

# GEOTECHNICAL ENGINEERING: PRINCIPLES AND PRACTICES

Second Edition

**Donald P. Coduto**

*California State Polytechnic University, Pomona*

**Man-chu Ronald Yeung**

*California State Polytechnic University, Pomona*

**William A. Kitch**

*California State Polytechnic University, Pomona*

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#### About the cover photo

The Tower of Pisa began to tilt during its construction during the 12<sup>th</sup> century. By the time construction was completed in 1370, the tower was tilting approximately 2° to the south. The tilt of the tower gradually increased over the centuries until it reached 5½° in 1990, by which time the top of the tower was approximately 4½ meters out of plumb. The tower was closed to the public in 1990 for fear that it might collapse, and a major international effort was undertaken to restore it to a safe condition. The cover photo shows the technique used to stabilize the tower. It involved carefully removing soil from under the foundation on the north side of the tower with the drilling equipment shown in the photo. This allowed the tower to settle back to the north and reduced the tilt by ½°, moving the top of the tower back to the north by ½ meter. The tower is now back to the position it was in during the 1830s and has not moved significantly since being stabilized. The tower was reopened to the public in 2001 (Burland et al. 2003 and 2009).

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# Preface

This second edition of *Geotechnical Engineering: Principles and Practices* reflects our experiences using the first edition with our own students over the past 12 years, as well as constructive suggestions we received from faculty, students, and practicing engineers. Some topics have been condensed or eliminated, while others have been expanded, clarified, or added. The primary target audience remains the same: undergraduate civil engineering students in their first geotechnical engineering course.

## WHAT IS NEW IN THIS EDITION

This edition benefits from the addition of two new co-authors: Man-chu Ronald Yeung and William A. Kitch. The three of us are colleagues at Cal Poly Pomona. Each brings unique experiences and skills to the manuscript, and we believe the final product has benefitted from this collaboration.

We have strengthened the coverage of “principles” to facilitate a better understanding of fundamental geotechnical engineering concepts and to provide a firmer foundation for more advanced studies. These discussions include extensive narratives intended to impart an understanding of the underlying physical processes, not just an ability to do computations. The book also retains a “practices” component, which introduces students to the practical application of these principles to real engineering problems. Although this book is not intended to be a comprehensive treatise on geotechnical engineering practice, we have found that a mix of theory and application facilitates the most effective learning.

Every chapter has some updates, some of which are quite extensive. The most noteworthy improvements include the following:

- The chapter on soil strength has been updated to provide more in-depth coverage of the underlying physical behavior.
- The chapter on slope stability has been enhanced.
- The coverage of structural foundations has been expanded to two chapters.
- A new appendix, *Finite Difference Solutions to Flow Problems*, has been added.
- Stand-alone chapters on geoenvironmental engineering, dams and levees, soil improvement, and geotechnical earthquake engineering have been eliminated.

Key points from these chapters have been condensed and moved to other locations.

- Many of the homework problems have been updated and new homework problems have been added.

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DONALD P. CODUTO  
MAN-CHU RONALD YEUNG  
WILLIAM A. KITCH  
CLAREMONT, CALIFORNIA  
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