DOWNLOAD PDF MULTISCALE GEOMECHANICS

Chapter 1 : Multiscale Geomechanics - Pierre-Yves Hicher - Bok () | Bokus

College of Civil Engineering and Architecture Zhejiang University, Hangzhou, China. CURRICULUM VITAE. Powered by Create your own unique website with customizable templates.

A geometry-based algorithm for cloning real grains. MAY Nardelli, V. From computed tomography to mechanics of granular materials via level set bridge. Numerical modeling of hydraulic fracture propagation, closure and reopening using XFEM with application to in-situ stress estimation. Mechanics of origin of flow liquefaction instability under proportional strain triaxial compression. Acta Geotechnica, 11 , A micro-mechanical study of peak strength and critical state. Effects of grain morphology on critical state: Acta Geotechnica, 11 3 , Level set discrete element method for threedimensional computations with triaxial case study. Journal of Mechanics and Physics of Solids. Multiscale characterization and modeling of granular materials through a computational mechanics avatar: Acta Geotechnica, 11 2 , Dynamic inter-particle force inference in granular materials: Experimental Mechanics, 56 2 , , Investigating the mechanical underpinnings of origin of liquefaction in field. A simple device for in-situ direct shear and sinkage tests. Mechanics of origin of flow liquefaction instability under triaxial loading. Grain-scale measurements during low velocity impact in granular media. Friction in inertial granular flows: Competition between dilation and grain-scale dissipation rates. Flow liquefaction instability prediction using finite elements. Force chains as the link between particle and bulk friction angles in granular matter. Geophysical Research Letters, On the contact treatment of non-convex particles in the granular element method. Computational Particle Mechanics, 1 3 , , Extracting inter-particle forces in opaque granular materials: Journal of the Mechanics and Physics of Solids, A contact dynamics approach to the Granular Element Method. Computer Methods in Applied Mechanics and Engineering, Granular element method for three-dimensional discrete element calculations. Design and implementation of a particle image velocimetry method for analysis of running gear-soil interaction. Journal of Terramechanics, The origin of macroscopic friction and rate-dependence in dense granular flows. Microscopic origin of macroscopic strength in granular media: Criterion for flow liquefaction instability. Investigating the life cycle of an avalanche. Andrade and KW Lim, Modeling failure at the grain scale: Experimental use of the Granular Element Method in opaque 3D grains. Micromechanical origin of static and dynamic liquefaction in granular soils. Conference Proceedings, Published Bibliography: Proceedings for Poromechanics , Vienna, Austria, July From tomography to physics-based mechanics of porous media. Granular element method for computational particle mechanics. Transient creep effects and the lubricating power of water in materials ranging from paper to concrete to Kevlar. Multiscale Tomography to Simulation Paradigm. Inter-particle forces in granular media inferred by the granular element method GEM. On a relation between micro and macro scales through chain forces in granular materials. On the rheology of dilative granular media: Journal of the Mechanics and Physics of Solids. Rover mobility on granular soil: Marrying multi-scale modeling and high fidelity experiments to infer stresses under the moving wheel. Granular element method GEM: Modeling diffuse instabilities in sands under drained conditions. Chen, A Seifried, J. Characterization of random fields and their impact on the mechanics of geosystems at multiple scales. AES for multiscale localization modeling in granular media. Connecting microstructural attributes and permeability from 3D tomographic images of in situ shear-enhanced compaction bands using multiscale computations. Geophysical Re- search Letters, AES multiscale localization modeling in granular media. Dubrovnik, Croatia, April Advances in Multiscale modeling and characterization of granular matter. Pensacola, Florida, May A GEM for measuring inter-particle forces. Multiscale modeling and characterization of granular matter: A nanoscale numerical model to predict macroscale properties of cement. Mechanics of Materials, Multiscale measurement of states in granular media. Multiscale characterization and modeling of geomaterials. San Francisco, California, December The lifecycle of avalanches: Experiment-based multiscale computations in granular materials. Le, "Granular element method GEM: In proceedings Engineering Mechanics Institute Conference. Boston, Massachusetts, June, Multiscale method for characterization of porous microstructures and their impact on macroscopic effective permeability. International Journal of Numerical Methods in

Engineering, A novel and general form of effective stress in a partially saturated porous material: Multiscale modeling of granular matter: Hierarchical multiscale modeling of failure in granular materials. Los Angeles, California, August Multiscale computations for the prediction of shear bands in granular materials. Modeling post-localization behavior in granular materials using a multiscale strong discontinuity approach. Capturing strain localization in granular matter with multiscale computations. Multiscale modeling guided by experiments. In situ permeability measurements within compaction bands in sandstone using X-ray CT and lattice Boltzmann calculations. Return mapping for nonsmooth and multiscale elastoplasticity. Multiscale framework for behavior prediction in granular media. X-ray aided permeability computations inside compaction bands in sandstones. Modeling geomaterials across scales keynote. Multi-scale random fields on the mechanics of het- erogenous media. Predictive multiscale modeling of granular matter: Liquefaction mapping in finite element simulations. Journal of Geotechnical and Geoenvironmental Engineering, A unified framework for capturing material in- stabilities in fluid saturated porous media. Multiscale modeling of granular media. Effects of random fields on mechanics of geosystems at multiple scales. A predictive framework for static liquefaction. Characterization and modeling of pores and surfaces in cement paste:

DOWNLOAD PDF MULTISCALE GEOMECHANICS

Chapter 2 : Multiscale Geomechanics Lab-Zhejiang University Personal homepage

Read "Multiscale Geomechanics From Soil to Engineering Projects" by with Rakuten Kobo. This book addresses the latest issues in multiscale geomechanics. Written by leading experts in the field as a tribute t.

Multiscale insights into borehole instabilities in high-porosity sandstones. Journal of Geophysical Research: Solid Earth 5 , Multiscale modeling and analysis of compaction bands in high-porosity sandstones. Acta Geotechnica 13 3 , Parallel hierarchical multiscale modelling of hydro-mechanical problems for saturated granular soils. Computer Methods in Applied Mechanics and Engineering , Multiscale analysis of shear failure of thick-walled hollow cylinder in dry sand. Computers and Geotechnics 80, Multiscale insights into classical geomechanics problems. The interplay between anisotropy and strain localisation in granular soils: International Journal for Numerical Methods in Engineering 99 11 , Local fluctuations and spatial correlations in granular flows under constant-volume quasistatic shear. Physical Review E 89, Rotational resistance and shear-induced anisotropy in granular media. Acta Mechanica Solida Sinica 27 1 , Unique critical state characteristics in granular media considering fabric anisotropy. The signature of shear-induced anisotropy in granular media. Computers and Geotechnics 47, Borehole instabilities in granular rocks revisited: A simple multiscale model for granular soils with geosynthetic inclusion. Volume of the series Springer Proceedings in Physics, pp. Hierarchical multiscale modeling of fluid-saturated soils. A multiscale study of inherent anisotropy and strain localization in granular soils. A multiscale investigation of strain localization in cohesionless sand. Bridging the micro and macro for granular media: A computational multi-scale paradigm. A hierarchical model for cross-scale simulation of granular media. A new definition on critical state of granular media accounting for fabric anisotropy. Unique quantification of critical state in granular media considering fabric anisotropy. Constitutive Modeling of Geomaterials: Signature of anisotropy in liquefiable sand under undrained shear. Bimodal character of induced anisotropy in granular materials under undrained shear. Proceeding of International Symposium on Geomechanics and Geotechnics: Conference Papers Zhao, J. Alternative pathway to granular plasticity via computational multiscale modeling. Keynote delivered by JZ. Multiscale modeling of compaction band in highly porous sandstone. Multiscale modeling of initial anisotropy, fabric evolution and strain localization in granular media. Fundamentals and Applications Particles Multiscale modeling of failure in saturated sand. Capturing the interplay among inherent anisotropy, non-coaxiality and strain localization in granular media. A multiscale insight into strain localization in sand. Multiscale modeling of strain localization in granular media. A hierarchical multiscale approach for granular media. A micromechanical study on the shear strength in granular materials: Characteristics of shear-induced anisotropy in granular media. In Yade Documentation, 2nd ed. PhD Thesis Guo, N. Multiscale characterization of the shear behavior of granular media.

DOWNLOAD PDF MULTISCALE GEOMECHANICS

Chapter 3 : Computational Geomechanics at Caltech

Multiscale Geomechanics: From Soil to Engineering Projects - Kindle edition by Pierre-Yves Hicher. Download it once and read it on your Kindle device, PC, phones or tablets. Use features like bookmarks, note taking and highlighting while reading Multiscale Geomechanics: From Soil to Engineering Projects.

Research Interests and Recent Projects Multiscale Regional Liquefaction Hazard Mapping The liquefaction of soil deposits during earthquake events has caused some of the most spectacular examples of earthquake damage. Quantitative assessment and mapping of liquefaction hazard across large area necessitate the integration of solution models and heterogeneous source of information across multiple scales Our research in this area aims to develop an integrated multiscale framework for accurately evaluating liquefaction potential and its effects across a region. The proposed framework provides a critical linkage between the local site-specific liquefaction analysis and the regional liquefaction hazard mapping through integration of novel multiscale random field models, simplified procedure for liquefaction evaluation, and the latest results from the probabilistic seismic hazard analysis research. Juang, On the spatial variability of CPT-based geotechnical parameters for liquefaction potential evaluation, Soil Dynamics and Earthquake Engineering, doi: Chen, Spatially correlated multiscale Vs30 mapping and a case study of the Suzhou site, Engineering Geology, doi: Juang, Probabilistic and spatial assessment of liquefaction-induced settlements through multiscale random field models, Engineering Geology, Juang, Probabilistic evaluation of liquefaction-induced settlement mapping through multiscale random field models, Proceedings of the 6th Asia-Pacific Symposium on Structural Reliability and Its applications, Shanghai, China, Juang, CPT-based evaluation of liquefaction potential accounting for soil spatial variability at multiple scales, Journal of Geotechnical and Geoenvironmental Engineering, 2 , , doi: The presence of fluid inside the pores and in between the interconnected grains may induce excess pore pressure, limit volumetric deformation, and introduce rate dependence to the mechanical response of the solid skeleton due to the transient nature of fluid diffusion. Moreover, for porous geomaterials such as sandstone, depending on the porosity level, they may be vulnerable to both shear and compaction failures. In addition to accumulating plastic dilation due to micro-crack growth, grain rotation, and sliding, these materials may exhibit significant inelastic compaction due to pore collapse or grain crushing when the confining pressure is sufficiently high. To capture the complicated hydro-mechanical interactions of fluid-infiltrating porous rock, we propose a stabilized enhanced strain finite element procedure for poromechanics and fully integrate it with an elasto-plastic cap model for porous rocks. Extensive fully-coupled finite element analysis are presented to study how macroscopic plastic volumetric response caused by pore collapse and grain rearrangement affects the seepage of pore fluid, and vice versa. Displacement left and Pore pressure right of 3D punch loading on water-saturated limestone Related publications: Ostien, Modeling the hydro-mechanical responses of strip and circular punch loadings on water-saturated collapsible geomaterials, Acta Geotechnica, doi: Ostien, Finite element analysis of hydro-mechanical coupling effects on shear failures of fully saturated collapsible geomaterials, Soil Behavior and Geomechanics, , doi: Sun, Finite element analysis of hydro-mechanical coupling of water saturated porous geomaterials, Proceedings of the 17th U. Hansen, Forward automatic differentiation for numerically exact computation of tangent operators in small- and large-deformation computational inelasticity, Supplemental UE: Zhou, Modeling dynamic responses of heterogeneous seabed with embedded pipeline through multiresolution random field and coupled hydromechanical simulations, in review, Discrete Element and Finite Element Modleing of Failure in Granular Materials The term granular media embraces a wide variety of materials both in nature and in engineering applications. Examples of granular media include sand, sandstone, pharmaceutical pills, and so on. Because of the abundant appearance, understanding and modeling of failure phenomena in granular materials can be of great practical importance. In this research, we propose multiscale approaches for modeling failure of granular media, where material descriptions at continuum scales are enhanced by information from finer scales. In particular, classical elasto-plasticity models are used to describe material behavior at the continuum scales and are cast within non-linear finite element programs through computational plasticity procedures. At the granular scale, discrete element method and high-fidelity local measurement data from physical experiments are used as micromechanical model to provide material response. Multiscale-nature of granular media shear band image from Alshibli et al. Discrete element simulation of triaxial compression experiment left and granular flow right. Experiment left, image from Alshibli et al. Evans, JMPS, Mechanical Model for Used Nuclear Fuel Cladding At the completion of the used nuclear fuel drying process, used fuel Zircaloy Zry4 cladding typically exhibits a significant population of circumferentially- and radially-oriented hydride inclusions. These hydride inclusions are formed during reactor operation, when water coolant that is in continual contact with the Zircaloy fuel cladding under elevated temperatures and pressures decomposes and the disassociated hydrogen goes into solid solution within the Zry4. The focus of this work is to develop a high-fidelity mechanical model for the Zry4-hydride system such that given a particular morphology of hydride inclusions, one can model and predict the response of the hydride cladding under various loading scenarios. The model treats the Zry4 matrix material as J2 elastoplastic, and treats the hydrides as platelets oriented in predefined directions e. Results from numerical modeling are compared well with as-fabricated Zry4 as well as hydride HB Robinson fuel cladding experiments. Radial left and circumferential right damage in hydrided nuclear cladding in ring compression test. Hansen, Journal of Nuclear Materials, ; G. Ductile Failure in Lightweight Metals under Various States of Stress Triaxiality Lightweight metals such as aluminum alloy are widely used in engineering applications. Their fracture strains have been shown experimentally to be linked with stress triaxiality, which is defined as the ratio of mean stress over effective shear stress. This work aims to understand and predict ductile failures in lightweight metals under various states of stress triaxiality through a combined numerical and experimental study. We employ a shear-modified Gurson-type damage model to account for damage void growth under low triaxiality. The model is formulated in a large-deformation hyper-elastic framework and implemented into our computing environment Albany to simulate various boundary value problems, where corresponding experimental efforts are undertaken by our collaboratores at Sandia National Laboratories. Tiraxiality left and damage right contours in combined tension and torsion simulation of a thin-tube Aluminum T specimen. High-performance Computing Software Packages Many of our recent reserch efforts are built on the high-performance computing environment Albany, developed at Sandia National Laboratories. The code is designed for the rapid development of finite-element analysis capabilities enabled through the concept of agile components. Albany has a unique infrastructure that limits the need for programming to just writing the physics residual equations based a generic data type; Albany will then compute the system Jacobian and preconditioner for the Newton nonlinear solver, as well as providing sensitivity and uncertainty information about the simulation and selected input and model parameters. In terms of computational mechanics capability, currently, Albany has multiphysics capabilities thermal-hydro-mechanical coupling and includes a extensive library of material models. Instruction to obtain and compile Albany can be found: An open source parallel discrete element method particle simulation software Trelis: A commercial scientific computing, data visualization and programming language and environment Spin 3D: A Fortran-based three-dimensional multiphysics finite element program References: We are grateful for the past and present support of our research by the following sponsors: Department of Energy, U.

DOWNLOAD PDF MULTISCALE GEOMECHANICS

Chapter 4 : Theoretical and Applied Mechanics Graduate Program | Northwestern Engineering

This book addresses the latest issues in multiscale geomechanics. Written by leading experts in the field as a tribute to Jean Biarez (), it can be of great use and interest to researchers and engineers alike. A brief introduction describes how a major school of soil mechanics came into.

His publications are numerous and well-known, particularly an early work Elementary Mechanics of Soil Behaviour co-authored with Jean Biarez. Early years and arrival in Grenoble 1 1. From Grenoble to Paris 4 1. The major research interests of Jean Biarez 8 1. Research and teaching 9 1. Conclusion 13 Chapter 2. From Particle to Material Behavior: The available tools, the variables analyzed and limits of the proposed analyses 16 2. Analysis of geometric anisotropy 18 2. Analysis of the distribution of contact forces in a granular material 21 2. Analysis of local arrays 24 2. Particle breakage 27 2. Bibliography 32 Chapter 3. Granular Materials in Civil Engineering: Behavior resulting from energy dissipation by friction 37 3. Main practical consequences 43 3. Influence of grain breakage on the behavior of granular materials 53 3. Introduction to the grain breakage phenomenon 53 3. Scale effect in shear strength 56 3. Practical applications to construction design 63 3. A new method for rational assessment of rockfill shear strength envelope 63 3. Incidence of scale effect on rockfill slope stability 65 3. Scale effects on deformation features 70 3. Bibliography 79 Chapter 4. Waste Rock Behavior at High Pressures: Development of new laboratory equipment for testing coarse materials 84 4. Mining rock waste 86 4. In situ grain size distribution 86 4. Analyzed waste rock 87 4. Characterization of mechanical behavior of the waste rock 88 4. Oedometric tests 88 4. Triaxial tests 89 4. Oedometric test results 90 4. Triaxial test results 94 4. Evolution of density 4. Stability analysis and design considerations 4. Operation considerations 4. Basal drainage system 4. Water management 4. Foundation conditions 4. Effects of rain and snow 4. Effects of in situ leaching on waste rock 4. Designing for closure 4. Bibliography Chapter 5. Biarez s model for the oedometer test 5. Perfect plasticity state and critical void ratio 5. Normally and overconsolidated isotropic loading 5. Analogy between sands and clays 5. Normally consolidated state ISL 5. Overconsolidated state Cs 5. The drained triaxial path for sands and clays 5. The reference behavior 5. The mathematical model 5. The undrained triaxial path for sands 5. Simplified Roscoe formula for undrained consolidated soils 5. Standard behavior for undrained sands 5. Perfect plasticity normalization of the curves in the q 1 plane and pore pressure variation 5.

Chapter 5 : Multiscale Geomechanics Lab - Home

Description. This book addresses the latest issues in multiscale geomechanics. Written by leading experts in the field as a tribute to Jean Biarez (), it can be of great use and interest to researchers and engineers alike.

Chapter 6 : Publication - Multiscale Geomechanics Lab

Multiscale Modeling. A family of geomaterials, ranging from granular rocks to concrete, exhibit a granular structure at some scale. For example, in sandstones and sands a granular structure at the millimeter scale is not uncommon.

Chapter 7 : Computational Geomechanics - Clemson University

GUONING,GUONING,Multiscale Geomechanics Lab,zju,æµ™æ±Ÿå¤§å-¦ä¸ªäººä¸»é¡µ,æµ™æ±Ÿå¤§å-¦,ä¸ªäººä¸»é¡µ.

Chapter 8 : Multiscale Geomechanics - ISTE

In this work, a multiscale method for linear elastic geomechanics is developed. It is shown that the framework previously proposed for flow through porous media in [9], [19] can be generalized to the simulation of the mechanical response of heterogeneous geological formations.