Book review

Advanced unsaturated soil mechanics and engineering.
C. W. W. Ng and B. Menzies. London: Taylor and Francis,
2007. 712 pp. ISBN 9 780 4154 3679 3. £100

The number of engineering books describing the theory and applications of unsaturated soil mechanics is relatively limited, with no more than two or three titles currently available. In this context, this book, co-authored by two leading international figures in the area of geotechnical engineering and soil testing, surely represents a welcome addition to the bookshelf of those interested in such a topic.

This book is different from the other texts on unsaturated soil mechanics currently available. After reading only a few pages, the reader immediately realises that (as hinted by the word 'advanced' in the title) the book is not targeted at an undergraduate readership but rather to experienced engineers with a sound background in geotechnics or to postgraduate students with some degree of previous knowledge in unsaturated soil mechanics. A further feature is that large parts of the text and figures in the book have been collected as verbatim quotes and excerpts from scholarly contributions published in other books, journals or conference proceedings. Because of this, the volume looks more like a sequence of state-of-the-art reviews focused on different aspects of unsaturated soil mechanics rather than as a conventional textbook.

The book is divided into four parts, which are in turn subdivided into one or more chapters covering an extensive range of information related to unsaturated soils. Part 1 covers the fundamental aspects of the engineering behaviour of unsaturated soils, including definitions of suction, the occurrence of cavitation in soils and the choice of constitutive variables, together with other topics related to the measurement of seepage flow and the determination of soil-water retention characteristics. Various aspects of the stress-strain behaviour and the mechanical properties specific to unsaturated soils are covered in Part 2, which includes the description of collapse/swelling caused by water content changes, the dependency of shear strength on suction and the effect of partial saturation on small strain stiffness. Part 3 presents the formulation of an elasto-plastic constitutive model recently proposed by the first author, which incorporates some of the main engineering features of unsaturated soil behaviour. Finally, Part 4 is devoted to slope engineering applications. It includes the presentation of a case study with extensive field monitoring recently undertaken in China, as well as a review of the methods used for slope stability analysis in unsaturated soils. Parts 1, 2 and 4 are approximately of equal length and they take most of the space in the volume whereas significantly less prominence is given to Part 3. This is possibly a deliberate choice by the authors but it produces a degree of imbalance in the structure of the text, with large emphasis put on the description of engineer-

ing behaviour, particularly in relation to slope engineering applications, and comparatively less attention dedicated to recent developments in the area of constitutive modelling.

The material covered in the book, as well as the general focus of the presentation, is rather skewed towards the personal research interests and recent work of the authors. This is, of course, inevitable in a contribution of this type, and is not in itself disadvantageous. Nor does it detract from the main merit of the text, which is to present some of the most recent scientific developments in the area. Nevertheless, it is perhaps surprising that a text on advanced unsaturated soil mechanics does not include a detailed description of the Barcelona Basic Model. This constitutive model has now become rather dated, but is still arguably the best known elasto-plastic model for unsaturated soils and has been a source of inspiration for the development of many subsequent constitutive models.

In Part 1 the influences of dry density and stress history on the water retention behaviour of unsaturated soils are clearly described in the light of detailed experimental evidence but the description is separated from the definition of the stress-strain elasto-plastic modelling ideas presented in Part 3. During the past ten years there has been growing evidence that soil straining and water retention are intrinsically linked phenomena that can be described within a single constitutive framework. Indeed, soil-water retention properties and stress-strain behaviour increasingly appear as two complementary aspects of the same constitutive characteristic of the soil. This should find wide recognition in an advanced text on unsaturated soil mechanics, where mechanical behaviour and water retention properties should be introduced in the same context together with the relevant constitutive models. The extension of Part 3 to include a description of the water retention behaviour, together with the formulation of a comprehensive constitutive framework coupling both hydraulic and mechanical behaviours, would be a desirable enhancement in future editions of this book.

The structure of the book, together with the nature of the subject matter covered, make this particularly attractive reading for those at the start of a research project in the area of unsaturated soils and, in general, for those aiming to establish a basis of knowledge on which to build further original scientific contributions. For example, any PhD student at the point of embarking on a new project in unsaturated soil mechanics would definitely benefit from reading those sections of the text relevant to her/his research, not only to acquire new relevant knowledge but also to learn about the key publications that deserve further exploration.

Overall, this book is a worthwhile reference with unique characteristics with respect to other books on unsaturated soil mechanics and it has the potential to become a useful complement to the texts available to researchers in this area.

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