptable, less than about 0.25 m. Three uplift mechanisms were observed in the centrifuge model tests: 1 a cyclic ratcheting mechanism of sand moving under the tunnel associated with cyclic lateral deformations of the tunnel; 2 seepage of water under the tunnel; and 3 heave of soft clay around the trench. Flow of the sand as a viscous liquid was not observed. Two approaches were used to record subsurface movements in the centrifuge experiments. The traditional approach used data from accelerometers and displacement transducers to determine the trajectory of the tunnel. A new approach, Electric Field Displacement Sensors (EFDS), involves installation of source and ground electrodes in the specimen through which well-defined multi-directional electric fields can be set up in the specimen. The movement of measurement electrode, which can be attached to an object of interest, can then be determined simply by measuring its voltage. Li (2006) was the first to use this approach, but she used an electrode switching system to sequentially excite multidirectional electric fields. A new contribution of this thesis was the idea that independent electric fields from different sources can be excited simultaneously at different frequencies, eliminating the need for the switching system. This has saved a lot of complexity in the equipment and also allowed much improved temporal resolution. After comparing the processed data from the EFDS and traditional approaches, the EFDS can capture the dynamic response pretty well, but the EFDS has its limitations. The change of soil resistivity and the heterogeneities of the soil resistivity affect the estimated movements greatly, but the change of the soil resistivity can not be captured from the voltage data in the current implementation. With continued work on solving its limitation, the EFDS could become a fairly inexpensive tool for tracking movements. A parametric study was performed using a finite difference program, FLAC 2D. In the numerical simulation, the UBC Sand model (Beatty and Byrne, 1998) was used to model the behavior of liquefiable soils. A mesh sensitivity study was performed to decide the appropriate number of nodes for the simulations and how to best model sliding at interfaces between the soil and tunnel. In the parametric study, effects of different geometry characteristics and soil properties on the

seismic behavior of the tunnel were explored and the results are summarized in a few dimensionless plots After effects of various factors on the tunnel performance were understood suggestions for the future tunnel design were made 1 densify the liquefiable soils to reduce the cyclic mobility associated with liquefaction 2 minimize the volume of the liquefiable soils and the thickness of the liquefiable soils underneath the tunnel to reduce the volume of pore water expelled and the space through which water and soil may flow under the tunnel 3 make the elevation of the interface between high and low permeability materials shallow enough so that high pore pressures are not trapped near the base of the tunnel 4 make the liquefiable soils as permeable as possible to drain high pore pressures away from the base of the tunnel and 5 make the unit weight of the tunnel as close as to the surrounding soil

A Numerical Simulation in Longitudinal Ventilation System of Long Highway Tunnel Wenchin Lin,1995 Geotechnical Aspects of Underground Construction in Soft Ground Klaas

Jan Bakker,Adam Bezuijen,Wout Broere,E.A. Kwast,2013-05-23 A valuable source of reference on the current practices of analysis design and construction of tunnels and underground structures in soft ground This collection of reviewed papers covers a wide range of tunnelling practice from deep excavations in Singapore to the construction of a new metro line in Barcelona The international scope of the contributors makes this a truly comprehensive collection of work on the geotechnical aspects of soft ground excavation Interaction Modeling in Mechanized Tunneling Günther Meschke,Rolf Breitenbücher,Steffen Freitag,Markus König,Markus Thewes,2023-03-17 This open access book compiles the research results of the Collaborative Research Center SFB 837 which has been running since 2010 and will end in 2022 with the topic Interaction Modeling in Mechanized Tunneling The Collaborative Research Center is funded by the German Research Foundation DFG and is currently the world s largest research facility in the field of tunneling The aim of the publication is to make our scientific findings accessible to the international professional community The individual chapters deal with all subsystems relevant in mechanized tunneling and their interaction The latest results of digital planning and real time tunneling support have been included Numerical Simulations of Physical and Engineering Processes Jan

Awrejcewicz,2011-09-26 Numerical Simulations of Physical and Engineering Process is an edited book divided into two parts Part I devoted to Physical Processes contains 14 chapters whereas Part II titled Engineering Processes has 13 contributions The book handles the recent research devoted to numerical simulations of physical and engineering systems It can be treated as a bridge linking various numerical approaches of two closely inter related branches of science i e physics and engineering Since the numerical simulations play a key role in both theoretical and application oriented research professional reference books are highly needed by pure research scientists applied mathematicians engineers as well post graduate students In other words it is expected that the book will serve as an effective tool in training the mentioned groups of researchers and beyond Proceedings of China-Europe Conference on Geotechnical Engineering Wei Wu,Hai-Sui Yu,2018-08-02 This book compiles the second part of contributions to the China Europe Conference on Geotechnical Engineering held 13 16 August

2018 in Vienna Austria About 400 papers from 35 countries cover virtually all areas of geotechnical engineering and make this conference a truly international event The contributions are grouped into thirteen special sessions and provide an overview of the geoenvironmental research and practice in China Europe and the world Constitutive model Micro macro relationship Numerical simulation Laboratory testing Geotechnical monitoring instrumentation and field test Foundation engineering Underground construction Environmental geotechnics New geomaterials and ground improvement Cold regions geotechnical engineering Geohazards risk assessment mitigation and prevention Unsaturated soils and energy geotechnics Geotechnics in transportation structural and hydraulic Engineering

Tunnels and Underground Cities: Engineering and Innovation Meet Archaeology, Architecture and Art Daniele Peila, Giulia Viggiani, Tarcisio Celestino, 2020-06-30 Tunnels and Underground Cities Engineering and Innovation meet Archaeology Architecture and Art Volume 6 Innovation in underground engineering materials and equipment Part 2 contains the contributions presented in the eponymous Technical Session during the World Tunnel Congress 2019 Naples Italy 3-9 May 2019 The use of underground space is continuing to grow due to global urbanization public demand for efficient transportation and energy saving production and distribution The growing need for space at ground level along with its continuous value increase and the challenges of energy saving and achieving sustainable development objectives demand greater and better use of the underground space to ensure that it supports sustainable resilient and more liveable cities The contributions cover a wide range of topics from artificial intelligence techniques for geomechanical forecasting via fiber reinforced concrete segmental lining to advanced 4 channel scan systems for tunnel inspection The book is a valuable reference text for tunnelling specialists owners engineers archaeologists architects artists and others involved in underground planning design and building around the world and for academics who are interested in underground constructions and geotechnics

The Second Half Century of Rock Mechanics, Three Volume Set Luis Ribeiro e Sousa, Claudio Olalla, N. Grossmann, 2007-08-05 Forty one years ago the International Society for Rock Mechanics ISRM held its 1st International Congress in Lisbon Portugal In July 2007 the 11th ISRM Congress returned to Lisbon where the Portuguese Geotechnical Society SPG the Portuguese National Group of the ISRM hosted the meeting The Second Half Century of Rock Mechanics comprises

Computational and Experimental Simulations in Engineering Shaofan Li, 2023-12-04 This book gathers the latest advances innovations and applications in the field of computational engineering as presented by leading international researchers and engineers at the 29th International Conference on Computational bioengineering geotechnical engineering offshore multi scale structural integrity materials design and computer modeling methods in engineering The contributions which were selected by means of a rigorous international peer review process highlight numerous exciting ideas that will spur novel research directions and foster multidisciplinary collaborations

Geotechnical Modeling and Intelligent Systems Gao-Feng Zhao, 2025-10-08 This open access book provides insights into research topics related to geotechnical engineering simulations With the development of

computing power and artificial intelligence research methods in geotechnical engineering are gradually shifting from field surveys and physical experiments toward simulation and prediction Through simulations it is possible to infer the impact of engineering structures on soil and rock masses as well as their response to natural disasters such as earthquakes landslides and debris flows allowing for early planning of mitigation measures Inside readers will find cutting edge studies on microbial soil stabilization finite element simulations centrifuge modeling and machine learning applications Topics include advanced material characterization predictive modeling of tunnels and slopes AI enhanced monitoring systems and risk mitigation strategies for deep excavations and mining subsidence These contributions illustrate how intelligent systems are optimizing both design and safety across a wide range of geotechnical scenarios This volume is an essential resource for researchers engineers and graduate students seeking to leverage intelligent technologies for more efficient accurate and resilient geotechnical solutions With its integration of theory experimentation and smart modeling it offers a forward looking perspective on the future of infrastructure in a rapidly evolving technological landscape

Applied Mechanics, Mechatronics and Intelligent Systems - Proceedings of the 2015 International Conference (ammis2015) Shihong Qin, 2015-12-08 This book consists of one hundred and twenty five selected papers presented at the 2015 International Conference on Applied Mechanics Mechatronics and Intelligent Systems AMMIS2015 which was held in Nanjing China during June 19 20 2015 AMMIS2015 focuses on seven main areas namely applied mechanics control and automation intelligent systems computer technology electronics engineering electrical engineering and materials science and technology Experts in this field from all over the world contributed to the collection of research results and development activities AMMIS2015 provides an excellent international exchange platform for researchers to share their development works and results in these areas All papers selected for this proceeding were subjected to a rigorous peer review process

Frontiers in Civil and Hydraulic Engineering, Volume 2 Mohamed A. Ismail, Hazem Samih Mohamed, 2023-03-23 Frontiers in Civil and Hydraulic Engineering focuses on the research of architecture and hydraulic engineering in civil engineering The proceedings feature the most cutting edge research directions and achievements related to civil and hydraulic engineering Subjects in the proceedings including Engineering Structure Intelligent Building Structural Seismic Resistance Monitoring and Testing Hydraulic Engineering Engineering Facility The works of this proceedings can promote development of civil and hydraulic engineering resource sharing flexibility and high efficiency Thereby promote scientific information interchange between scholars from the top universities research centers and high tech enterprises working all around the world

2019 Rock Dynamics Summit Ömer Aydan, Takashi Ito, Takafumi Seiki, Katsumi Kamemura, Naoki Iwata, 2019-07-04 Rock dynamics has become one of the most important topics in the field of rock mechanics and rock engineering and involves a wide variety of topics from earthquake engineering blasting impacts failure of rock engineering structures as well as the occurrence and prediction of earthquakes induced seismicity rock bursts to non destructive testing and explorations Rock dynamics has wide

applications in civil and infrastructural resources and energy geological and environmental engineering geothermal energy and earthquake hazard management and has become one of the most topical areas 2019 Rock Dynamics Summit contains 8 keynote addresses and 128 regular full papers that were presented at the 2019 Rock Dynamics Summit 2019 RDS Okinawa Japan 7-11 May 2019 a specialized conference jointly organized by the Rock Dynamics Committee of the Japanese Society of Civil Engineers JSCE RDC the Japanese Society for Rock Mechanics JSRM and which was supported by the International Society for Rock Mechanics and Rock Engineering ISRM and the Turkish National Society for Rock Mechanics TNSRM The contributions cover a wide range of topics on the dynamic behavior of rock and rock masses and scientific and engineering applications and include Laboratory tests on Dynamic Responses of Rocks and Rock Masses Fracturing of Rocks and Associated Strong Motions Estimation Procedures and Numerical Techniques of Strong Motions Associated with the Rupture of Earth's Crust and Some Strong Motion Dynamic Response and Stability of Rock Foundations Underground Excavations in Rock Rock Slopes Dynamic Responses and Stability of Stone Masonry Historical Structures and Monuments Induced Seismicity Dynamic Simulation of Loading and Excavation Blasting and machinery induced vibrations Rockburst Outburst Impacts Nondestructive Testing Using Shock Waves Case Histories of Failure Phenomenon in Rock Engineering 2019 Rock Dynamics Summit contains the state of the art in rock dynamics and will be invaluable to professionals and academics interested in the latest advances in new techniques for experiments analytical and numerical modelling as well as monitoring in dynamics of rocks and rock engineering structures

Understanding soil wind erosion and control practices in arid and semiarid environments Huawei Pi, Brandon L. Edwards, Bailiang Li, 2023-04-18 *Introduction to Statistical Physics, Second Edition* Kerson Huang, 2009-09-21 Written by a world renowned theoretical physicist *Introduction to Statistical Physics Second Edition* clarifies the properties of matter collectively in terms of the physical laws governing atomic motion This second edition expands upon the original to include many additional exercises and more pedagogically oriented discussions that fully explain the concepts and applications The book first covers the classical ensembles of statistical mechanics and stochastic processes including Brownian motion probability theory and the Fokker-Planck and Langevin equations To illustrate the use of statistical methods beyond the theory of matter the author discusses entropy in information theory Brownian motion in the stock market and the Monte Carlo method in computer simulations The next several chapters emphasize the difference between quantum mechanics and classical mechanics the quantum phase Applications covered include Fermi statistics and semiconductors and Bose statistics and Bose-Einstein condensation The book concludes with advanced topics focusing on the Ginsburg-Landau theory of the order parameter and the special kind of quantum order found in superfluidity and superconductivity Assuming some background knowledge of classical and quantum physics this textbook thoroughly familiarizes advanced undergraduate students with the different aspects of statistical physics This updated edition continues to provide the tools needed to understand and work with random processes

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