Discontinuity Spacing Analysis In Rock Masses Using 3d

This pioneering work deals with the parameterization of rockfalls in the context of 3D run-out modelling at a study site in the Bavarian Alps. The main objective was to cover not only low-magnitude, high-frequency rockfalls (10 msup3/sup) but also Mid-Magnitude events, which involve rock volumes of between 10 and 100 msup3/sup (boulder falls) and between 100 and 10,000 msup3/sup (block falls). As Mid-Magnitude events have been insufficiently covered in terms of rockfall modelling up to now, a geomechanical approach has been developed to characterize those events by means of a case study. For a 200 msup3/sup limestone block a potential failure scenario was analysed by combining a deterministic failure analysis with a numerical process-based run-out model. To model potential run-out scenarios of the 200 msup3/sup block, the beta version of the code RAMMS::Rockfall, developed by the Swiss Institute for Snow and Avalanche Research (SLF), was applied. RAMMS::Rockfall makes it possible to include the block shape and thus consider the effects of varying block shapes on the run-out distance. The run-out modelling for the entire project site was performed using the scientific code Rockyfor3D (Dorren/ecorisQ). To provide quantitative information in terms of input parameters, a field recording of block sizes at the talus slope, as well as a detailed discontinuity analysis at the source area, were conducted. The book successfully demonstrates how detailed and quantitative field investigation can contribute to 3D rockfall modelling./pp

These proceedings address the latest developments in information communication and technologies for geo-engineering. The 3rd International Conference on Information Technology in Geo-Engineering (ICITG 2019), held in Guimarães, Portugal, follows the previous successful installments of this conference series in Durham (2014) and Shanghai (2010). The respective chapters cover the following: Use of information and communications technologies Big data and databases Data mining and data science Imaging technologies Building information modelling applied to geo-structures Artificial intelligence Smart geomaterials and intelligent construction Sensors and monitoring Asset management Case studies on design, construction and maintenance Given its broad range of coverage, the book will benefit students, educators, researchers and professional practitioners alike, encouraging these readers to help take the geo-engineering community into the digital age

Drug prescribing errors are a common cause of hospital admission, and adverse reactions can have devastating effects, some even fatal. Pocket Prescriber Emergency Medicine is a concise, up-to-date prescribing guide containing all the "must have" information on a vast range of drugs that staff from junior doctors to emergency nurses, nurse prescribers, paramedics and other pre-hospital providers may encounter in the emergency setting. Key features: • A-Z list of over 500 of the most commonly prescribed

drugs with each entry containing the key prescribing information • Safety issues, warnings, drug errors and adverse effects • Practical guidance on drug selection, plus protocols and resuscitation guidelines • Advice and reference information for complicated prescriptions • Concise management summaries for common medical and surgical emergencies • Essential advice for pain relief—from acute pain management to procedural sedation • Clinically useful reminders of key facts from basic pharmacology to acute poisoning syndromes Pocket Prescriber Emergency Medicine supplies all your information needs concerning commonly prescribed drugs at a glance, enabling on-the-spot decision-making to provide the highest standard of care whilst mitigating prescribing errors.

Drilled shafts in rock are widely used as foundations of heavy structures such as highway bridges and tall buildings. Although much has been learned about the analysis and design of drilled shafts in rock, all the major findings are published in the form of reports and articles in technical journals and conference proceedings. This book i

Underground Space Use. Analysis of the Past and Lessons for the Future, Two Volume Set

Proceedings of the International World Tunnel Congress and the 31st ITA General Assembly, Istanbul, Turkey, 7-12 May 2005

Engineering Rock Mass Classifications

Guidelines for Open Pit Slope Design

Rock Slope Engineering

Predicting Flow Characteristics of a Lixiviant in a Fractured Crystalline Rock Mass

This book presents some fundamental concepts behind the basic theories and tools of discrete element methods (DEM), its historical development, and its wide scope of applications in geology, geophysics and rock engineering. Unlike almost all books available on the general subject of DEM, this book includes coverage of both explicit and implicit DEM approaches, namely the Distinct Element Methods and Discontinuous Deformation Analysis (DDA) for both rigid and deformable blocks and particle systems, and also the Discrete Fracture Network (DFN) approach for fluid flow and solute transport simulations. The latter is actually also a discrete approach of importance for rock mechanics and rock engineering. In addition, brief introductions to some alternative approaches are also provided, such as percolation theory and Cosserat micromechanics equivalence to particle systems, which often appear hand-in-hand with the DEM in the literature. Fundamentals of the particle mechanics approach using DEM for granular media is also presented. · Presents the fundamental concepts of the discrete models for fractured rocks, including constitutive models of rock fractures and rock masses for stress, deformation and fluid flow · Provides a comprehensive presentation on discrete element

methods, including distinct elements, discontinuous deformation analysis, discrete fracture networks, particle mechanics and Cosserat representation of granular media · Features constitutive models of rock fractures and fracture system characterization methods detaiing their significant impacts on the performance and uncertainty of the DEM models

More often than not, it is difficult or even impossible to obtain directly the specific rock parameters of interest using in situ methods. The procedures for measuring most rock properties are also time consuming and expensive. Engineering Properties of Rocks, Second Edition, explores the use of typical values and/or empirical correlations of similar rocks to determine the specific parameters needed. The book is based on the author's extensive experience and offers a single source of information for the evaluation of rock properties. It systematically describes the classification and characterization of intact rock, rock discontinuities, and rock masses, and presents the various indirect methods for estimating the deformability, strength, and permeability of these components as well as the in situ rock stresses. Presents a single source for the correlations on rock properties Saves time and resources invested on in situ testing procedures Fully updated with current literature Expanded coverage of rock types and geographical locations

This book focuses on the implementation and application of new concepts and methods to modelling, analysis, building, performance control and repair of structures of and in jointed rock and rock masses. It provides a forum for presentation of new research results and discussion for researchers.

Rock mechanics is a field of applied science which has become recognised as a coherent engineering discipline within the last two decades. It consists of a body of knowledge of the mechanical properties of rock, various techniques for the analysis of rock stress under some imposed perturbation, a set of established principles expressing rock mass response to load, and a logical methodology for applying these notions and techniques to real physical prob lems. Some of the areas where application of rock mechanics concepts have been demonstrated to be of industrial value include surface and subsurface construction, mining and other methods of mineral recovery, geothermal energy recovery and subsurface hazardous waste isolation. In many cases, the pressures of industrial demand for rigour and precision in project or process design have led to rapid evolution of the engineering discipline, and general improvement in its basis in both the geosciences and engineering mechanics. An intellectual commitment in some outstanding research centres to the proper development of rock mechanics has now resulted in a capacity for engineering design in rock not conceivable two decades ago. Mining engineering is an obvious candidate for application of rock mechanics principles in

the design of excavations generated by mineral extrac tion. A primary concern in mining operations, either on surface or underground, is loosely termed 'ground control', i. e.

A Complete Manual for Engineers and Geologists in Mining, Civil, and Petroleum Engineering

Advances in the Study of Fractured Reservoirs

An Equivalent Continuum Model

Rock Engineering

Mining and Rock Construction Technology Desk Reference

Deals with the methods of assessing the stability of rock slopes and the techniques of improving the stability conditions of natural and artificial slopes which are at risk. It also describes survey and measurement methods to model the behaviour of rock masses.

This classic handbook deals with the geotechnical problems of rock slope design. It has been written for the non-specialist mining or civil engineer, with worked examples, design charts, coverage of more detailed analytical methods, and of the collection and interpretation of geological and groundwater information and tests for the mechanical properties of rock.

Engineers wishing to build structures on or in rock use the discipline known as rock mechanics. This discipline emerged as a subject in its own right about thirty five years ago, and has developed rapidly ever since. However, rock mechanics is still based to a large extent on analytical techniques that were originally formulated for the mechanical design of structures made from man made materials. The single most important distinction between man-made materials and the natural material rock is that rock contains fractures, of many kinds on many scales; and because the fractures - of whatever kin- represent breaks in the mechanical continuum, they are collectively termed 'discontinuities' . An understanding of the mechanical influence of these discontinuities is essential to all rock engineers. Most of the world is made of rock, and most of the rock near the surface is fractured. The fractures dominate the rock mass geometry, deformation modulus, strength, failure behaviour, permeability, and even the local magnitudes and directions of the in situ stress field. Clearly, an understanding of the presence and mechanics of the discontinuities, both singly and in the rock mass context, is therefore of paramount importance to civil, mining and petroleum engineers. Bearing this in mind, it is surprising that until now there has been no book dedicated specifically to the subject of discontinuity analysis in rock engineering.

Rock mass classification methods are commonly used at the preliminary design stages of a construction project when there is very little information. It forms the bases for design and estimation of the required amount and type of rock support and groundwater control measures. Encompassing nearly all aspects of rock mass classifications in detail, Civil Engineering Rock Mass Classification: Tunnelling, Foundations and Landsides provides construction engineers and managers with extensive practical knowledge which is time-tested in the projects in Himalaya and other parts of the world in complex geological conditions. Rock mass classification is an essential element of feasibility studies for any near surface construction project prior to any excavation or disturbances made to earth. Written by an author team with over 50 years of experience in some of the most difficult mining regions of the world, Civil Engineering Rock Mass Classification: Tunnelling, Foundations and Landsides provides construction engineers, construction managers and mining engineers with the tools and methods to gather geotechnical data, either from rock cuts, drifts or core, and process the information for subsequent analysis. The goal is to use effective

mapping techniques to obtain data can be used as input for any of the established rock classification systems. The book covers all of the commonly used classification methods including: Barton ' s Q and Q ' systems, Bieniawski ' s RMR, Laubscher ' s MRMR and Hoek ' s and GSI systems. With this book in hand, engineers will be able to gather geotechnical data, either from rock cuts, drifts or core, and process the information for subsequent analysis. Rich with international case studies and worked out equations, the focus of the book is on the practical gathering information for purposes of analysis and design. Identify the most significant parameters influencing the behaviour of a rock mass Divide a particular rock mass formulation into groups of similar behaviour, rock mass classes of varying quality Provide a basis of understanding the characteristics of each rock mass class Relate the experience of rock conditions at one site to the conditions and experience encountered at others Derive quantitative data and guidelines for engineering design Provide common basis for communication between engineers and geologists

Applications to Porphyry Copper Deposits

Quantitative Parameterization and 3D – run – out Modelling of Rockfalls at Steep Limestone Cliffs in the Bavarian Alps

Third Edition

Engineering Rock Mechanics

Mining Science and Technology

Modeling of Rock Mass Discontinuities for Deformation Analysis

Naturally fractured reservoirs constitute a substantial percentage of remaining hydrocarbon resources; they create exploration targets in otherwise impermeable rocks, including under-explored crystalline basement; and they can be used as geological stores for anthropogenic carbon dioxide. Their complex behaviour during production has traditionally proved difficult to predict, causing a large degree of uncertainty in reservoir development. The applied study of naturally fractured reservoirs seeks to constrain this uncertainty by developing new understanding, and is necessarily a broad, integrated, interdisciplinary topic. This book addresses some of the challenges and advances in knowledge, approaches, concepts, and methods used to characterize the interplay of rock matrix and fracture networks, relevant to fluid flow and hydrocarbon recovery. Topics include: describing, characterizing and identifying controls on fracture networks from outcrops, cores, geophysical data, digital and numerical models; geomechanical influences on reservoir behaviour; numerical modelling and simulation of fluid flow; and case studies of the exploration and development of carbonate, siliciclastic and metamorphic naturally fractured reservoirs.

A comprehensive and illustrated desk reference with terms, definitions, explanations, abbreviations, trade names, quantifications, units and symbols used in rock mechanics, drilling and blasting. Now including rock mechanics as well, this updated edition presents 5127 terms, 637 symbols, 507 references, 236 acronyms, 108 formulas, 68 figures, 47 ta

Discontinuity Analysis for Rock EngineeringSpringer Science & Business Media

Guidelines for Open Pit Slope Design is a comprehensive account of the open pit slope design process. Created as an outcome of the Large Open Pit (LOP) project, an international research and technology transfer project on rock slope stability in open pit mines, this book provides an up-to-date compendium of knowledge of the slope design processes that should be followed and the tools that are available to aid slope design practitioners. This book links innovative mining geomechanics research into the strength of closely jointed rock masses with the most recent advances in numerical modelling, creating more effective ways for predicting rock slope stability and reliability in open pit mines. It sets out the key elements of slope design, the required levels of effort and the acceptance criteria that are needed to satisfy best practice with respect to pit slope investigation, design, implementation and performance monitoring. Guidelines for Open Pit Slope Design comprises 14 chapters that directly follow the life of mine sequence from project commencement through to closure. It includes: information on gathering all of the field data that is required to create a 3D model of the geotechnical conditions at a mine site; how data is collated and used to design the walls of the open pit; how the design is implemented; up-to-date procedures for wall control and performance assessment, including limits blasting, scaling, slope support and slope monitoring; and how formal risk management procedures can be applied to each stage of the process. This book will assist in meeting stakeholder requirements for pit slopes that are stable, in regards to safety, ore recovery and financial return, for the required life of the mine.

Discontinuity Analysis for Rock Engineering

Mechanics of Jointed and Faulted Rock

Probabilistic Methods in Geotechnical Engineering

Rock Mechanics, Drilling & Blasting

Proceedings of the conference, Canberra, 10-12 February 1993

IAEG/AEG Annual Meeting Proceedings, San Francisco, California, 2018 - Volume 1

This book is one out of six IAEG XIII Congress and AEG 61st Annual Meeting proceeding volumes, and deals with topics related to slope stability including case histories, landslide mapping, and emerging technologies. The theme of the IAEG/AEG Meeting, held in San Francisco from September 17–21, 2018, is Engineering Geology for a Sustainable World. The meeting proceedings analyze the dynamic role of engineering geology in our changing world. The meeting topics and subject areas of the six volumes are: Slope Stability: Case Histories, Landslide Mapping, Emerging Technologies; Geotechnical and Environmental Site Characterization; Mining, Aggregates, Karst; Dams, Tunnels, Groundwater Resources, Climate Change; Geologic Hazards: Earthquakes, Land Subsidence, Coastal Hazards, and Emergency Response; and Advances in Engineering Geology: Education, Soil and Rock Properties, Modeling.

Introduction to geologic fracture mechanics covering geologic structural discontinuities from

theoretical and field-based perspectives.
The 200 papers in this two-volume set are a selection of work by tunnel experts from Europe, Asia, and the USA, and also showcase the work of the host nation, Turkey. As the title implies, the scope of the book is enormous, covering every aspect of tunnelling from contract management to safety. The book is of special interest to researchers, scient
This book is open access under a CC BY 4.0 license. This volume contains peer-reviewed papers from the Fourth World Landslide Forum organized by the International Consortium on Landslides (ICL), the Global Promotion Committee of the International Programme on Landslides (IPL), University of Ljubljana (UL) and Geological Survey of Slovenia in Ljubljana, Slovenia from May 29 to June 2, 2017. The complete collection of papers from the Forum is published in five full-color volumes. Thisfirst volume contains the following: • Three forum lectures • Background and Content of the Sendai Partnerships 2015-2025 • Contribution from the signatory organizations of the Sendai Partnerships • Landslide Dynamics: ISDR-ICL Landslide Interactive Teaching Tools (LIT T) • Progress of the World Report on Landslides (WRL) • International Programme on Landslides (IPL): Objects, History and List of WCoE/IPL projects • UNESCO-KU-ICL UNITIWIN Network supporting IPL • Landslides: Journal of International Consortium on Landslides • International Programme on Landslides (IPL): WCoEs and IPL Projects • Landslides and Society Prof. Kyoji Sassa is the Founding President of the International Consortium on Landslides (ICL). He is Executive Director of ICL and the Editor-in-Chief of International Journal Landslides since its foundation in 2004. Prof. Matjaž Mikoš is the Forum Chair of the Fourth World Landslide Forum. He is the Vice President of International Consortium on Landslides and President of the Slovenian National Platform for Disaster Risk Reduction. Prof. Yueping Yin is the President of the International Consortium on Landslides and the Chairman of the Committee of Geo-Hazards Prevention of China, and the Chief Geologist of Geo-Hazard Emergency Technology, Ministry of Land and Resources, P.R. China. IPL (International Programme on Landslides) is a programme of the ICL. The programme is managed by the IPL Global Promotion Committee including ICL and ICL supporting organizations, UNESCO, WMO, FAO, UNISDR, UNU, ICSU, WFEO, IUGS and IUGG. The IPL contributes to the United Nations International Strategy for Disaster Reduction and the ISDR-ICL Sendai Partnerships 2015-2025.
Estimation of Shear Strength Using Fractals as a Measure of Rock Fracture Roughness
Practical Rock Mechanics
Volume 1 ISDR-ICL Sendai Partnerships 2015-2025
Engineering Group Working Party Report
Rock Characterization
Proceedings of the 3rd International Conference (ICITG), Guimarães, Portugal

Most rock masses encountered in civil and mining engineering projects contain pre-existing discontinuities. These discontinuities weaken the rock masses to an extent, which depends very much on the size of engineering structure relation to discontinuity spacing. The strength and deformability of rock mass is controlled not only by the intact portion of rock, but by the characteristic of the joints that break up the mass, particularly their pattern and their orientation with respect to the in-situ stresses. In considering the effect of joints, the discrete approach emerged as an efficient tool and advocated since 1970s (Cundall, 1971). However, the numerical approach with modelling the joints explicitly has the limitation of computational complexity for modelling large-scale problems with extremely large number of joints. As an alternative to this limitation, the equivalent continuum approach models the jointed rock masses as a continuum with the equivalent properties that represent implicitly the effects of the joints. Several numerical methods have been developed by various researchers to model jointed rock masses as equivalent continuum, using various techniques. However, the existing equivalent continuum models are complicated and need more input data from experimental or field testing in order to carry out the analysis. Present approach attempts to use statistical relations, which are simple and obtained after analyzing a large data from the literature on laboratory test results of jointed rock masses. Systematic investigations were done including laboratory experiments to develop the methodologies to determine the equivalent material properties of rock mass and their stress-strain behaviour, using a hyperbolic approach (Duncan and Chang, 1970). Present study covers the development of equivalent continuum model for rock mass right from developing statistical correlations to find out equivalent material properties based on experimental results, to the implementat.

Engineering rock mechanics is the discipline used to design structures built in rock. These structures encompass building foundations, dams, slopes, shafts, tunnels, caverns, hydroelectric schemes, mines, radioactive waste repositories and geothermal energy projects: in short, any structure built on or in a rock mass. Despite the variety of projects that use rock engineering, the principles remain the same. Engineering Rock Mechanics clearly and systematically explains the key principles behind rock engineering. The book covers the basic rock mechanics principles; how to study the interactions between these principles and a discussion on the fundamentals of excavation and support and the application of these in the design of surface and underground structures. Engineering Rock Mechanics is recommended as an across-the-board source of information for the benefit of anyone involved in rock mechanics and rock engineering.

The Engineering Group of the Geological Society Working Party brought together experts in glacial and periglacial geomorphology, Quaternary history, engineering geology and geotechnical engineering to establish best practice when working in former glaciated and periglaciated environments. The Working Party addressed outdated terminology and reviewed the latest academic research to provide an up-to-date understanding of glaciated and periglaciated terrains. This transformative, state-of-the-art volume is the outcome of five years of deliberation and synthesis by the Working Party. This is an essential reference text for practitioners, students and academics working in these challenging ground conditions. The narrative style, and a comprehensive glossary and photo-catalogue of active and relict sediments, structures and landforms make this material relevant and accessible to a wide readership.

Report No. FHWA-RD.

Rock-socketed Shafts for Highway Structure Foundations

ISRM Symposium, Eurock ?92, Chester, UK, 14-17 September 1992

Drilled Shafts in Rock

An Introduction to the Principles

Comprehensive Rock Engineering:: Principles, Practice and Projects

This is the first authoritative reference on rock mass classification, consolidating into one handy source information once widely scattered throughout the literature. It includes new, previously unpublished material and case histories, presents the fundamental concepts of classification schemes, and critically appraises their practical application in industrial projects such as tunneling and mining.

As mining operations increase in scale and mines go progressively deeper, the geotechnical input into mine design is of importance. This book covers topics in geotechnical instrumentation and monitoring, including coverage of groundwater, displacement and environmental monitoring.

Jointly sponsored by the China University of Mining and Technology and the University of Nottingham, UK, a total of 187 papers have been included in the proceedings, of which fifty-two are contributed by authors outside of China. Scholars and experts from both China and abroad discuss and exchange information on the latest developments in mining sc

This book covers the main mining issues where geostatistics, a discipline founded in the 1960s to study regionalized variables measured at a limited number of points in space, is expected to play a role. Each chapter of the book is associated with a stage of the mining sequence, including the interpretation and geological modeling of mineral deposits, evaluation of in-situ and recoverable resources, long-term mine planning, short-term planning and ore control, geotechnics, geometallurgy and sampling. This work, featuring more than 150 illustrations, avoids the traditional laborious and crippling theoretical treatment of geostatistics and is systematically oriented toward a practical exhibition of the problems and proposed solutions. The writing is fluid and intended to involve the reader. The book is the fruit of more than 35 cumulative years of applied research by the authors, a professor at the University of Chile and a researcher at Mines ParisTech, carried out in collaboration with the Chilean company Codelco since the late 1990s. Despite focusing on copper porphyry deposits, the generalization of the methods presented to the entire mining industry is straightforward. The broad range of problems addressed, including generally neglected disciplines such as geotechnics, geometallurgy and sampling, and their practical presentation make this book unique and usable by a very wide audience – students, researchers, geologists, engineers, geotechnicians and metallurgists.

Geotechnical Instrumentation and Monitoring in Open Pit and Underground Mining

Analysis and Design

Discontinuous Deformation Analysis in Rock Mechanics Practice
Strength And Deformation Behaviour Of Jointed Rocks
Geostatistics for the Mining Industry
Slope Stability: Case Histories, Landslide Mapping, Emerging Technologies

The numerical, discrete element, Discontinuous Deformation Analysis (DDA) method was developed by Dr. Gen-hua Shi while he was working at the University of California, Berkeley, under the supervision of Prof. Richard E. Goodman in the late 1980s. Two-dimensional DDA was published in 1993 and three-dimensional DDA in 2001. Since its publication DDA has been verified, validated and applied in numerous studies worldwide and is now considered a powerful and robust method to address both static and dynamic engineering problems in discontinuous rock masses. In this book Yossef H. Hatzor and Guowei Ma, co-chairs of the International Society for Rock Mechanics (ISRM) Commission on DDA, join Dr. Shi in authoring a monograph that presents the state of the art in DDA research. A comprehensive discussion of DDA development since its publication is provided in Chapter 1, followed by concise reviews of 2D and 3D DDA in chapters 2 and 3. Procedures to select geological and numerical input parameters for DDA are discussed in Chapter 4, and DDA validation and verification is presented in Chapter 5. Applications of DDA in underground and rock slope engineering projects are discussed in chapters 6 and 7. In Chapter 8 the novel contact theory recently developed by Dr. Shi is published in its complete form, for the first time. This book is published within the framework of the ISRM Book Series and is the contribution of the ISRM DDA Commission to the international rock mechanics community.

The proceedings of this conference contain keynote addresses on recent developments in geotechnical reliability and limit state design in geotechnics. It also contains invited lectures on such topics as modelling of soil variability, simulation of random fields and probability of rock joints. Contents: Keynote addresses on recent development on geotechnical reliability and limit state design in geotechnics, and invited lectures on modelling of soil variability, simulation of random field, probabilistic of rock joints, and probabilistic design of foundations and slopes. Other papers on analytical techniques in geotechnical reliability, modelling of soil properties, and probabilistic analysis of slopes, embankments and foundations.

An Ideal Source for Geologists and Others with Little Background in Engineering or Mechanics Practical Rock Mechanics provides an introduction for graduate students as well as a reference guide for practicing engineering geologists and geotechnical engineers. The book considers fundamental geological processes that give rise to the nature of rock masses and control their mechanical behavior. Stresses in the earth's crust are discussed and methods of measurement and prediction explained. Ways to investigate, describe, test, and characterize rocks in the laboratory and at project scale are reviewed. The application of rock mechanics principles to the design of engineering structures including tunnels, foundations, and slopes is addressed. The book is illustrated throughout with simple figures and photographs, and important concepts are illustrated by modern case examples. Mathematical equations are kept to the minimum necessary and are explained fully—the book leans towards practice rather than theory. This text: Addresses the principles of rock mechanics as it applies to both structural geology and engineering practice Demonstrates the importance of and methods

of geological characterisation to rock engineering Examines the standard methods of rock mechanics testing and measurement as well as interpretation of data in practice Explains connections between main parameters both empirically as well as on the basis of scientific theory Provides examples of the practice of rock mechanics to major engineering projects Practical Rock Mechanics teaches from first principles and aids readers' understanding of the concepts of stress and stress transformation and the practical application of rock mechanics theory. This text can help ensure that ground models and designs are correct, realistic, and produced cost-effectively.

Rock Slope Engineering covers the investigation, design, excavation and remediation of man-made rock cuts and natural slopes, primarily for civil engineering applications. It presents design information on structural geology, shear strength of rock and ground water, including weathered rock. Slope design methods are discussed for planar, wedge, circular and toppling failures, including seismic design and numerical analysis. Information is also provided on blasting, slope stabilization, movement monitoring and civil engineering applications. This fifth edition has been extensively up-dated, with new chapters on weathered rock, including shear strength in relation to weathering grades, and seismic design of rock slopes for pseudo-static stability and Newmark displacement. It now includes the use of remote sensing techniques such as LiDAR to monitor slope movement and collect structural geology data. The chapter on numerical analysis has been revised with emphasis on civil applications. The book is written for practitioners working in the fields of transportation, energy and industrial development, and undergraduate and graduate level courses in geological engineering.

Engineering Geology and Geomorphology of Glaciated and Periglaciated Terrains

Engineering Properties of Rocks

Proceedings of the 5th International Symposium on Mining Science and Technology, Xuzhou, China 20-22 October 2004

Tunnelling, Foundations and Landslides

Rock Testing and Site Characterization

Engineering Rock Mass Classification