Rock Failure Mechanisms: Explained and Illustrated

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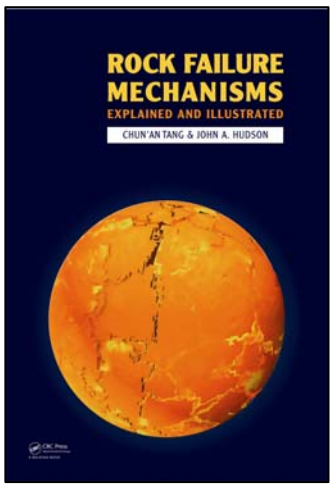

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INTRODUCTION

The subject of rock failure has been studied in a co-ordinated way since the 1960s. The way in which rock fails can be studied by examination of natural rock formations that have been stressed and strained over geological time, by laboratory experiments on rock samples, through *in situ* experiments, and by observing the results of rock excavation and loading during engineering construction. In this book, rock failure mechanisms are illustrated and explained.

Over the years, there have been three main developmental phases supporting rock engineering design: analysis based on elasticity theory; the use of rock mass classification systems; and computer modelling. The elasticity theory approach is useful because it enables the stresses around circular and elliptical holes to be determined, although the approach is most useful for deep excavations where the rock behaviour is essentially elastic. Rock mass classification is also useful because the variety of factors affecting rock behaviour can be accommodated in a mathematical expression, thus providing an index value for rock quality. Computer modelling started as a method of displaying analytical results and extending the analyses to more complex situations. However, in the last two decades, computer modelling has advanced by leaps and bounds so that it is now, not only the design tool of choice for rock engineering, but is also a research tool in its own right for exploring rock failure mechanisms. For example, a comprehensive knowledge of the state of stress throughout the micro-structure of a rock specimen or throughout a fractured rock mass several kilometres in size cannot be established by direct laboratory or *in situ* measurements but it can be studied through computer modelling using numerical techniques. For this reason, to illustrate rock failure mechanisms, many of the diagrams in this book are the output from numerical simulations. By many comparisons with the behaviour of real rocks, there is the confidence that these simulations do indeed represent real rock failure behaviour.

When engineering on or in rock masses, one may wish to avoid failure (e.g. when excavating a cavern to host the turbines in a hydro-electric project) or one may wish to cause failure (e.g. in the block caving method of mining when a large rock block is undercut and breaks up as it descends). In both cases, wishing to avoid or to cause rock failure, it is important to understand the rock failure mechanisms and the many factors that can affect the mode of rock failure, in particular the nature of the applied stress state and the nature of the rock. The applied stress can be in the form of tension, compression or shear, and various combinations of these. The rock itself is generally discontinuous, inhomogeneous and anisotropic and occurs on a multiplicity of scales. This means that rock failure can be manifested in many ways. In the book mainly brittle rock failure is considered.

The authors' intention in writing this book has been to provide an overview of the physical manifestations of rock failure in the variety of circumstances that can occur. Accordingly, the Chapters follow the logic of an overall introduction explaining the geological background and engineering failure, then direct loading in tension, compression and shear, the effects of inhomogeneity, anisotropy, multiple loading and time dependency, the effects of water and heat flow, engineering projects, and finally the two concluding Chapters on 3-D modelling and concluding remarks. Five of the individual chapters are somewhat longer than the others because of the importance of their subject matter: Chapter 3 on indirect tension, Chapter 4 on uniaxial compression, Chapter 6 on the effect of rock heterogeneity, Chapter 10 on the coalescence of fractures and Chapter 19 on particle breakage.

Photographs and computer simulation outputs are included to explain and illustrate the rock failure mechanisms. It has not been the intention to provide detailed mathematical expressions characterising rock failure in the different circumstances, but rather to present illustrative examples of the rock failure mechanisms so that the overall spectrum of rock failure can be appreciated by all those concerned, including clients, consulting engineers, contractors, students, lecturers and researchers.

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Rock Failure Mechanisms Explained and Illustrated Chunâ€™an Tang School of Civil and Hydraulic Engineering Dalian University of Technology, Dalian, P.R. China John A. Hudson Department of Earth Science and Engineering Imperial College of Science, Technology and Medicine London, UK CRC Press Taylor & Francis Group 6000 Broken Sound Parkway NW, Suite 300 Boca Raton, FL 33487-2742 Â© 2011 by Taylor & Francis.Â We use photographs and computer simulation outputs to explain and illustrate the rock failure mechanisms. It is not our intention to 4.2.3.3 Stress distribution and failure-. induced stress redistribution . 68 4.3 Rock failure modes in uniaxial compression .Â 11.3.2 Influence of stress wave amplitude on the. fracture process and failure pattern . 186 12 Rock failure and water flow . 189 12.1 Introduction . 189 12.2 Rock failure under hydraulic pressure . It subsquently deals in detail with explaining, simulating and illustrating rock failure in laboratory and field. The concluding chapter discusses coupled modelling and the anticipated future directions for this type of computer simulation. An appendix describing the RFPA numerical model (Rock Failure Process Analysis program) is also included. Download from free file storage. Resolve the captcha to access the links! It contains an introductory chapter explaining the role of rock failure in engineering projects plus a summary of the theories governing rock failure and an explanation of the computer simulation method. It subsquently deals in detail with explaining, simulating and illustrating rock failure in laboratory and field. The concluding chapter discusses coupled modelling and the anticipated future directions for this type of computer simulation. An appendix describing the RFPA numerical model (Rock Failure Process Analysis program) is also included. Authors / Editors: Hudson and John A. Price: $129...Â No comments were found for Rock Failure Mechanisms: Illustrated and Explained. Be the first to comment! Add your comment. It contains an introductory chapter explaining the role of rock failure in engineering projects plus a summary of the theories governing rock failure and an explanation of the computer simulation method. Read more iformation about he book here! Want to read more like this story?Â Geoengineer.org uses third party cookies to improve our website and your experience when using it. To find out more about the cookies we use and how to delete them visit our Cookies page. Allow cookies.