# Numerical Methods and Implementation in Geotechnical Engineering – Part 1

Y.M. Cheng, J.H. Wang
L. Liang, W.H. Fung Ivan

Bentham Books

# Frontiers in Civil Engineering

*(Volume 3)*

## *Numerical Methods and Implementation in Geotechnical Engineering – Part 1*

**Authored by**

**Y.M. Cheng**

*School of Civil Engineering, Qingdao University of Technology, Qingdao, China*
*Department of Civil and Environmental Engineering, Hong Kong, Polytechnic University, Hong Kong*

**J. H. Wang**

*National Base of International Science and Technology Cooperation, for Intelligent Manufacturing Service, Chongqing Technology and Business University, Chongqing, China*
*Chongqing South-to-Thais Environmental Protection Technology, Research Institute Co. Ltd., China*

**L. Liang**

*School of Civil Engineering, Qingdao University of Technology, Qingdao, China*

**W. H. Fung Ivan**

*Department of Architecture and Civil Engineering, City University of Hong Kong, Hong Kong*

# Frontiers in Civil Engineering

*Volume # 3*

*Numerical Methods and Implementation in Geotechnical Engineering – Part 1*

Authors: Y.M. Cheng, J. H. Wang, L. Liang and W. H. Fung Ivan

ISSN (Online): 2468-4708

ISSN (Print): 2468-4694

ISBN (Online): 978-981-14-3739-7

ISBN (Hardback/Hardcover): 978-981-14-3737-3

ISBN (Paperback/Softcover): 978-981-14-3738-0

need for a court order if at any point you breach any terms of this License Agreement. In no event will any delay or failure by Bentham Science Publishers in enforcing your compliance with this License Agreement constitute a waiver of any of its rights.

3. You acknowledge that you have read this License Agreement, and agree to be bound by its terms and conditions. To the extent that any other terms and conditions presented on any website of Bentham Science Publishers conflict with, or are inconsistent with, the terms and conditions set out in this License Agreement, you acknowledge that the terms and conditions set out in this License Agreement shall prevail.

**Bentham Science Publishers Pte. Ltd.**
80 Robinson Road #02-00
Singapore 068898
Singapore
Email: subscriptions@benthamscience.net

BENTHAM
SCIENCE

# CONTENTS

# PREFACE

For most of the geotechnical problems, particularly those related to real life problems, analytical solutions are usually not available. For both research and practical applications, numerical methods and computer programs are required for many cases. In the recent forty years, many numerical methods have evolved for various kinds of engineering problems. Engineers are now well adapted to the uses of different computer programs for the solution of engineering problems. There is however a major drawback in the current engineering practice in that most of the engineers are not familiar with the basics of the numerical methods, the methods of implementations and the limitations of the numerical methods/programs. In fact, to a certain extent, the methods of implementations and the limitations of the numerical methods are related. In many internal studies using different commercial numerical programs, the authors sometimes found noticeable or even completely different results with different programs or the same program with different default setting for a given problem, and this situation is not uncommon. For a problem with unknown solution, how an engineer assess the acceptability of the computer results is a difficult issue that needs serious attention. In several technical meetings in the Hong King Institution of Engineers, the authors have discussed with some engineers about the appreciation of the limitations of the daily-used engineering programs. If two computer programs can produce significantly different results, how an engineer determine the acceptability of the results actually require deeper knowledge about the basics of the numerical methods and implementations. Interestingly, the authors like to ask the students a question "Different answers can be obtained from different commercial programs. Which results should be accepted, and why should those results be accepted?". In general, the authors challenge the students (undergraduate and graduate students) every year for this question, and virtually this question is never answered properly. The problems in the assessment of the numerical results will also be discussed in this book, which is seldom addressed in other books or research papers.

The authors have participated in different types of geotechnical research and consultancy works in different countries, and has written a book *Frontier in Civil Engineering, Vol.1, Stability Analysis of Geotechnical Structures*, which is well-favored by many students, engineers and researchers. Most of the books on numerical methods seldom address the actual procedures in numerical implementations, but many postgraduates actually need to develop computer programs to consider special constitutive models, loadings, numerical methods, boundary conditions and other effects. In view of the limitations of most of the books at present, the authors would like to write a new book on numerical methods and the implementations based on their previous works, and this new book should be useful for senior undergraduates, postgraduates, engineers as well as researchers.

In this book, finite element method, optimization method, plasticity based slip line method, limit analysis method, distinct element method, Smoothed-Particle Hydrodynamics Method, Spectral Element Method and Material Point Method will be introduced. The present book will not cover dynamic problems which is a big topic, and hopefully this will be covered later by the authors in another book. The authors will also try to explain the methods of implementation for some of these methods through sample computer programs. Sample programs are given and discussed to assist students in developing programs for their own uses. These programs are not meant to be efficient or up-to-date, but will help the students in learning about the implementation of some numerical methods. This book should not be taken as a classical textbook, as the authors do not intend it to be. There are many new contributions to numerical methods in geotechnical engineering over the last 30 years, and many topics can be covered by individual books for detailed discussion. There is also no way for the authors to cover all numerical methods in details in this book. This book is a basic introduction to some more commonly used numerical methods in geotechnical engineering which have been used by the authors for teaching and research, with the discussion of some common commercial program problems, programming techniques and applications.

## ACKNOWLEDGEMENTS

The authors would like to acknowledge the support from the Hong Kong Research Grant Council through the project PolyU 5128/13E, the National Natural Science Foundation of China (Grant No. 51778313), the Cooperative Innovation Center of Engineering Construction and Safety in Shangdong Blue Economic Zone. The present book is also partly supported by CityU Strategic Research Grant for unfunded GRF/ECS (SRG-Fd): Enhancement of Building Information Modelling (BIM) in Construction Safety by GIS: 4D Modelling, Geo-spatial Analysis and Topography Modelling (Preliminary Study) (CityU Project No. 7004631).

## CONSENT FOR PUBLICATION

Not applicable.

## CONFLICT OF INTEREST

The authors confirm that this chapter contents have no conflict of interest.

**Y.M. Cheng**
School of Civil Engineering, Qingdao University of Technology,
Qingdao,
China
&
Department of Civil and Environmental Engineering, Hong Kong,
Polytechnic University,
Hong Kong

CHAPTER 1

# Introduction

**Abstract:** This chapter is an introduction to the requirement and the various problems that will be encountered during numerical modelling in geotechnical engineering. A large scale tunneling work in Australia will be used to illustrate the necessity to use numerical methods in some real life engineering problems. After that, the authors will introduce a series of numerical problems that may be encountered during the use of commercial engineering programs. Such problem cases may arise from various sources, and engineers are strongly advised to understand the basic principle of each commercial program and to assess the program output with care before accepting the results of analysis. Finally, some of the more important governing differential equations for geotechnical problems are discussed.

**Keywords:** Errors, Finite element, Governing differential equations, Modelling, Numerical methods, Slope stability, Tunneling.

## 1.1. INTRODUCTION

For most of the geotechnical problems, particularly those related to real life problems, analytical solutions are usually not available. The authors have carried out many research works and large scale practical projects, and in general, most of the works are complicated in both geometry, applications of loadings, construction sequences, material behavior, ground water conditions as well as other factors. As a good illustration, the construction of the Airport Link project in Brisbane at Australia is a good example (Cheng *et al*. 2019). The project is located beneath the railway embankment of the North Coast Railway line adjacent to Kalinga Park, and the site comprises a thick layer of soft clay. The Airport Link, which is one of the most complex roads and tunnel engineering feats in Queensland's history, will be the first major motorway linking Brisbane city to the northern suburbs and airport precinct. The Link is a 6.7km toll road, mainly underground, connecting the Clem 7 Tunnel, Inner City Bypass and local road network at Bowen Hills, to the northern arterials of Gympie Road and Stafford Road at Kedron, Sandgate Road and the East West Arterial leading to the airport. At one of the project sites, the tunnel section under the QR railway embankment at Toombul is constructed by box jacking technique. The significant size of the

**Y.M. Cheng, J. H. Wang, L. Liang, W. H. Fung Ivan (Eds.)**

launch box requires 85,000m$^3$ of spoil to be excavated under the railway embankment. Headwalls, canopy tubes and sidewall nails are constructed to retain the railway embankment for the excavation of the jacking shafts. The challenging ground conditions and requirements for the present project require the combinations of innovative ground support, construction methods and detailed and realistic analysis for the proper execution of the works. In this project, the site is mostly composed of soft clays which are susceptible to ground settlement problem during construction, and a typical section is shown in Fig. (**1.1**). The SPT value for the soft clay is less than ten, whereas the CPT friction ratio for soft clay ranges between 2% and 4% with a mean pore pressure of approximately 0.12 MPa (see also Table **1.1**). The SPT value for the firm clay is approximately 20, whereas the friction ratio for firm clay ranges between 4-8% with a mean pore pressure of approximately 0.38 MPa. The railway has to be maintained in operation during the whole construction to ensure the transportation, and the settlement of the soft clay must be maintained at a low level with minimal disturbance to the railway track. This is technically a very difficult problem, and the original construction proposal is to inject large amount of grout into the ground to stabilize it prior to excavation. However, the cost of the original scheme is extremely high so that a more economical alternative is considered. Ground improvement works underneath the QR railway embankment are hence required for the stability consideration during box jacking stages. A trapezoidal jet grout block constructed immediately behind the headwall is used as a gravity type retaining wall to reduce the earth pressures on the piled headwall. A smaller jet grout block is provided at the north west of the final jacked box location and is used as an anchorage to the northern sidewall nails. A low strength grout wall is installed west of the railway to provide a water cut-off for the TBM launch box. The grout wall is also used in the jacking scheme design to provide adequate anchorage to the geonails at the receiving pit side, eliminating an approximate 10m length of nail with significant time and cost savings. The resulting 'nail anchored' western grout wall can then be used to maintain slope stability, enabling initial excavations in the cut and cover receiving pit to commence early.

**Table 1.1. Average properties of ground soil (Young's modulus determined from dilatometer, vane shear and CPT tests).**

| Soil | Undrained Shear Strength. (kPa) | Young's Modulus. (MPa) | Water Content. (%) | Plasticity Index |
|---|---|---|---|---|
| Soft clay | 20 | 6 | 57 | 25 |
| Firm clay | 37 | 20 | 46 | 45 |

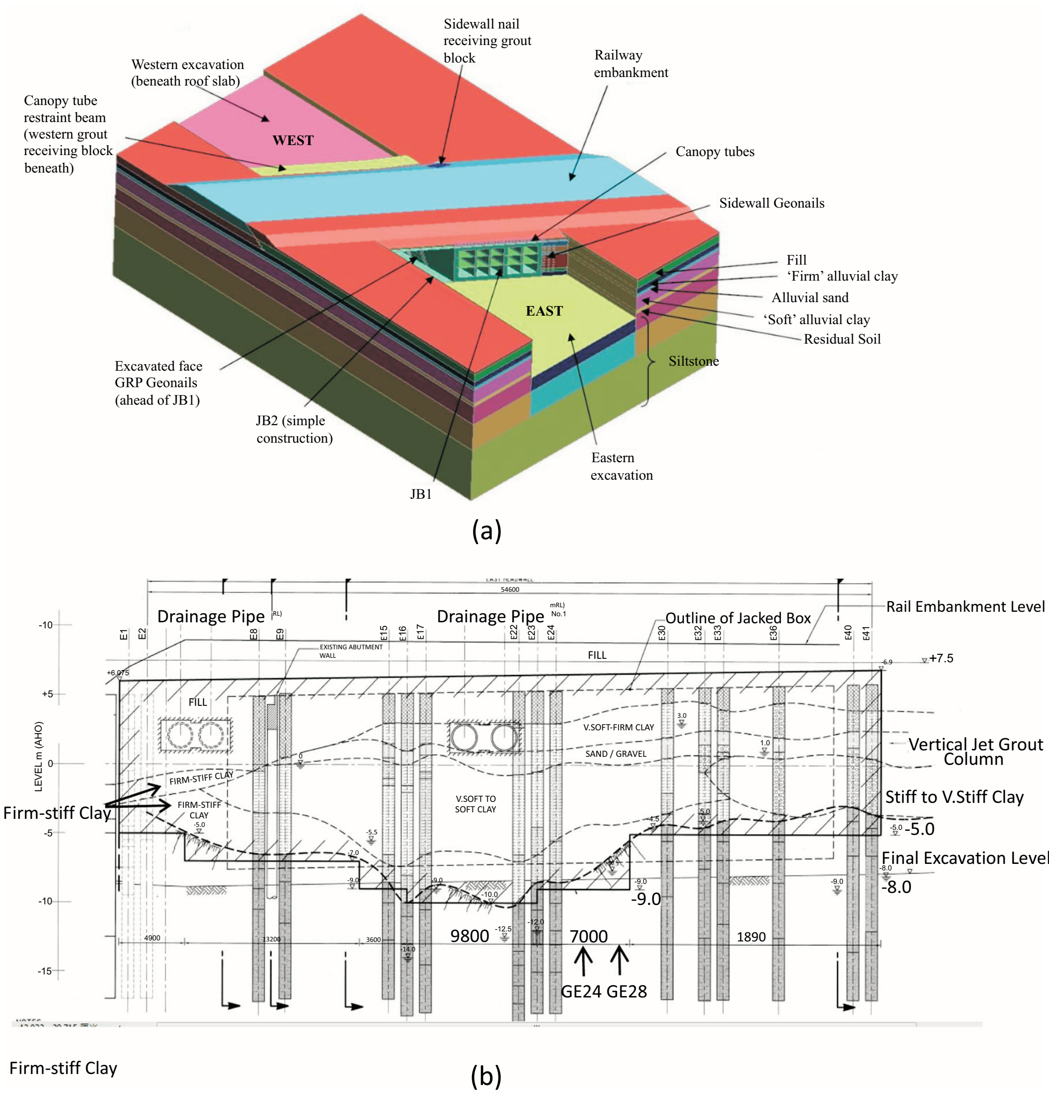


**Fig. (1.1).** (**a**) Geological condition for the tunnel project in soft clay, (**b**) a typical section of the tunnel work.

In order to optimize the ground improvement design, a combined fracture grouting and GFRP soil nails ground improvement scheme is proposed by the authors as the alternative solution (Cheng *et al*. 2013), and the cost of the alternative scheme is critically reduced to 50% of the original scheme. In the past, fracture grouting was mainly adopted for compensation grouting, and the

CHAPTER 2

# Numerical Methods in Geotechnical Engineering

**Abstract:** Finite element method is the most popular and important numerical method in geotechnical engineering analysis and design. In this chapter, the basic formulation for finite element method will be introduced, followed by the various procedures in the actual implementation of the method which are illustrated by several sample Fortran programs. The style of Fortran programming, mesh generation, bandwidth/profile minimizer as well as the development of modern thick plate element are used for the illustration of the various techniques required in developing a finite element program.

**Keyword:** Fortran, Finite element, Isoparametric element, Programming style, Plate element, Shape functions.

## 2.1. INTRODUCTION TO PROGRAMMING

Many books on finite element method or numerical methods have provided sample programs for the readers to learn the actual implementation of the methods. Very good references are provided by Smith *et al*. (2014), Owen and Hinton (1980), Hinton and Owen (1977), Zienkiewicz *et al*. (2011). During learning the finite element method and the techniques in programming, the authors have learnt a lot from these references and many other technical papers. Many of these references on finite element method target at simple input data format and standard problems, but not much on other types of problems. Some open source programs or commercial programs are too fruitful with many libraries and functions which are not easy to modify or to learn. For example, the program Abaqus comes with series of program manuals which require a steep learning curve, and to develop a special add-in subroutine to Abaqus can be a tedious task. If a reader prefers to carry a new analysis and adopt his preferred pre-processor or post-processor, it is extremely time-consuming to spend the effort to learn some large scale commercial engineering programs. The present book actually targets at such a group of readers, which are most probably research students who need to develop computer codes for some new algorithms.

There are many numerical methods that are being used for various purposes, which include finite element method, boundary element method, distinct element

Y.M. Cheng, J. H. Wang, L. Liang, W. H. Fung Ivan (Eds.)

method, meshless method and others. Out of these methods, the boundary element method will not be discussed in this book, as there are many practical limitations to the boundary element method in general geotechnical engineering problems. Fortran language is adopted in this book, as many numerical programs are actually developed in Fortran because this language is targeted towards mathematical and matrix operations, and the relatively simple language format has avoided many bugs that may be found in C/C++. In views of that, the authors will only present the results in Fortran in this book, even though some engineering programs are developed in C by the authors.

### 2.1.1. Management of Input Data

As mentioned in chapter 1, most of the practical problems require the use of numerical methods and computer software for the analysis and design. Throughout the years, the authors have developed series of computer programs for teaching and research, and some of the experience and results will be shared in this book. To begin with, some skill commonly adopted by the authors are first discussed.

The authors have used Fortran 90/95 for the development of many structural and geotechnical programs. The authors have not adopted the more advanced Fortran 2003, 2008 or later Fortran versions, as Fortran 90/95 (Chapman, 2007) is adequate for most applications. There are some important utilities for which the authors adopt in various programs development, and some of these utilities will be discussed below. Throughout this book, the subroutines/programs are developed by mainly Lahey Fortran while GFortran and Absoft Fortran are also used for some cases, but the codes should also work under other Fortran compilers. The readers should be able to modify the codes to comply with different compilers, or to remove some old style programming formats. The authors assume the readers to have sufficient knowledge of basic Fortran language, and the works by Chapman (2007) and others can be referred if necessary.

Classically, Fortran, C other computer languages have only relatively simple methods in reading input files which are usually text file for ease of transportation between different systems. Even with the refined input standard in the latest Fortran or C language, the way a program reads the input file is still basically sequential, and a well-defined data structure is required. To allow for more flexible input approach, the authors have adopted the open source library FLIB with some modifications, and the revised version of FLIB can be obtained freely from the authors. FLIB adopts the operator overloading function available in Fortran 90/95, and only limited functions will be discussed in this section. With reference to the subroutine as shown below, the input module uses the functions in FLIB through the modules STRPAK and FIOPAK, while the data required by the main program is communicated through module DATA.

```
SUBROUTINE INPUT

USE STRPAK ; USE FIOPAK ; USE DATA

Integer :: ndat, i, j, k, ndat, bore_n, bore_s, errar

Real :: Toler

Open (25, file='input.txt')

call vi_getvar(25,'1', 'TOLER', ndat, errvar)

if (ndat > 0) then ! toler is defined with a value in the input file

call vi_data(1, TOLER, errvar) ; CALL VI_ERASE

! read the value of toler as ndat > 0, else, do not read

endif

CALL VI_GETVAR(25,'1','bore_n', ndat,errar)

if (ndat > 0) then

CALL VI_DATA(1, bore_n, errvar) ; CALL VI_ERASE

endif

CALL VI_GETVAR(25,'1','bore_s',ndat,errar)

if (ndat > 0) then

CALL VI_DATA(1, bore_s, errvar) ; CALL VI_ERASE

endif

call vi_getvar(25,'1','bore_data',ndat,errvar)

if (ndat == bore_n*bore_s) then

allocate (bore(bore_n,bore_s))

k=0
```

CHAPTER 3

# Plasticity, Limit Equilibrium and Limit Analysis Methods in Geotechnical Engineering

**Abstract:** In this chapter, the ultimate limit state of a system is considered by means of limit equilibrium, plasticity slip line method, limit analysis and DLO methods. The basic plasticity formulation for the slip line method is given, which is applied to some classical geotechnical problems. Following this, the three major geotechnical problems are unified under the extremum principle by the plasticity formulation. There is also discussion on the basic formulation for the DLO method and the limitations of the method or the commercial program.

**Keyword:** Axi-symmetric, Bearing capacity, DLO, Extremum, Lateral earth pressure, Limit equilibrium, Limit analysis, Plasticity, Slip line, Slope stability.

## 3.1. INTRODUCTION TO ULTIMATE LIMIT STATE ANALYSIS

Due to the difficulties in defining the *in situ* stress, the complications in many constitutive models as well as the difficulty in determining the various parameters required for a constitutive model, many geotechnical analysis and design works are still based on the ultimate limit state consideration, despite many finite element programs with various capabilities developed over the years. This is not surprising for the engineers and researchers, particularly for the engineers. The authors are greatly interested in a case in Hong Kong, where a highly theoretical soil constitutive model was developed and calibrated for the various required parameters in laboratory. This model was used for the interpretation of a plate load test in Hong Kong, and the percentage error of the prediction was found to be around 400%. On the other hand, the model can predict extremely well for the laboratory test results. It is not surprising that many engineers have various hesitations on the use of many modern and sophisticated soil constitutive models. In Hong Kong and many other countries, these advanced constitutive models are not commonly used for practical purposes. Unless this critical limitation can be overcome, the very large gap between the theoretical development and the actual applications will remain there. Actually, Cheng has written a very complicated nonlinear large strain elasto-plastic geotechnical program with 13 constitutive mo-

Y.M. Cheng, J. H. Wang, L. Liang, W. H. Fung Ivan (Eds.)

dels, where different combinations of yield functions and plastic potential functions can be combined and used. So far, Cheng seldom adopts this program or other commercial programs using advanced constitutive model for real engineering design. The limited site investigations and laboratory/field test results for most projects cannot justify the choice of a highly sophisticated constitutive model, and many surprising results (usually local effects) can be obtained from every commercial program that the authors have tried when those advanced constitutive models are used. In fact, some engineers in Hong Kong will simply turn the complicated constitutive soil model to simple elastic/elasto-plastic model when numerical problems occur. Interestingly, many engineers find that a very famous geotechnical analysis program (the latest version already) can run into problems easily with the more advanced constitutive models for many excavation/lateral support problems. From the authors' view, a constitutive model which is not accurate enough for real problems or can run into numerical problems easily is not a good model, no matter how good is the theoretical background behind the model.

On the other hand, the use of the ultimate limit state for design is well-received and used by the engineers, with the application of a suitable factor of safety. With the experience accumulated over many years, engineers tend to rely more on the ultimate limit state analysis and design than the use of modern constitutive models for some types of problems. It is not surprising that some geotechnical designs are still based on the use of the limit state analysis up to the present. There many different references and research papers associated with this, and some additional references are given by Liu *et al*. (2019), Baars (2018), Nedderman (1992), Yu (2006), Davis and Selvadurai (2002), Rees (2006) as well as the classical works by Hill (1950), Sokolovskii (1965) and Chen (1975).

For stability analysis, there are various methods available to the engineers, and the choice of the method depends on the complexity of the geometry and the convenience in the solution. In this chapter, the slip line method, limit equilibrium method and limit analysis will be introduced for the lateral earth pressure, ultimate bearing capacity and slope stability problems. It is interesting to note that these three topics are usually considered separately in most of the books or research studies, and different methods of analyses have been proposed for individual problem even though they are governed by the same requirements for the ultimate conditions. Since the governing equations and boundary conditions for these problems are actually the same, Cheng and Li (2017) view that each problem can be viewed as the inverse of the other problems which will also be demonstrated in the present chapter. After the introduction of the three basic stability analysis methods, the unification of the three most important stability problems will be discussed.

The three stability methods together with the corresponding numerical solution techniques will be discussed with the use of different computer programs developed by the authors. The limit equilibrium methods as discussed in this chapter are available in the program SLOPE 2000 developed by Cheng, which can be obtained from the authors at natureymc@yahoo.com.hk. SLOPE2000 is also one of the analysis modules in the large scale geotechnical analysis and design package GEOCalc 1.0/2.0/4.0.

## 3.2. SLIP-LINE METHOD

At the ultimate condition, both equilibrium and yield conditions must be satisfied. Combining the Mohr-Coulomb yield criterion (which is generally adequate for soil) and the equilibrium equations, a set of hyperbolic partial differential equations of plastic equilibrium can be developed. In order to solve the governing partial differential equation, it is more convenient to transform the governing equations to curvilinear coordinates along the directions of the failure planes for mathematical convenience. Once the equations are solved, the failure modes with the corresponding systems of stresses will be automatically determined. The slip directions or slip lines constitute a network which is called slip-line field. The governing equations can be solved with adequate boundary conditions to investigate the stresses at the ultimate condition, and the solution of the problem is commonly taken as the rigorous solution, as the solutions are either similar to those from other methods or are better. Since the governing equations are written along the slip lines, the slip line fields corresponding to the solutions are commonly considered as the failure mechanism of the governing problem. For example, the bearing capacity of footing and the lateral earth pressure behind a retaining wall are commonly analyzed by the slip line analysis, but not for the slope stability problem.

Kötter (1903) was the first to derive the slip-line equations for two-dimensional ultimate problems, while Prandtl (1920) was the first to obtain an analytical solution for footing by assuming the weight of soil to be negligible. His results were then applied by Reissner (1924) and Novotortsev (1938) to different problems on the bearing capacity of footing on weightless soil. The inclusion of soil weight in the solution of the governing partial differential equation is analytically impossible, and Sokolovskii (1965) proposed a finite difference approximation of the slip-line equations for which the accuracy can be further improved by an iteration scheme (Cheng 2002, 2003), and such iteration to update the coordinates of the grid points on the slip line field has been demonstrated to be important for passive pressure evaluation. Sokolovskii (1965) solved many types of problems on the bearing capacity of footings, slopes as well as the lateral earth

# References

Adami, S. (2014). Modeling and Simulation of Multiphase Phenomena with Smoothed Particle Hydrodynamics.Doktor-Ingenieurs, Technischen Universität München.

Adoko, A.C., Jiao, Y.Y., Wu, L., Wang, H., Wang, Z.H. (2013). Predicting tunnel convergence using multivariate adaptive regression spline and artificial neural network. *Tunn. Undergr. Space Technol, 38*, 368-376.
[http://dx.doi.org/10.1016/j.tust.2013.07.023]

Al-Defae, A.H., Knappett, J.A. (2015). Newmark sliding block model for pile reinforced slopes under earthquake loading. *Soil. Dyn. Earthquake Eng, 75*, 265-278.
[http://dx.doi.org/10.1016/j.soildyn.2015.04.013]

Al-Bittar, T., Soubra, A.H. (2013). Probabilistic Analysis of Strip Footings Resting on Spatially Varying Soils and Subjected to Vertical or Inclined Loads. *J. Geotech. Geoenviron. Eng.*
[http://dx.doi.org/10.1061/(ASCE)GT.1943-5606.0001046]

Alonso, E. (1976). Risk analysis of slopes and its application to slopes in Canadian sensitive clays. *Geotechnique, 26*(3), 453-472.
[http://dx.doi.org/10.1680/geot.1976.26.3.453]

Aluru, N. (2000). A point collocation method based on reproducing kernel approximation. *Int. J. Numer. Methods Eng, 47*(6), 1083-1121.
[http://dx.doi.org/10.1002/(SICI)1097-0207(20000228)47:6<1083::AID-NME816>3.0.CO;2-N]

Anderheggen, E., Knopfel, H. (1972). Finite element limit analysis using linear programming. *Int. J. Solids Struct, 8*(12), 1413-1431.
[http://dx.doi.org/10.1016/0020-7683(72)90088-1]

Ang, A.H., Tang, W. (1984). *Probability concepts in engineering planning and design* (Vol. 2). New York: John Wiley and Sons Inc.

Arai, K., Tagyo, K. (1985). Determination of noncircular slip surfaces giving the minimum factor of safety in slope stability analysis. *Soil Found, 25*, 43-51.
[http://dx.doi.org/10.3208/sandf1972.25.43]

Arai, K., Tagyo, K., Barber, J.R. (2010). Determination of noncircular slip surfaces giving the minimum factor of safety in slope stability analysis, Soils and Foundations. *Elasticity* (Vol. 25, pp. 43-51). London: Springer.
[http://dx.doi.org/10.1007/978-90-481-3809-8]

Au, S.K., Beck, J.L. (2001). Estimation of small failure probabilities in high dimensions by subset simulation. *Probab. Eng. Mech, 16*(4), 263-277.
[http://dx.doi.org/10.1016/S0266-8920(01)00019-4]

Au, S.K., Beck, J.L. (2003). Subset simulation and its application to seismic risk based on dynamic analysis. *J. Eng. Mech, 129*(8), 901-917.
[http://dx.doi.org/10.1061/(ASCE)0733-9399(2003)129:8(901)]

Au, S.K., Ching, J., Beck, J.L. (2007). Application of subset simulation methods to reliability benchmark problems. *Struct. Saf, 29*(3), 183-193.

[http://dx.doi.org/10.1016/j.strusafe.2006.07.008]

Au, S.K., Cao, Z.J., Wang, Y. (2010). Implementing advanced Monte Carlo simulation under spreadsheet environment. *Struct. Saf, 32*(5), 281-292.
[http://dx.doi.org/10.1016/j.strusafe.2010.03.004]

Au, S.K., Wang, Y. (2014). *Engineering risk assessment with subset simulation.* Singapore: John Wiley & Sons.
[http://dx.doi.org/10.1002/9781118398050]

Baars, S.V. (2018). *100 years of Prandtl's wedge.* IOS Press.

Babuska, I., Melenk, J.M. (1997). The partition of unity method. *Int. J. Numer. Methods Eng, 40*, 727-758.
[http://dx.doi.org/10.1002/(SICI)1097-0207(19970228)40:4<727::AID-NME86>3.0.CO;2-N]

Baker, R., Garber, M. (1978). Theoretical analysis of the stability of slopes. *Geotechnique, 28*, 395-411.
[http://dx.doi.org/10.1680/geot.1978.28.4.395]

Baker, R. (1980). Determination of the critical slip surface in slope stability computations. *Int. J. Numer. Anal. Methods Geomech, 4*, 333-359.
[http://dx.doi.org/10.1002/nag.1610040405]

Baker, R. (2003). Sufficient conditions for existence of physically significant solutions in limiting equilibrium slope stability analysis. *Int. J. Solids Struct, 40*(13-14), 3717-3735.
[http://dx.doi.org/10.1016/S0020-7683(03)00075-1]

Bathe, K.J. (1985). A Four node plate bending element based on Mindlin/Ressiner plate theory and mixed interpolation. *Int. J. Numer. Methods Eng, 21*, 367-383.
[http://dx.doi.org/10.1002/nme.1620210213]

Bathe, K.J. (2014). *Finite element Procedures.* K.J. Bathe.

Bathurst, R., Rothenburg, L. (1989). Investigation of micromechanical features of idealized granular assemblies using DEM *Proceeding of the 1st US Conference on Discrete Element Methods,* Golden, Colo12.

Bauer, S., Lackner, R. (2015). Gradient-based adaptive discontinuity layout optimization for the prediction of strength properties in matrix-inclusion materials. *Int. J. Solids Struct, 63*, 82-98.
[http://dx.doi.org/10.1016/j.ijsolstr.2015.02.042]

Baecher, G.B., Ingra, T.S. (1981). Stochastic FEM in settlement predictions. *J. Geotech. Eng. Div, 107*(4), 449-463.

Baecher, G.B. (1987). *Statistical analysis of geotechnical data.* Vicksburg, Mississippi: USACE Waterways Experiment Station.

Baecher, G.B., Christian, J.T. (2003). *Reliability and statistics in geotechnical engineering.* John Wiley.

Belytschko, T., Liu, W.K., Moran, B., Elkhodary, K.I. (2014). *Nonlinear finite elements for continua and structures.* John Wiley.

Belytschko, T., Lu, Y.Y., Gu, L. (1994). Element-free Galerkin methods. *Int. J. Numer. Methods Eng, 37*, 229-256.
[http://dx.doi.org/10.1002/nme.1620370205]

Berezantzev, V.G. (1958). Earth pressure on the cylindrical retaining wall. *Proc., Brussels Conf. on Earth*

*Pressure Problems, 2*, 21-27.

Bhattacharya, G., Jana, D., Ojha, S., Chakraborty, S. (2003). Direct search for minimum reliability index of earth slopes. *Comput. Geotech, 30*, 445-462.
[http://dx.doi.org/10.1016/S0266-352X(03)00059-4]

Birolini, A. (2014). *Reliability engineering* Springer.
[http://dx.doi.org/10.1007/978-3-642-39535-2]

Bishop, A.W. (1955). The use of the slip circle in the stability analysis of earth slopes. *Geotechnique, 5*(1), 7-17.
[http://dx.doi.org/10.1680/geot.1955.5.1.7]

Bolton, H.P.J., Heymann, G., Groenwold, A. (2003). Global search for critical failure surface in slope stability analysis. *Eng. Optim, 35*(1), 51-65.
[http://dx.doi.org/10.1080/0305215031000064749]

Blum, C., Raidl, G.R. (2016). *Hybrid Metaheuristics Powerful Tools for Optimization.* Springer.

Booker, J.R., Zheng, X. (2000). *Application of the theory of classical plasticity to the analysis of the stress distribution in wedges of a perfectly frictional material, Modelling in Geomechanics.* New York: John Wiley.

Bottero, A., Negre, R., Pastor, J., Turgeman, S. (1980). Finite element method and limit analysis theory for soil mechanics problems. *Comput. Methods Appl. Mech. Eng, 22*, 131-149.
[http://dx.doi.org/10.1016/0045-7825(80)90055-9]

Breitung, K. (1984). Asympotic approximations for multinormal integrals. *J. Eng. Mech, 110*(3), 357-366.
[http://dx.doi.org/10.1061/(ASCE)0733-9399(1984)110:3(357)]

Bucher, C.G., Bourgund, U. (1990). A fast and efficient response surface approach for structural reliability problems. *Struct. Saf, 7*(1), 57-66.
[http://dx.doi.org/10.1016/0167-4730(90)90012-E]

Bui, H.H. (2007).

Bui, H.H., Fukagawa, R., Sako, K., Ohno, S. (2008). Lagrangian meshfree particles method (SPH) for large deformation and failure flows of geomaterial using elastic-plastic soil constitutive model. *Int. J. Numer. Anal. Methods Geomech, 32*, 1537-1570.
[http://dx.doi.org/10.1002/nag.688]

Busby, D. (2009). Hierarchical adaptive experimental design for Gaussian process emulators. *Reliab. Eng. Syst. Saf, 94*(7), 1183-1193.
[http://dx.doi.org/10.1016/j.ress.2008.07.007]

Cai, Y., Liang, G.P., Shi, G.H., Cook, N.G.W. (1996). Studying an impact problem by using LDDA method.

Cao, W.G., Shu, B.Y. (2001). A study on techniques of automatically forming of cover system of numerical manifold method. *Chinese Journal of Geotechnical Engineering, 23*(2), 187-190.

Castilo, E., Luceno, A. (1980). Evaluation of variational methods in slope analysis. *Proceedings of International Symposium on Landslides,* New-Delhi, India*1*, 255-258.

Castilo, E., Luceno, A. (1982). A critical analysis of some variational methods in slope stability analysis. *Int. J. Numer. Anal. Methods Geomech, 6*, 195-209.

[http://dx.doi.org/10.1002/nag.1610060206]

Celestino, T.B., Duncan, J.M. (1981). Simplified Search for Non-Circular Slip Surface *Proceedings of 10th International Conference on Soil Mechanics and Foundation Engineering,* Stockholm, Sweden391-394.

Chang, W.A. (2006). *Advances in Evolutionary Algorithms Theory, Design and Practice.* Springer.

Chapman, S.J. (2007). *Fortran 95/2003 for Scientists & Engineers* McGraw Hill.

Chen, Z. (2003). *Stability analysis of soil slopes: theories, methods and programs.* Beijing: Water Power Press. (in Chinese)

Chen, H., Lee, C.F. (2000). Numerical simulation of debris flows. *Can. Geotech. J, 37*(1), 146-160. [http://dx.doi.org/10.1139/t99-089]

Chen, W.F., Giger, M.W. (1971). Limit analysis of stability of slopes. Journal of the Soil Mechanics and Foundations Division. *Proc. Am. Soc. Civ. Eng, 97*, 19-26.

Chen, W.F. (1975). *Limit Analysis and Soil Plasticity.* US: Elsevier.

Chen, W.F., Liu, X.L. (1990). *Limit analysis in soil mechanics.* New York: Elsevier.

Chen, Z., Morgenstern, N.R. (1983). Extensions to generalized method of slices for stability analysis. *Can. Geotech. J, 20*(1), 104-109.
[http://dx.doi.org/10.1139/t83-010]

Chen, Z., Shao, C. (1983). Evaluation of minimum factor of safety in slope stability analysis. *Can. Geotech. J, 25*(4), 735-748.
[http://dx.doi.org/10.1139/t88-084]

Chen, Z. (1998). On Pan's principles of rock and soil stability analysis. *Journal of Tsinghua University (Sci & Tech), 38*, 1-4.

Chen, Y.P., Lee, J.D., Eskandarian, A. (2006). *Meshless Methods in Solid Mechanics.* Springer.

Chen, G.Q., Ohnishi, Y., Ito, T. (1997). Development of high order manifold method. *Proceedings of the Second International Conference on Analysis of Discontinuous Deformation,* Kyoto, Japan132-154.

Chen, G.Q., Ohnishi, Y., Ito, T. (1998). Development of High-order Manifold Method. *Int. J. Numer. Methods Eng, V43*, 685-712.
[http://dx.doi.org/10.1002/(SICI)1097-0207(19981030)43:4<685::AID-NME442>3.0.CO;2-7]

Chen, G.Q., Miki, S., Ohnishi, Y. (1996). Practical improvements on DDA.

Chen, G.Q., Ohnishi, Y., Zhen, L., Sasaki, T. (2013). Frontiers of Discontinuous Numerical Methods and Practical Simulations in Engineering and Disaster Prevention *Proceedings of the 11th International Conference on analysis of Discontinuous Deformation, ICADD11.* Fukuoka, Japan27-29 August
[http://dx.doi.org/10.1201/b15791]

Chen, G.Q., Ohnishi, Y. (1999). A non-liner model for discontinuous in DDA. *The Third International Conference on Analysis of Discontinuous Deformation from Theory to Practice,* Vail, Colorado, USA57-64.

Chen, W., Qiu, T. (2011). Numerical Simulations of Granular Materials Using Smoothed Particle Hydrodynamics Method. *Int. J. Geomech, 12*(2), 157-164.

Cheng, Y.P., Nakata, Y., Bolton, M.D. (2003). Distinct element simulation of crushable soil. *Geotechnique, 53*(7), 633-641.
[http://dx.doi.org/10.1680/geot.2003.53.7.633]

Cheng, Y.M. (1989). An Efficient and Flexible Out-of-Core Equation Solver. *Microcomputers in Civil Engineering, 4*, 297-306.
[http://dx.doi.org/10.1111/j.1467-8667.1989.tb00031.x]

Cheng, Y.M., Tsui, Y. (1993). A Simple and Flexible Finite Element Mesh Graphics Program. *Comput. Struc, 48*, 555-574.

Cheng, Y.M. (1993). An Effective Storage Minimizer Program. *J. Struct. Eng, 20*, 103-110.

Cheng, Y.M. (1996). Iterative Solution using Sparse Matrix Storage in Finite Element Analysis *International Conference on Computing & Information Technology for Architecture, Engineering,* Construction, Singapore16-17 May93-96.

Cheng, Y.M., Tsui, Y. (1996).

Cheng, Y.M., Tsui, Y. (1997). Use of Discrete Element Analysis in Geotechnical Engineering *The Second International Symposium on Structures and Foundations in Civil Engineering,* Jan. 7-10153-156.

Cheng, Y.M. (1997). Application of Discrete Element Method/Discontinuous Deformation Analysis, The International Symposium on Rock Mechanics and Environmental Geotechnology, April, Chongqing, p. 214-218.

Cheng, Y.M. (1998). Advancement and Improvements in Discontinuous Deformation Analysis. *Comput. Geotech, 22*(2), 153-163.
[http://dx.doi.org/10.1016/S0266-352X(98)00002-0]

Cheng, Y.M., Zhang, Y.H. (1998). The Extension and Application of DDA Method. *Chinese Journal of Geotechnical Engineering, 20*(3), 109-111. a

Cheng, Y.M., Zhang, Y.H. (1998). Block Rotation in DDA and Its Application to Rolling Stone. *Chinese Journal of Rock Mechanics and Engineering, 17*, 834-839. b

Cheng, Y.M., Zhang, Y.H. (2000). Rigid Body Rotation and Internal Block Discretization in DDA Analysis. *Int. J. Numer. Anal. Methods Geomech, 24*, 567-578.
[http://dx.doi.org/10.1002/(SICI)1096-9853(200005)24:6<567::AID-NAG83>3.0.CO;2-N]

Cheng, Y.M., Zhang, Y.H., Wang, K.J. (2000). Coupling of Fem and DDA methods in engineering. *J. Geotech. Eng, 22*, 727-730.

Cheng, Y.M. (2002). Slip Line Solution and Limit Analysis for Lateral Earth Pressure Problem, the Ninth Conference on Computing in Civil and Building Engineering, April 3-5, Taipei, Taiwan, p.311-314.

Cheng, Y.M. (2003). Seismic lateral earth pressure coefficients by slip line method. *Comput. Geotech, 30*(8), 661-670.
[http://dx.doi.org/10.1016/j.compgeo.2003.07.003]

Cheng, Y.M., Zhang, Y.H., Chen, W.S. (2002). Wilson non-conforming Element in Numerical Manifold Method. *Commun. Numer. Methods Eng, 18*, 877-884.
[http://dx.doi.org/10.1002/cnm.545]

Cheng, Y.M., Chen, W.S., Guo, X.R. (2002). Distinct Element Analysis of Ground Deformation arising from Underground Mining. *Chinese Journal of Rock Mechanics and Engineering, 21*(8), 1130-1135.

Cheng, Y.M., Zhang, Y.H. (2002). Coupling of FEM and DDA Methods. *Int. J. Geomech, 2*(4), 503-517. [http://dx.doi.org/10.1061/(ASCE)1532-3641(2002)2:4(503)]

*Procedure to the detect of three-dimensional blocks using penetration edges method* Cheng, Y.M., Chen, W.S., Guo, X.R. (2002). Geotechnical Special PublicationASCE.

Cheng, Y.M. (2003). Locations of Critical Failure Surface and some Further Studies on Slope Stability Analysis. *Comput. Geotech, 30*, 255-267.
[http://dx.doi.org/10.1016/S0266-352X(03)00012-0]

Cheng, Y.M., Zhang, Y.H. (2003). Application of NMM in Underground excavation *Proceedings of GeoEng2003,* Beijing1159-1164.

Cheng, Y.M., Zhang, Y.H. (2004). Application and discussion of three dimensional numerical manifold method based on hexahedron element. *Chinese Journal of Rock Mechanics and Engineering,* 1745-1754.

Cheng, Y.M., Chen, W.S., Zheng, H., Zhang, Y.H. (2004). Detection of 3D block contacts by penetration edges. *Chinese Journal of Rock mechanics and engineering, 23*(4), 565-571.

Cheng, Y.M., Zhu, L.J. (2004). Unified Formulation for Two Dimensional Slope Stability Analysis and Limitations in Factor of Safety Determination. *Soils and Foundations, 44*(6), 121-128.

Cheng, Y.M., Chen, W.S., Zhang, Y.H. (2006). A robust method for the detection of contacts for three-dimensional blocks. *Int. J. Geomech, 6*(5), 303-310.
[http://dx.doi.org/10.1061/(ASCE)1532-3641(2006)6:5(303)]

Cheng, Y.M., Au, S.K. (2005). Slip line solution of bearing capacity problems with inclined ground. *Can. Geotech. J, 42*, 1232-1241.
[http://dx.doi.org/10.1139/t05-037]

Cheng, Y.M., Liu, H.T., Wei, W.B., Au, S.K. (2005). Location of critical three- dimensional non-spherical failure surface by NURBS functions and ellipsoid with applications to highway slopes. *Comput. Geotech, 32*(6), 387-399.
[http://dx.doi.org/10.1016/j.compgeo.2005.07.004]

Cheng, Y.M., Yip, C.J. (2007). Three-dimensional asymmetrical slope stability analysis – Extension of Bishop's, Janbu's, and Morgenstern–Price's techniques. *J. Geotech. Geoenviron. Eng, 133*(12), 1544-1555.
[http://dx.doi.org/10.1061/(ASCE)1090-0241(2007)133:12(1544)]

Cheng, Y.M., Hu, Y.Y., Wei, W.B. (2007). General Axi-symmetric active earth pressure by Methods of Characteristics – Theory and Numerical Formulation. *International Journal on Geomechanics, ASCE, 7*(1), 1-15.

Cheng, Y.M., Li, L. (2007). Particle swarm optimization algorithm for non-circular failure surface in two dimensional lope stability analysis. *Comput. Geotech, 34*(2), 92-103.
[http://dx.doi.org/10.1016/j.compgeo.2006.10.012]

Cheng, Y.M. (2007). Global optimization analysis of slope stability by simulated annealing with dynamic bounds and Dirac function. *Eng. Optim, 39*(1), 17-32.
[http://dx.doi.org/10.1080/03052150600916294]

Cheng, Y.M., Li, L., Chi, S.C. (2007). Studies on six heuristic global optimization methods in the location of critical slip surface for soil slopes. *Comput. Geotech, 34*, 462-484. [http://dx.doi.org/10.1016/j.compgeo.2007.01.004]

Cheng, Y.M., Lansivaara, T., Wei, W.B. (2007). Two-dimensional Slope Stability Analysis by Limit Equilibrium and Strength Reduction Methods. *Comput. Geotech, 34*, 137-150. [http://dx.doi.org/10.1016/j.compgeo.2006.10.011]

Cheng, Y.M., Zhang, Y.H. (2008). Three-dimensional Numerical Manifold Method - Tetrahedron and Hexahedron Mesh. *International for Rock Mechanics and Rock Engineering, 41*(4), 601-628. [http://dx.doi.org/10.1007/s00603-006-0120-9]

Cheng, Y.M., Hu, Y.Y., Au, S.K., Wei, W.B. (2008). Active pressure for circular cut with Berezantzev's and Prater's Theories. *Soil Found, 48*(5), 621-632. [http://dx.doi.org/10.3208/sandf.48.621]

Cheng, Y.M., Lansivaara, T., Siu, J. (2008). Impact of Convergence on Slope Stability Analysis and Design. *Comput. Geotech, 35*(1), 105-115. [http://dx.doi.org/10.1016/j.compgeo.2007.02.011]

Cheng, Y.M., Li, L., Chi, S.C., Wei, W.B. (2008). Determination of critical slip surface using artificial fish swarms algorithm. *J. Geotech. Geoenviron. Eng, 134*(2), 244-251. [http://dx.doi.org/10.1061/(ASCE)1090-0241(2008)134:2(244)]

Cheng, Y.M., Li, L., Lansivaara, T., Chi, S.C., Sun, Y.J. (2008). Minimization of factor of safety using different slip surface generation methods and an improved harmony search minimization algorithm. *Eng. Optim, 40*(2), 95-115. [http://dx.doi.org/10.1080/03052150701618153]

Cheng, Y.M., Law, C.W. (2008). Development of a New and Efficient Thick Plate Element. *Struct. Eng. Mech, 29*(3), 327-354. [http://dx.doi.org/10.12989/sem.2008.29.3.327]

Cheng, Y.M., Liu, Z.N., Song, W.D., Au, S.K. (2009). Laboratory test and Particle Flow Simulation of Silos problem with nonhomogeneous materials. *J. Geotech. Geoenviron. Eng, 135*, 1754-1761. [http://dx.doi.org/10.1061/(ASCE)GT.1943-5606.0000125]

Cheng, Y.M., Chau, K.T., Xiao, L.J., Li, N. (2010). Flow pattern for silo with two layers of materials with single and double openings. *Journal of Geotechnical and Geoenvironmental Engineering, ASCE, 136*(9), 1278-1286.

Cheng, Y.M., Zhao, Z.H., Sun, Y.J. (2010). Evaluation of interslice force function and discussion on convergence in slope stability analysis by the lower bound method. *J. Geotech. Geoenviron. Eng, 136*(8), 1103-1113. [http://dx.doi.org/10.1061/(ASCE)GT.1943-5606.0000317]

Cheng, Y.M., Li, D.Z., Li, L., Sun, Y.J., Baker, R., Yang, Y. (2011). Limit equilibrium method based on approximate lower bound method with variable factor of safety that can consider residual strength. *Comput. Geotech, 38*, 628-637. [http://dx.doi.org/10.1016/j.compgeo.2011.02.010]

Cheng, Y.M., Li, L., Sun, Y.J., Au, S.K. (2012). A coupled particle swarm and harmony search optimization algorithm for difficult geotechnical problems. *Struct. Multidiscipl. Optim, 45*, 489-501.

[http://dx.doi.org/10.1007/s00158-011-0694-z]

Cheng, Y.M., Lansivaara, T., Baker, R., Li, N. (2013). The use of internal and external variables and extremum principle in limit equilibrium formulations with application to bearing capacity and slope stability problems. *Soil Found, 53*(1), 130-143.
[http://dx.doi.org/10.1016/j.sandf.2012.12.009]

Cheng, Y.M., Li, D.Z., Li, N., Li, Y.Y., Au, S.K. (2013). Solution of some engineering partial differential equations governed by the minimal of a functional by global optimization method. *J. Mech, 29*(3), 493-506.

Cheng, Y.M., Lau, C.K. (2014). *Soil Slope stability analysis and stabilization - new methods and insights* Spon Press.
[http://dx.doi.org/10.1201/b17015]

Cheng, Y.M., Li, L., Liu, L.L. (2015). Simplified Approach for Locating the Critical Probabilistic Slip Surface in Limit Equilibrium Analysis. *Nat. Hazards Earth Syst. Sci, 15*, 2241-2256.
[http://dx.doi.org/10.5194/nhess-15-2241-2015]

Cheng, Y.M., Li, N. (2017). Equivalence between Bearing Capacity, Lateral Earth Pressure and Slope Stability Problems by Slip-line and Extremum Limit Equilibrium Methods. *International Journal of Geomechanics, 17*(12) ASCE, 04017113.

Cheng, Y.M., Li, N., Fung, W.H., Li, L. (2019). Laboratory and Field Test and Distinct Element Analysis of Debris Flow. *Nat. Hazards Earth Syst. Sci, 19*, 181-199.
[http://dx.doi.org/10.5194/nhess-19-181-2019]

Cheng, Y.M., Au, S.K., Wong, H. (2019). *Fracture Grouting and Geonails for Soft Soil Tunnelling.* Geomechanics and Geoengineering.
[http://dx.doi.org/10.1080/17486025.2019.1573321]

Ching, J.Y., Phoon, K.K., Hu, Y.G. (2009). Efficient evaluation of reliability for slopes with circular slip surfaces using importance sampling. *J. Geotech. Geoenviron. Eng, 135*(6), 768-777.
[http://dx.doi.org/10.1061/(ASCE)GT.1943-5606.0000035]

Ching, J.Y., Phoon, K.K. (2013). Effect of element sizes in random field finite element simulations of soil shear strength. *Comput. Struc, 126*, 120-134.
[http://dx.doi.org/10.1016/j.compstruc.2012.11.008]

Chiou, Y.J., Tsay, R.J., Chuang, W.L. (1997). Crack propagation using manifold method. *Proceedings of the Second International Conference on Analysis of Discontinuous Deformation,* Kyoto, Japan298-308.

Chiou, Y.J., Tsay, R.J. (2000). Nonlinear analysis of low-rise reinforced concrete shear walls by manifold method. *Zhongguo Gongcheng Xuekan, 23*(6), 721-729.
[http://dx.doi.org/10.1080/02533839.2000.9670593]

Chiou, Y.J., Lee, Y.M., Tsay, R.J. (2002). Mixed mode fracture propagation by manifold method. *Int. J. Fract, 114*(4), 327-347.
[http://dx.doi.org/10.1023/A:1015713428989]

Cho, S.E. (2009). Probabilistic stability analyses of slopes using the ANN-based response surface. *Comput. Geotech, 36*, 787-797.
[http://dx.doi.org/10.1016/j.compgeo.2009.01.003]

Cho, S.E. (2010). Probabilistic assessment of slope stability that considers the spatial variability of soil properties. *J. Geotech. Geoenviron. Eng, 136*(7), 10.

[http://dx.doi.org/10.1061/(ASCE)GT.1943-5606.0000309]

Cho, S.E. (2013). First-order reliability analysis of slope considering multiple failure Modes. *Eng. Geol, 154*, 98-105.
[http://dx.doi.org/10.1016/j.enggeo.2012.12.014]

Chowdhury, R.N., Xu, D.W. (1995). Geotechnical system reliability of slopes. *Reliab. Eng. Syst. Saf, 47*, 141-151.
[http://dx.doi.org/10.1016/0951-8320(94)00063-T]

Christian, J.T., Ladd, C.C., Bolcher, G.B. (1992). Reliability and probability in stability analysis. *Stability and Performance of Slopes and Embankments - II* Geotechnical Special PublicationASCE.

Christian, J.T., Ladd, C., Baecher, G.B. (1994). Reliability applied to slope stability analysis. *J. Geotech. Eng, 120*(12), 2180-2207.
[http://dx.doi.org/10.1061/(ASCE)0733-9410(1994)120:12(2180)]

Clarke, S.D., Smith, C.C., Gilbert, M. (2013). Modelling discrete soil reinforcement in numerical limit analysis. *Can. Geotech. J, 50*, 705-715.
[http://dx.doi.org/10.1139/cgj-2012-0387]

Cornell, C.A. (1969). A probability based structural code. *J. Am. Concr. Inst, 66*(12), 974-985.

Coley, D.A. (1999). *An Introduction to Genetic Algorithms for Scientists and Engineers.* World Scientific.
[http://dx.doi.org/10.1142/3904]

Collins, I.F. (1974). A note on the interpretation of Coulomb's analysis of the thrust on a rough retaining wall in terms of the limit theorems of limit plasticity. *Geotechnique, 24*, 106-108.
[http://dx.doi.org/10.1680/geot.1974.24.1.106]

Cornell, C.A. (1969). A probability-based structural code. *J. Am. Concr. Inst, 66*(12), 974-985.

Cressie, N. (1993). *Statistics for spatial data.* John Wiley & Sons.

Crouch, S.L., Starfield, A.M. (1983). *Boundary element methods in solid mechanics, S. L. Crouch and A. M. Starfield.* London: George Allen & Unwin.

Cuevas, E., Zaldívar, D., Cisneros, M.P. (2018). *Advances in Metaheuristics Algorithms: Methods and Applications.* Springer.
[http://dx.doi.org/10.1007/978-3-319-89309-9]

Cundall, P.A. (1971). A computer model for simulating progressive, large-scale movements in blocky rock systems.

Cundall, P.A. (1978). *Ball - A computer program to model granular medium using the distinct element method, Technical note TN-LN-13* (pp. 129-163). London: Advanced Technology Group, Dames and Moore.

Cundall, P.A., Strack, O.D.L. (1979). A discrete model for granular assemblies. *Geotechnique, 29*(1), 47-65.
[http://dx.doi.org/10.1680/geot.1979.29.1.47]

Cundall, P.A., Strack, O.D.L. (1979). A discrete model for granular assemblies. *Geotechnique, 29*(1), 47-65.

Cundall, P.A., Hart, R.D. (1985). *Development of generalized 2-D and 3-D distinct element programs for modeling jointed rock, Misc. Paper SL-85-1.* US Army Corps of Engineers.

Cundall, P.A. (1987). Distinct Element Models of Rock and Soil structure. *Analytical and Computational Methods in Engineering Rock Mechanics* (pp. 129-163). London: George Allen and Unwin.

Cundall, P.A. (1988). Formulation of a 3-D distinct element model-Part I. A scheme to detect and represent contacts in system composed of many polyhedral blocks. *Int. J. Rock Mech. Min. Sci. Geomech. Abstr, 25*(3), 107-116.
[http://dx.doi.org/10.1016/0148-9062(88)92293-0]

Cundall, P.A., Hart, D.H. (1992). Numerical Modelling of Discontinua. *Eng. Comput, 9*, 101-111.
[http://dx.doi.org/10.1108/eb023851]

Dasaka, S.M., Zhang, L. (2012). Spatial variability of in situ weathered soil. *Geotechnique, 49*(6), 835-840.
[http://dx.doi.org/10.1680/geot.8.P.151.3786]

Davis, R.O., Selvadurai, A.P.S. *Cambridge University Press.*

De Jong, D.J.G. (1957). Graphical method for the determination of slip-line fields in soil mechanics. *Ingenior, 69*, 61-65.

De Jong, D.J.G. (1980). Application of calculus of variation to the vertical cut-off in cohesive frictionless soil. *Geotechnique, 30*(1), 1-16.
[http://dx.doi.org/10.1680/geot.1980.30.1.1]

De Jong, D.J.G. (1981). Variational fallacy. *Geotechnique, 31*(4), 289-290.
[http://dx.doi.org/10.1680/geot.1981.31.2.289]

DeGroot, D.J., Baecher, G.B. (1993). Estimating autocovariance of insitu soil properties. *J. Geotech. Eng, 119*(1), 147-166.
[http://dx.doi.org/10.1061/(ASCE)0733-9410(1993)119:1(147)]

Der Kiureghian, A., Ke, J.B. (1988). The stochastic finite element method in structural reliability. *Probab. Eng. Mech, 3*(2), 83-91.
[http://dx.doi.org/10.1016/0266-8920(88)90019-7]

Der Kiureghian, A., Dakessian, T. (1998). Multiple design points in first and second order reliability. *Struct. Saf, 20*(1), 37-49.
[http://dx.doi.org/10.1016/S0167-4730(97)00026-X]

Desai, C.S., Zaman, M.M., Lightner, J.G., Siriwardane, H.J. (1984). Thin-layer element for interfaces and joints. *Int. J. Numer. Anal. Methods Geomech.*
[http://dx.doi.org/10.1002/nag.1610080103]

Diaby, M., Karwan, M.H. (2016). *Advances in combinatorial optimization.* World Scientific Publishing.
[http://dx.doi.org/10.1142/9725]

Dinis, L.M.J.S., Jorge, R.M.N., Belinha, J. (2007). Analysis of 3D solids using the natural neighbor radial point interpolation method. *Comput. Methods Appl. Mech. Eng, 196*(13-16), 2009-2028.
[http://dx.doi.org/10.1016/j.cma.2006.11.002]

Dolinski, K. (1983). First order second moment approximation in reliability of structural systems -critical review and alternative approach. *Struct. Saf, 1*(3), 211-231.
[http://dx.doi.org/10.1016/0167-4730(82)90027-3]

Donald, I.B., Chen, Z. (1997). Slope stability analysis by the upper bound approach: fundamentals and

methods. *Can. Geotech. J, 34*, 853-862.
[http://dx.doi.org/10.1139/t97-061]

Doss, L.J.T., Arathi, P. (2016). A constructive bandwidth reduction algorithm-A variant of GPS algorithm. *AKCE International Journal of Graphs and Combinatorics, 13*, 241-254.
[http://dx.doi.org/10.1016/j.akcej.2016.06.014]

Ditlevsen, O. (1979). Generalized second moment reliability index. *Journal of Structural Mechanics, 7*(4), 435-451.
[http://dx.doi.org/10.1080/03601217908905328]

Dow, J.O. (2015). *A concise overview of the finite element method.* Momentum Press.

Drescher, A. (1983). Limit plasticity approach to piping in bins. *ASME Trans. J. Appl. Mech, 50*, 549-553.
[http://dx.doi.org/10.1115/1.3167089]

Drescher, A. (1986). Kinematics of axisymmetric vertical slopes at collapse. *Int. J. Numer. Anal. Methods Geomech, 10*, 431-444.
[http://dx.doi.org/10.1002/nag.1610100407]

Drescher, A., Detournay, E. (1993). Limit load in translational failure mechanisms for associative and non-associative materials. *Geotechnique, 43*(3), 443-456.
[http://dx.doi.org/10.1680/geot.1993.43.3.443]

Drucker, D.C., Prager, W. (1952). Soil mechanics and plastic analysis or limit design. *Q. Appl. Math, 10*, 157-165.
[http://dx.doi.org/10.1090/qam/48291]

Drucker, D.C., Greenberg, W., Prager, W. (1951). The safety factor of an elastic plastic body in plane strain, Transactions of the ASME. *J. Appl. Mech, 73*, 371.

Duarte, C.A., Oden, J.T. (1996). h-p clouds - an h-p meshless method. *Numer. Methods Partial Differ. Equ, 12*(6), 673-705.
[http://dx.doi.org/10.1002/(SICI)1098-2426(199611)12:6<673::AID-NUM3>3.0.CO;2-P]

Duncan, J.M. (1996). State of the art: Limit equilibrium and finite element analysis of slopes. *J. Geotech. Eng, 122*(7), 577-596.
[http://dx.doi.org/10.1061/(ASCE)0733-9410(1996)122:7(577)]

Duncan, J.M. (2000). Factors of safety and reliability in geotechnical engineering. *J. Geotech. Geoenviron. Eng, 126*(4), 307-316.
[http://dx.doi.org/10.1061/(ASCE)1090-0241(2000)126:4(307)]

Ellingwood, B.R., Galambos, T.V., MacGregor, J.G., Cornell, C.A. (1980). Development of probability-based load criterion for American National Standard A58. *Special Publication 577, National Bureau of Standards, Washington.*
[http://dx.doi.org/10.6028/NBS.SP.577]

Fan, K., Fredlund, D.G., Wilson, G.W. (1986). An interslice force function for limit equilibrium slope stability analysis. *Can. Geotech. J, 23*(3), 287-296.
[http://dx.doi.org/10.1139/t86-042]

Fellin, W., Lessmann, H., Oberguggenberger, M., Vieider, R. (2005). *Analyzing Uncertainty in Civil Engineering.* Springer.

[http://dx.doi.org/10.1007/b138177]

Fenton, G.A. (1999). Random field modeling of CPT data. *J. Geotech. Eng, 125*(6), 486-498. [http://dx.doi.org/10.1061/(ASCE)1090-0241(1999)125:6(486)]

Fenton, G.A., Vanmarcke, E.H. (1998). Spatial variation in liquefaction risk. *Geotechnique, 48*(6), 819-831. [http://dx.doi.org/10.1680/geot.1998.48.6.819]

Fenton, G.A., Griffiths, D.V. (2002). Probabilistic foundation settlement on spatially random soil. *J. Geotech. Geoenviron. Eng, 128*(5), 381-390. [http://dx.doi.org/10.1061/(ASCE)1090-0241(2002)128:5(381)]

Fenton, G.A., Griffiths, D.V. (2003). Bearing-capacity prediction of spatially random c-phi soils. *Can. Geotech. J, 40*(1), 54-65. [http://dx.doi.org/10.1139/t02-086]

Fenton, G.A., Griffiths, D.V. (2005). Three-dimensional probabilistic foundation settlement. *J. Geotech. Geoenviron. Eng, 131*(2), 232-239. [http://dx.doi.org/10.1061/(ASCE)1090-0241(2005)131:2(232)]

Fenton, G.A. (2007). Data analysis/geostatistics. *Probabilistic methods in geotechnical engineering* (pp. 51-73). New York: Springer.

Fiessler, B., Neumann, H.J., Rackwitz, R. (1979). Quadratic limit states in structural reliability. *J. Eng. Mech, 105*(4), 661-676.

Fleming, K., Weltman, A., Randolph, M., Elson, K. (2009). *Piling engineering* Taylors and Francis. Flibs.http://flibs.sourceforge.net/

Floudas, C.A., Pardalos, P.M. (2009). *Encyclopedia of Optimization.* Springer. [http://dx.doi.org/10.1007/978-0-387-74759-0]

Fredlund, D.G., Krahn, J. (1984). Analytical methods for slope analysis *International Symposium on Landslides,* 229-250.

Freudenthal, A.M. (1947). Safety of Structures. *Trans. Am. Soc. Civ. Eng, 112*, 125-159.

Frey, P.L., George, P.J. (2000). *Mesh generation* John Wiley.

Friedman, J.H. (1991). Multivariate adaptive regression splines. *Ann. Stat, 19*(1), 1-67. [http://dx.doi.org/10.1214/aos/1176347963]

Ganesan, S., Tobiska, L. (2017). *Finite elements theory and algorithms.* Cambridge University Press. [http://dx.doi.org/10.1017/9781108235013]

Ghanem, R., Saad, G., Doostan, A. (2007). Efficient solution of stochastic systems: application to the embankment dam problem. *Struct. Saf, 29*(3), 238-251. [http://dx.doi.org/10.1016/j.strusafe.2006.07.015]

Gharti, H.N., Komatitsch, D., Oye, V., Martin, R., Tromp, J. (2012). Application of an elastoplastic spectral-element method to 3D slope stability analysis. *Int. J. Numer. Methods Eng, 91*(1), 1-26. [http://dx.doi.org/10.1002/nme.3374]

Gharti, H.N., Tromp, J. (2017).

Gilbert, M., Smith, C., Pritchard, T. (2010). Masonry arch analysis using discontinuity layout optimisation. *Proc. Instn Civ. Engrs - Engng. Comput. Mech, 163*(3), 155-166.

Gingold, R.A., Monaghan, J.J. (1977). Smoothed particle hydrodynamics: theory and application to non-spherical stars. *Mon. Not. R. Astron. Soc, 181*, 375-389.
[http://dx.doi.org/10.1093/mnras/181.3.375]

Glover, F., Laguna, M. (1996). *Tabu Search.* Dordrecht, Netherlands: Kluwer.

Goh, A.T.C. ((1984)). Genetic algorithm search for critical slip surface in multiple-wedge stability analysis. In: Graham , J., (Ed.), *Canadian Geotechnical Journal, 36(2), 382–391. Graham J* Slope Instability, John Wiley & Sons.36(2),

Goldreich, O.P. (2010). *NP, and NP-Completeness.* Cambridge University Press.
[http://dx.doi.org/10.1017/CBO9780511761355]

Gong, W.P., Wang, L., Khoshnevisan, S., Juang, C.H., Huang, H.W., Zhang, J. (2015). Robust geotechnical design of earth slopes using fuzzy sets. *J. Geotech. Geoenviron. Eng, 141*(1), 1-9.
[http://dx.doi.org/10.1061/(ASCE)GT.1943-5606.0001196]

Goodman, R.E. (1976). *Methods of geological engineering in discontinuous rocks.* San Francisco, CA, USA: West Publishing Company.

Greco, V.R. (1996). Efficient Monte Carlo technique for locating critical slip surface. *J. Geotech. Eng, 122*, 517-525.
[http://dx.doi.org/10.1061/(ASCE)0733-9410(1996)122:7(517)]

Gregory, B. B., John, T. C. (2005). Reliability and Statistics in Geotechnical Engineering. .Wiley Press, Baecher Christian.

Griffiths, D.V., Fenton, G.A. (2000). Influence of soil strength spatial variability on the stability of an undrained clay slope by finite element, Slope stability 2000. *GSP, 101*, 184-193.

Griffiths, D.V., Fenton, G.A. (2001). Bearing capacity of spatially random soil:The undrained clay Prandtl problem revisited. *Geotechnique, 51*(4), 351-359.
[http://dx.doi.org/10.1680/geot.2001.51.4.351]

Griffiths, D.V., Fenton, G.A. (2004). Probabilistic slope stability analysis by Finite element methods. *J. Geotech. Geoenviron. Eng, 130*(5), 507-518.
[http://dx.doi.org/10.1061/(ASCE)1090-0241(2004)130:5(507)]

Griffiths, D.V., Fenton, G.A. (2007). Probabilistic slope stability analysis by Finite element methods. *J. Geotech. Geoenviron. Eng, 130*(5), 507-518.
[http://dx.doi.org/10.1061/(ASCE)1090-0241(2004)130:5(507)]

Griffiths, D.V., Fenton, G.A. (2009). Probabilistic Settlement Analysis by Stochastic and Random Finite element methods. *J. Geotech. Geoenviron. Eng, 135*(11), 1629-1637.
[http://dx.doi.org/10.1061/(ASCE)GT.1943-5606.0000126]

Griffiths, D.V., Huang, J., Fenton, G.A. (2011). Probabilistic infinite slope analysis. *Comput. Geotech, 38*, 577-584.
[http://dx.doi.org/10.1016/j.compgeo.2011.03.006]

Guenin, B., Konemann, J., Tuncel, L. (2014). *A Gentle Introduction to Optimization.* Cambridge University

Press.
[http://dx.doi.org/10.1017/CBO9781107282094]

Haddad, O.B. (2018). *Advanced Optimization by Nature-Inspired Algorithms.* Springer.

Haldar, A., Mahadevan, S. (2000). *Reliability assessment using stochastic finite Reliability assessment using stochastic finite Reliability assessment using stochastic finite analysis.* John Wiley.

Haldar, A., Mahadevan, S. (2000). *Probability, reliability and statistical methods in engineering design.* John Wiley. a

Haldar, A., Mahadevan, S. (2000). *Reliability assessment using stochastic finite Reliability assessment using stochastic finite Reliability assessment using stochastic finite analysis.* John Wiley. b

Halsey, T., Mehta, A. (2002). *Challenges in Granular Physics.* World Scientific.

Hansen, J.B. (1970). A revised and extended formula for bearing capacity, Danish Geotechnical Institute. *Bulletin,* 28. [Copenhagen.].

Harr, M.E. (1977). *Mechanics of particulate media: A probabilistic approach.* New York: McGraw Hill.

Hartmann, F., Katz, C. (2004). *Structural Analysis with Finite Elements.* Springer.
[http://dx.doi.org/10.1007/978-3-662-05423-9]

Hasofer, A.M., Lind, N.C. (1974). Exact and invariant second-moment code format. *J. Eng. Mech. Div, 100*(EM1), 111-121.

Hassan, A.M., Wolff, T.F. (1999). Search algorithm for minimum reliability index of earth slopes. *J. Geotech. Geoenviron. Eng, 125*(4), 301-308.
[http://dx.doi.org/10.1061/(ASCE)1090-0241(1999)125:4(301)]

Henderson, C.R. (1975). Best linear unbiased estimation and prediction under a selection model. *Biometrics, 31*(2), 423-447.
[http://dx.doi.org/10.2307/2529430]

Hertz, H. (1881). Ueber die Berührung fester elastischer Körper. *J. Reine Angew. Math, 92*, 156-171.

Hicks, M.A., Spencer, W. (2010). Influence of heterogeneity on the reliability and failure of a long 3D slopes. *Comput. Geotech, 37*(7-8), 948-955.
[http://dx.doi.org/10.1016/j.compgeo.2010.08.001]

Hilbert, L.B., Yi, W., Cook, N.G.W., Cai, Y., Liang, G.P. (1994). A new discontinuous finite element method for interaction of many deformable bodies in geomechanics.

Hill, R. (1950). *Mathematical theory of plasticity.* Oxford University Press.

Hill, J.M., Cox, G.M. (2000). Cylindrical cavities and classical rat-hole theory occurring in bulk materials. *Int. J. Numer. Anal. Methods Geomech, 24*, 971-990.
[http://dx.doi.org/10.1002/1096-9853(200010)24:12<971::AID-NAG107>3.0.CO;2-G]

Hinton, E., Owen, D.R.J. (1977). *Programming the finite element method.* Academic Press.

Homayouni, S.M., Tang, S.H., Motlagh, O. (2014). A genetic algorithm for optimization of integrated scheduling of cranes, vehicles, and storage platforms at automated container terminals. *J. Comput. Appl. Math, 270*, 545-556.

[http://dx.doi.org/10.1016/j.cam.2013.11.021]

Hohenbichler, M., Rackwitz, R. (1988). First order concept in system reliability. *Struct. Saf, 1*(3), 177-188. [http://dx.doi.org/10.1016/0167-4730(82)90024-8]

Hong, H.P. (1999). Simple approximations for improving second-order reliability estimates. *J. Eng. Mech, 125*(5), 592-595. [http://dx.doi.org/10.1061/(ASCE)0733-9399(1999)125:5(592)]

Hong, H.P., Roh, G. (2008). Reliability evaluation of earth slopes. *J. Geotech. Geoenviron. Eng, 134*(12), 1700-1705. [http://dx.doi.org/10.1061/(ASCE)1090-0241(2008)134:12(1700)]

Honjo, Y., Kuroda, K.A. (1991). New look at fluctuating geotechnical data for reliability design. *Soil Found, 31*(01), 110-120. [http://dx.doi.org/10.3208/sandf1972.31.110]

Houlsby, G.T., Wroth, C.P. (1982). Direct solution of plasticity problems in soils by the method of characteristics *Proc., 4th Int. Conf. on Numerical Methods in Geomechancis,* Edmonton, Alta., Canada*3*, 1059-1071.

Hovland, H.J. (1977). Three-Dimensional Slope Stability analysis method. *J. Geotech. Eng. Div, 103*, 971-986.

Huang, C.C., Tsai, C.C. (2000). New method for 3D and asymmetrical slope stability analysis. *J. Geotech. Geoenviron. Eng, 126*(10), 917-927. [http://dx.doi.org/10.1061/(ASCE)1090-0241(2000)126:10(917)]

Huang, C.C., Tsai, C.C., Chen, Y.H. (2002). Generalized method for three- dimensional slope stability analysis. *J. Geotech. Geoenviron. Eng, 128*(10), 836-848. [http://dx.doi.org/10.1061/(ASCE)1090-0241(2002)128:10(836)]

Huang, J.S., Griffiths, D.V., Fenton, G.A. (2010). Probabilistic analysis of coupled soil consolidation. *J. Geotech. Geoenviron. Eng, 136*(3), 417-430. a [http://dx.doi.org/10.1061/(ASCE)GT.1943-5606.0000238]

Huang, J.S., Griffiths, D.V., Fenton, G.A. (2010). System reliability of slopes by RFEM. *Soil Found, 50*(3), 345-355. b [http://dx.doi.org/10.3208/sandf.50.343]

Hughes, T.J.R., Hinton, E. (1986). *Finite Element Methods for Plates and Shell Structures* Pineridge Press.

Ibrahimbegovic, A. (1993). Quadrilateral Finite Elements for Analysis of Thick and Thin Plates. *Comput. Methods Appl. Mech. Eng, 10*, 195-209. [http://dx.doi.org/10.1016/0045-7825(93)90160-Y]

Irfan, T.Y. (1986). *Mode and mechanism of a complex failure at Tin Wan Hill, Special Projects Report 2/86.* Hong Kong: Geotechnical Control Office.

Irfan, T.Y. (1998). Structurally controlled landslides in saprolitic soils in Hong Kong. *Geotech. Geol. Eng, 16*, 215-238. [http://dx.doi.org/10.1023/A:1008805827178]

Isukapalli, S.S., Roy, A., Georgopoulos, P.G. (1998). Stochastic response surface methods for uncertainty propagation: application to environmental and biological systems. *Risk Anal, 18*(3), 351-363.

[http://dx.doi.org/10.1111/j.1539-6924.1998.tb01301.x]

(1995). PFC3D 1.0, User Guide.

(2004). PFC3D 3.1, User Guide.

Iwashita, K., Oda, M. (1998). Rolling resistance at contacts in simulation of shear band development by DEM. *J. Eng. Mech, 124*(3), 285-292.
[http://dx.doi.org/10.1061/(ASCE)0733-9399(1998)124:3(285)]

Izbicki, R.J. (1981). Limit plasticity approach to slope stability problems, Journal of the Geotechnical Engineering Division. *Proc. Am. Soc. Civ. Eng, 107*, 228-233.

Janbu, N. (1957). Earth pressure and bearing capacity by generalized procedure of slices *Proc. 4th International Conference on Soil Mechanics,* 207-212.

Janbu, N. (1973). Slope stability computations. *Embankment-Dam Engineering* John Wiley.

Jaksa, M.B., Kaggwa, W.S., Brooker, P.I. (1999). Experimental evaluation of the scale of fluctuation of a stiff clay

Jaksa, M.B., Fenton, G.A. (2000). Random field modeling of CPT data. *J. Geotech. Geoenviron. Eng, 126*(12), 1212-1216.
[http://dx.doi.org/10.1061/(ASCE)1090-0241(2000)126:12(1212)]

Jebahi, M., André, D., Terreros, I., Iordanoff, I. (2015). *Discrete Element Method to Model 3D Continuous Materials.* John Wiley.
[http://dx.doi.org/10.1002/9781119103042]

Jenike, A.J., Yen, B.C. (1962). Slope stability in axial symmetry *Proc., 5th Symp. on Rock Mechanics,* Univ. of Minnesota, Pergamon.New York: 689-711.

Jha, S.K., Ching, J.Y. (2013). Simplified reliability method for spatially variable undrained engineered slopes. *Soil Found, 53*(5), 708-719.
[http://dx.doi.org/10.1016/j.sandf.2013.08.008]

Ji, J., Low, B.K. (2012). Stratified response surfaces for system probabilistic evaluation 781 of slopes. *J. Geotech. Geoenviron. Eng, 138*(11), 1398-1406.
[http://dx.doi.org/10.1061/(ASCE)GT.1943-5606.0000711]

Ji, J., Liao, H.J., Low, B.K. (2012). Modeling 2-D spatial variation in slope reliability analysis using interpolated autocorrelations. *Comput. Geotech, 40*, 135-146.
[http://dx.doi.org/10.1016/j.compgeo.2011.11.002]

Jing, L.R., Stephansson, O., Erling, N. (1993). Study of rock joints under cyclic loading conditions. *Rock Mech. Rock Eng, 26*(3), 215-232.
[http://dx.doi.org/10.1007/BF01040116]

Jiang, Q.H. (2000). *Research on three dimensional discontinuous deformation analysis method.*

Jiang, M.J., Yu, H.S., Harris, D. (2005). A novel discrete model for granular material incorporating rolling resistance. *Comput. Geotech, 32*, 340-357.
[http://dx.doi.org/10.1016/j.compgeo.2005.05.001]

Jiao, Y.Y. (1998). *Three dimension DDA and its application. Ph.D. Thesisi.* Wuhan, China: Wuhan Institute of Rock & Soil Mechanics.

Jing, R.J. (2007). *Fundamentals of Discrete Element Methods for Rock Engineering: Theory and Applications.* Elsevier.

Jiang, S.H., Huang, J.S. (2016). Efficient slope reliability analysis at low-probability levels in spatially variable soils. *Comput. Geotech, 75*, 18-27.
[http://dx.doi.org/10.1016/j.compgeo.2016.01.016]

Jiang, S.H., Li, D.Q., Zhang, L.M., Zhou, C.B. (2014). Slope reliability analysis considering spatially variable shear strength parameters using a non-intrusive stochastic finite element method. *Eng. Geol, 168*, 120-128.
[http://dx.doi.org/10.1016/j.enggeo.2013.11.006]

Jiang, S.H., Qi, X.H., Cao, Z.J., Li, D.Q. (2015). System reliability analysis of slope with stochastic response surface method. *Chin J Rock Soil Mech, 36*(3), 809-818.

Jirousek, J., Wroblewski, A., Szybinski, B. (1995). A new 12 d.o.f. Quadrilateral element for analysis of thick and thin plates. *Int. J. Numer. Methods Eng, 38*, 2619-2638.
[http://dx.doi.org/10.1002/nme.1620381508]

Juang, C.H., Rosowsky, D.V., Tang, W.H. (1999). Reliability-based method for assessing liquefaction potential of soils. *J. Geotech. Geoenviron. Eng, 128*(8), 684-689.
[http://dx.doi.org/10.1061/(ASCE)1090-0241(1999)125:8(684)]

Kang, F., Han, S.X., Salgado, R., Li, J.J. (2015). System probabilistic stability analysis of soil slopes using Gaussian process regression with Latin hypercube sampling. *Computers and Geotechnics, 63:13:25.*

Kang, F., Li, J. (2015). Artificial bee colony algorithm optimized support vector regression for system reliability analysis of slopes. *J. Comput. Civ. Eng.*04015040

Karel, K. (1977). Application of energy method, Journal of the Geotechnical Engineering Division. *Proc. Am. Soc. Civ. Eng, 103*, 381-397. a

Karel, K. (1977). Energy method for soil stability analyses, Journal of the Geotechnical Engineering Division. *Proc. Am. Soc. Civ. Eng, 103*, 431-445. b

Kaymaz, I. (2005). Application of kriging method to structural reliability problems. *Struct. Saf, 27*(2), 133-151.
[http://dx.doi.org/10.1016/j.strusafe.2004.09.001]

Ke, T.C. (1995). Modification of DDA with respect to rigid-body rotation. *Proceedings of the First International Conference on Analysis of Discontinuous Deformation,* Chungli, Taiwan260-273.

Ke, T.C., Thapa, B., Goodman, R.E. (1994). Stability analysis of a penstock slope. *Proceedings of the First North American Rock Mechanics Symposium,* Austin, TX, USA1109-1116.

Ke, T.C., Tang, J.H. (1996). Modeling of solid-fluid Interactions using the manifold method. *Proceedings of the Second North American Rock Mechanics Symposium,* Montreal, Quebec, Canada1815-1822.

Kennedy, J., Eberhart, R. (1995). Particle Swarm Optimization *International Conference on Neural Networks,* Perth, Australia1942-1948.

Kerisel, J., Absi, E. (1990). *Active and passive earth pressure tables.* U.K.: Taylor and Francis.

Khoei, A.R. (2015). *Extended finite element method.* John Wiley.

Kim, J.M., Sitar, N. (2013). Reliability approach to slope stability analysis with spatially correlated soilproperties. *Soil Found, 53*(1), 1-10.
[http://dx.doi.org/10.1016/j.sandf.2012.12.001]

Kirk, P.A., Campbell, S.D.G., Fletcher, C.J.N., Merriman, R.J. (1997). The significance of primary volcanic fabrics and clay distributions in landslides in Hong Kong. *J. Geol. Soc. London, 154*, 1009-1019.
[http://dx.doi.org/10.1144/gsjgs.154.6.1009]

Knill, J. (2006). *Report on Shum Wan Road Landslide of 13 August 1995.* Geotechnical Engineering Office, Hong Kong SAR Government.

Knill and GEO (2006). Report on the Fei Tsui road landslide of 13 August 1995, Hong Kong SAR Government.

Krige, D.G. (1994). A statistical approach to some basic mine valuation problems on the witwatersrand. *J. S. Afr. Inst. Min. Metall, 94*(3), 95-112.

Komzsik l. (2009). *Applied Calculus of Variations for Engineers.* CRC Press.

Koo, C.Y., Chern, J.C., Chen, S. (1995). The development of the second-order displacement function for discontinuous deformation analysis. *Proceedings of the Sixth Conference on Geotechnical Engineering,* Taiwan665-674.

Koo, C.Y., Chern, J.C. (1996). *The development of DDA with third displacement function. DDA and Simulations of Discontinuous Media* TSI press.

Konietzky, H. (2004). Numerical Modelling of Discrete Materials in Geotechnical Engineering, Civil Engineering and Earth Sciences: Proceedings of the First International UDEC/3DEC Symposium, Bochum, Germany, 29 September - 1 October 2004, CRC Press.

Korte, B., Vygen, J. (2018). *Combinatorial Optimization Theory and Algorithms6th edition.* Springer.
[http://dx.doi.org/10.1007/978-3-662-56039-6]

Kosinski, W. (2008). *Advances in Evolutionary algorithms, AvE4EvA.*

Kotter, F. (1903). *Die Bestimmung des Druckes an gekrmmten Gleitflchen, eine Aufgabe aus der Lehre vom Erddruck, Berlin Akad* (pp. 229-233). Berlin: Wiss.

Koutromanos, I. (2018). *Fundamentals of Finite Element Analysis, Linear Finite Element Analysis.* John Wiley.

Koyluoglu, H.U., Nielsen, S.R.K. (1994). New approximations for SORM integrals. *Struct. Saf, 13*(4), 235-246.
[http://dx.doi.org/10.1016/0167-4730(94)90031-0]

Krahn, J., Fredlund, D.G. (1997). Evaluation of the University of Saskatchewan slope stability program." R.T.A.C Forum, Roads and Transportation Association of Canada, Quebec City, Canada, 69–76.

Kulhawy, F.H., Mayne, P.W. (1990). *Manual on estimating soil properties for foundation design.* Ithaca, NY, USA: Cornell Univ.

Kumar, J. (2001). Seismic passive earth pressure coefficients for sands. *Can. Geotech. J, 38*, 876-881.
[http://dx.doi.org/10.1139/t01-004]

Kumar, J., Chitikela, S. (2002). Seismic passive earth pressure coefficients using the method of characteristics. *Can. Geotech. J, 39*, 463-471.
[http://dx.doi.org/10.1139/t01-103]

Lasdon, L.S., Warren, A.D., Jain, A., Ratner, M. (1978). Design and testing of a generalized reduced gradient code for nonlinear programming. *ACM Trans.Math, 4*(1), 34-50.
[http://dx.doi.org/10.1145/355769.355773]

Lam, L., Fredlund, D.G., Barbour, S.L. (1987). Transient Seepage Model for Saturated-Unsaturated Soil Systems: a Geotechnical Engineering Approach. *Can. Geotech. J, 24*, 565-580.
[http://dx.doi.org/10.1139/t87-071]

Lam, L., Fredlund, D.G. (1993). A general limit equilibrium model for three-dimensional slope stability analysis. *Can. Geotech. J, 30*(6), 905-919.
[http://dx.doi.org/10.1139/t93-089]

Lawrence, C.T., Tits, A.L. (1996). Nonlinear equality constraints in feasible sequential quadratic programming. *Optim. Methods Softw, 6*, 265-282.
[http://dx.doi.org/10.1080/10556789608805638]

Lawrence, S. (1984). *Resource constrained project scheduling: An experimental investigation of heuristic scheduling techniques, Pittsburgh: School of industrial Administration, Carnegie.* USA: Mellon University.

Lemos, J.V. (1983). *A Hybrid Distinct Element-Boundary Element Computational Model for the Half-Plane.*

Leshchinsky, B. (2015). Bearing Capacity of Footings Placed Adjacent to c′-ϕ′ Slopes. *J. Geotech. Geoenviron. Eng, 141*(6)04015022
[http://dx.doi.org/10.1061/(ASCE)GT.1943-5606.0001306]

Leshchinsky, B., Ambauen, S. (2015). Limit Equilibrium and Limit Analysis: Comparison of Benchmark Slope Stability Problems. *J. Geotech. Geoenviron. Eng, 141*(10)04015043
[http://dx.doi.org/10.1061/(ASCE)GT.1943-5606.0001347]

Li, K.S., Lee, I.K. (1991). The assessment of geotechnical safety. *Selected Topics in Geotechnical Engineering, The Lumb Volume* (pp. 195-229). Canberra: University College, University of New South Wales.

Li, K.S., Lumb, P. (1987). Probabilistic design of slopes. *Can. Geotech. J, 24*(4), 520-535.
[http://dx.doi.org/10.1139/t87-068]

Li, L., Chu, X.S. (2015). Multiple response surfaces for slope reliability analysis. *Int. J. Numer. Anal. Methods Geomech, 39*(2), 175-192.
[http://dx.doi.org/10.1002/nag.2304]

Li, D.Q., Jiang, S.H., Cao, Z.J., Zhou, W., Zhou, C.B., Zhang, L.M. (2015). A multiple response surface method for slope reliability analysis considering spatial variability of soil properties. *Eng. Geol, 187*, 60-72.
[http://dx.doi.org/10.1016/j.enggeo.2014.12.003]

Li, S.F., Liu, W.K. (2007). *Meshfree Particle Methods.* Springer.

Li, X.K., Feng, Y.T., Mustoe, G. (2017). *Proceedings of the 7th International Conference on Discrete Element Methods*Springer.

Li, D.Z., Cheng, Y.M. (2012). Lower Bound Limit Analysis Using Nonlinear Failure Criteria, 2012

International Conference on Structural Computation and Geotechnical Mechanics. Procedia Earth and Planetary Science City: Kun Ming China, pp. 170-174.

Li, D.Z., Cheng, Y.M., Wang, J.A., Yang, Y., Li, N. (2013). Application of finite-element-based limit analysis with mesh adaptation in geotechnical engineering, Chinese. *J. Geotech. Eng, 35*(5), 922-929.

Li, N., Cheng, Y.M. (2015). Laboratory and 3D-Distinct Element Analysis of Failure Mechanism of Slope under External Surcharge. *Nat. Hazards Earth Syst. Sci, 15*, 35-43.
[http://dx.doi.org/10.5194/nhess-15-35-2015]

Li, N., Cheng, Y.M., Fung, W.H. (2018). Transition Zone in Bearing Capacity Problem from Plasticity Method, Discrete Element Method and Laboratory Tests. *Adv. Geosci, 2*(1), 1-21.

Li, H., Mulay, S.S. (2013). *Meshless methods and their numerical properties.* CRC Press.
[http://dx.doi.org/10.1201/b14492]

Li, L., Chu, X.S. (2016). Locating the Multiple Failure Surfaces for Slope Stability Using Monte Carlo Technique. *Geotech. Geol. Eng, 34*(5), 1475-1486.
[http://dx.doi.org/10.1007/s10706-016-0055-1]

Li, X.Y., Zhang, L.M., Gao, L., Zhu, H. (2016). Simplified slope reliability analysis considering spatial soil variability. *Eng. Geol.*
[http://dx.doi.org/10.1016/j.enggeo.2016.11.013]

Libersky, L.D., Petschek, A.G., Carney, T.C., Hipp, J.R., Allahdadi, F.A. (1993). High strain lagrangian hydrodynamics: A three-dimensional SPH code for dynamic material response. *J. Comput. Phys, 109*(1), 67-75.
[http://dx.doi.org/10.1006/jcph.1993.1199]

Lind, N.C. (1971). Consistent partial safety factors. *J. Struct. Div, 97*(ST6), 1651-1669.

Lin, J.S., Lee, D.H. (1996). Manifold method using polynomial basis function of any order.

Lin, D.Z., Mo, H.H. (1994). *Manifold method of material analysis.* The University of Oklahoma.

Lind, N.C. (1983). Modelling uncertainty in discrete dynamical systems. *Appl. Math. Model, 7*(3), 146-152.
[http://dx.doi.org/10.1016/0307-904X(83)90001-X]

Liu, H.P. (2009). *Taylor kriging metamodeling for simulation interpolation, sensitivity analysis and optimization.*

Liu, H.P., Shi, J., Erdem, E. (2010). Prediction of wind speed time series using modified taylor kriging method. *Energy, 35*(12), 4870-4879.
[http://dx.doi.org/10.1016/j.energy.2010.09.001]

Liu, G.R. (2010). *Meshfree methods Moving Beyond the Finite Element Method.* CRC Press.

Liu, M.B., Liu, G.R. (2016). *Particle methods for multi-scale and multi-physics.* World Scientific Publishing.
[http://dx.doi.org/10.1142/9017]

Liu, L.L., Cheng, Y.M. (2016). Efficient system reliability analysis of soil slopes using multivariate adaptive regression splines-based Monte Carlo simulation. *Comput. Geotech, 79*, 41-54.
[http://dx.doi.org/10.1016/j.compgeo.2016.05.001]

Liu, L.L., Cheng, Y.M., Wang, X.M. (2017). Genetic algorithm optimized Taylor Kriging surrogate model

for system reliability analysis of soil slopes. *Journal of Landslides, 14*, 535-546.
[http://dx.doi.org/10.1007/s10346-016-0736-0]

Liu, L.L., Cheng, Y.M. (2017). Conditional random field reliability analysis of a cohesion-frictional slope. *Comput. Geotech, 82*, 173-186.
[http://dx.doi.org/10.1016/j.compgeo.2016.10.014]

Liu, L.L., Cheng, Y.M., Wang, X.M., Zhang, S.H., Wu, Z.H. (2017). System reliability analysis and risk assessment of a layered slope in spatially variable soils considering stratigraphic boundary uncertainty. *Comput. Geotech, 89*, 213-225.
[http://dx.doi.org/10.1016/j.compgeo.2017.05.014]

Liu, L.L., Deng, Z., Zhang, S.H., Cheng, Y.M. (2018). Simplified framework for system reliability analysis of slopes in spatially variable soils. *Eng. Geol, 239*, 330-343.
[http://dx.doi.org/10.1016/j.enggeo.2018.04.009]

Liu, L.L., Cheng, Y.M., Zhang, S.H, Z., Deng (2018). Simplified framework for system reliability analysis of slopes in spatially variable soils. *Engineering Geology, 239*, 330-343.

Liu, L.L., Zhang, S.H., Cheng, Y.M. (2018). Advanced reliability analysis of slopes in spatially variable soils using multivariate adaptive regression splines. *Geoscience Frontiers.*
[http://dx.doi.org/10.1016/j.gsf.2018.03.013]

Liu, W.K., Jun, S., Zhang, Y. (1995). Reproducing kernel particle methods. *Int. J. Numer. Methods Eng, 20*, 1081-1106.
[http://dx.doi.org/10.1002/fld.1650200824]

Liu, W.K., Li, S., Belytschko, T. (1997). Moving least square reproducing kernel methods part i: Methodology and convergence. *Comput. Methods Appl. Mech. Eng, 143*(1-2), 113-154.
[http://dx.doi.org/10.1016/S0045-7825(96)01132-2]

Liu, Y.X., Zheng, Y.R. (2019). *Plastic Mechanics of Geomaterial.* Science Press and Springer.
[http://dx.doi.org/10.1007/978-981-13-3753-6]

Liu, G.R., Liu, M.B. (2003). *Smoothed Particle Hydrodynamics: A Meshfree Particle Method.* Singapore: World Scientific Publishing.
[http://dx.doi.org/10.1142/5340]

Livesley, R.K., Sabin, M.A. (1991). Algorithms for numbering the nodes of finite-element meshes. *Comput. Syst. Eng, 2*(1), 103-114.
[http://dx.doi.org/10.1016/0956-0521(91)90042-4]

Lloret-Cabot, M., Fenton, G.A., Hicks, M.A. (2014). On the estimation of scale of fluctuation in geostatistics. Georisk. *Assessment and Management of Risk for Engineered Systems and Geohazards, 8*(2), 129-140.
[http://dx.doi.org/10.1080/17499518.2013.871189]

Lo, S.H. (2015). *Finite element mesh generation.* CRC Press.

Lophaven, S.N., Nielsen, H.B., Søndergaard, J. (2002). *Dace, a matlab kriging toolbox.*

Lorig, L.J. (1984). *A Hybrid Computational Model for Excavation and Support Design in Jointed Media.*

Low, B.K., Tang, W.H. (1997). Reliability analysis of reinforced embankments on soft ground. *Can. Geotech. J, 34*, 672-685. a

[http://dx.doi.org/10.1139/t97-032]

Low, B.K., Tang, W.H. (1997). Probabilistic slope analysis using Janbu's generalized procedure of slices. *Comput. Geotech, 21*(2), 121-142. b
[http://dx.doi.org/10.1016/S0266-352X(97)00019-0]

Low, B.K. (2003). Practical probabilistic slope stability analysis.

Low, B.K., Lacasse, S., Nadim, F. (2007). Slope reliability analysis accounting for low spatial variation. *Georisk, 1*(4), 177-189.

Low, B.K., Zhang, J., Tang, W.H. (2011). Efficient system reliability analysis illustrated for a retaining wall and a soil slope. *Comput. Geotech, 38*(2), 196-204.
[http://dx.doi.org/10.1016/j.compgeo.2010.11.005]

Lowe, J., Karafiath, L. (1960). Stability of Earth Dams Upon Drawdown *Proceedings of the 1st Pan-American Conference on Soil Mechanics and Foundation Engineering,* Mexico*2*, 537-552.

Lu, Z.M., Zhang, D.X. (2007). Stochastic simulations for flow in nonstationary randomly heterogeneous porous media using a KL-based moment-equation approach. *Multiscale Model. Simul, 6*(1), 228-245.
[http://dx.doi.org/10.1137/060665282]

Lucy, L.B. (1977). )A numerical approach to the testing of the fission hypothesis. *The Astronomical Journal, 82*(1977), 1024.

Lumb, P., Lee, C.F. (1975). Clay mineralogy of the Hong Kong soils. *Proceedings 4th South East Asian Conference on Soil Engineering,* Kuala Lumpur, Malaysia1-41.

Lumb, P. (1970). Safety factors and the probability distribution of soil strength. *Can. Geotech. J, 7*(3), 225-242.
[http://dx.doi.org/10.1139/t70-032]

Lumb, P., Lee, C.F. (1975). Clay mineralogy of the Hong Kong soils. Proceedings 4th South East Asian Conference on Soil Engineering.(pp. 1-41). Kuala Lumpur, Malaysia,.

Luo, S.M., Zhang, X.W., Cai, Y.C. (2000). The variational principle and application of nonlinear numerical manifold method. *Chinese Journal of Applied Mathematics and Mechanics, 21*(12), 1265-1270.

Luo, S.M., Zhang, X.W., Cai, Y.C. (2001). The variational principle and application of numerical manifold method. *Chinese Journal of Applied Mathematics and Mechanics, 22*(6), 587-592.

Luo, X.F., Li, X., Zhou, J., Cheng, T. (2012). A Kriging-based hybrid optimization algorithm for slope reliability analysis. *Struct. Saf, 34*(1), 401-406.
[http://dx.doi.org/10.1016/j.strusafe.2011.09.004]

Luo, X.F., Li, X., Zhou, J., Cheng, T. (2012). A kriging-based hybrid optimization algorithm for slope reliability analysis. *Struct. Saf, 34*(1), 401-406. b
[http://dx.doi.org/10.1016/j.strusafe.2011.09.004]

Lyamin, A.V., Sloan, S.W. (1997). A comparison of linear and nonlinear programming formulations for lower bound limit analysis In: Pietruszczak, S., Pande, G.N., (Eds.), *Proceedings of the 6th International Symposium on Numerical Models in Geomechanics,* 367-373.Balkema.Rotterdam:

Lysmer, J. (1970). Limit analysis of plane problems in soil mechanics. *J. Soil Mech. Found. Div, 96*(SM4), 1311-1334.

Ma, S., Zhang, X., Qiu, X.M. (2009). Comparison study of MPM and SPH in modeling hypervelocity impact problems. *Int. J. Impact Eng, 36*(2), 272-282.
[http://dx.doi.org/10.1016/j.ijimpeng.2008.07.001]

Maclaughlin, M.M., Sitar, N. (1996). Rigid-body rotations in DDA Proceedings of the First International Forum on Discontinuous Analysis(DDA) and Simulations of Discontinuous Media, TSI Press, Berkeley, California, USA, p. 620-636.

Maday, Y., Patera, A.T. (1989). Spectral element methods for the incompressible Navier-Stokes equations. *State-of-the-Art surveys on computational mechanics.* New York: ASME.

Malkawi, A.I.H., Hassan, W.F., Sarma, S.K. (2001). Global search method for locating general slip surface using Monte Carlo techniques. *J. Geotech. Geoenviron. Eng, 127*, 688-698.
[http://dx.doi.org/10.1061/(ASCE)1090-0241(2001)127:8(688)]

Mao, Z., Liu, G.R., Dong, X. (2017). A comprehensive study on the parameters setting in smoothed particle hydrodynamics (SPH) method applied to hydrodynamics problems. *Comput. Geotech, 92*, 77-95.
[http://dx.doi.org/10.1016/j.compgeo.2017.07.024]

Martin, C.M. (2004). *User Guide for ABC - Analysis of Bearing Capacity (v1.0).* Department of Engineering Science, University of Oxford.

Matsuo, M., Kuroda, K. (1974). Probabilistic approach to design of embankments. *Soil Found, 14*(2), 1-17.
[http://dx.doi.org/10.3208/sandf1972.14.2_1]

Matuttis, H.G., Chen, J. (2014). *Understanding the discrete element method.* John Wiley.
[http://dx.doi.org/10.1002/9781118567210]

Mayne, D.Q., Polak, E. (1976). Feasible directions algorithms for optimization problems with equality and inequality constraints. *Math. Program, 11*, 67-80.
[http://dx.doi.org/10.1007/BF01580371]

Mester, D., Ronin, D., Frenkel, M., Korol, A., Braysy, Z., Dullaert, O., Raa, W. (2010). *Discrete optimization for TSP-Like genome mapping problems.* Nova Science Publishers.

Meyerhof, G.G. (1963). Some recent research on the bearing capacity of foundations. *Can. Geotech. J, 1*, 16-26.
[http://dx.doi.org/10.1139/t63-003]

Michalowski, R.L. (1989). Three-dimensional analysis of locally loaded slopes. *Geotechnique, 39*(1), 27-38.
[http://dx.doi.org/10.1680/geot.1989.39.1.27]

Michalowski, R.L. (1995). Slope stability analysis: A kinematical approach. *Geotechnique, 45*(2), 283-293.
[http://dx.doi.org/10.1680/geot.1995.45.2.283]

Michalowski, R.L. (1997). An estimate of the influence of soil weight on bearing capacity using limit analysis. *Soil Found, 37*(4), 57-64.
[http://dx.doi.org/10.3208/sandf.37.4_57]

Mohammadi, S. (2003). *Discontinuous mechanics Using finite and discrete elements.* WIT Press.

Monaghan, J.J., Lattanzio, J.C. (1985). A refined particle method for astrophysical problems. *Astron. Astrophys, 149*, 135-143.

Mononobe, N., Matsuo, H. (1929). On the determination of earth pressure during earthquakes *Proceeding of the World Engineering Congress,* Tokyo*Vol.9*, 179-187.

Morgenstern, N.R., Price, V.E. (1965). The analysis of stability of general slip surface. *Geotechnique, 15*(1), 79-93.
[http://dx.doi.org/10.1680/geot.1965.15.1.79]

*The Evaluation of Slope Stability - A 25-Year Perspective, Stability and Performance of Slopes and Embankments - II* Morgenstern, N.R. (1992). Geotechnical Special PublicationASCE.

Morgenstern, N.R. (1994). *Report on Kwun Lung Lau Landslide of 23 July, 1994; Causes of the Landslide and Adequacy of Slope Safety Practice in Hong Kong.* Hong Kong: Civil Engineering Department.

Morgenstern, N.R. (1995). Managing risk in geotechnical engineering. *Proceedings 10th Pan-American Conference on Soil Mechanics and Foundation Engineering,* Guadalajara *4*, 102-126.

Morrison, E.E., Jr, Ebeling, R.M. (1995). Limit equilibrium computation of dynamic passive earth pressure. *Can. Geotech. J, 32*, 481-487.
[http://dx.doi.org/10.1139/t95-050]

Mroz, Z., Drescher, A. (1969). Limit plasticity approach to some cases of flow of bulk solids, Journal of Engineering for Industry. *Trans. Am. Soc. Mech. Eng, 51*, 357-364.

Munjiza, A.A., Knight, E.E., Rougier, E. (2012). *Computational mechanics of discontinua.* John Wiley.

Munjiza, A. (2004). *The Combined Finite-Discrete Element Method.* John Wiley.
[http://dx.doi.org/10.1002/0470020180]

Nash, D. (1987). A comparative review of limit equilibrium methods of stability analysis. *Slope Stability* (pp. 11-75). New York: John Wiley & Sons.

Nayroles, B., Touzot, G., Villon, P. (1992). Generalizing the finite element method: diffuse approximation and diffuse elements. *Comput. Mech, 10*, 307-318.
[http://dx.doi.org/10.1007/BF00364252]

Nayyar, A., Le, D.N., Nguyen, N.G. (2019). *Advances in Swarm Intelligence for Optimizing Problems in Computer Science.* CRC Press.

Nedjah, N., Alba, E. (2006). Parallel Evolutionary Computations, Springer.

Nedderman, R.M. (1992). Statistics and kinematics of granular materials, Cambridge University Press.

Nguyen, V.U. (1985). Determination of critical slope failure surfaces. *J. Geotech. Eng, 111*(2), 238-250.
[http://dx.doi.org/10.1061/(ASCE)0733-9410(1985)111:2(238)]

Nithiarasu, P., Lewis, R.W., Seetharamu, K.N. (2016). *Fundamentals of the Finite Element Method for Heat and Mass Transfer* John Wiley.

Nocedal, J., Wright, S.J. (2006). *Numerical Optimization.* Springer.

Norouzi, H.R., Zarghami, R., Sotudeh-Gharebagh, R., Mostoufi, N. (2016). *Coupled CFD-DEM Modeling.* John Wiley.
[http://dx.doi.org/10.1002/9781119005315]

Novotortsev, V.I. (1938). Experience with the application of the theory of plasticity to problems of determination of the bearing capacity of foundation beds of structures, Izv. Nauchno-Issled. *Inst. Anzh. Geol, 22*, 115-128.

Oka, Y., Wu, T.H. (1990). System reliability of slope stability, Journal of Geotechnical Engineering, ASCE. *Geotech. Eng, 116*(8), 1185-1189.
[http://dx.doi.org/10.1061/(ASCE)0733-9410(1990)116:8(1185)]

Ohnishi, Y., Tanaka, M., Sasaki, T. (1995). Modification of DDA for elasto-plastic analysis with illustrative generic problems. *Proceedings of the 35th U.S. Symposium On Rock Mechanics,* Lake Tahoe, California45-50.

Ohnishi, Y., Miki, S. (1996). Development of circular and elliptic disc elements for DDA.

Ohtsubo, H., Suzuki, K., Terada, K., Nakanishi, K. (1997). Utilization of finite covers in the manifold method for accuracy control. *Proceedings of the Second International Conference on Analysis of Discontinuous Deformation,* Kyoto, Japan317-322.

Ohnishi, Y., Tanaka, R., Koyama, T. (1999). Manifold method in saturated-unsaturated groundwater flow analysis.

Okereke, M., Keates, S. (2018). *Finite Element Applications A Practical Guide to the FEM Process.* Springer.
[http://dx.doi.org/10.1007/978-3-319-67125-3]

Oñate, E., Idelsohn, S. (1998). A mesh-free finite point method for advective-diffusive transport and fluid flow problems. *Comput. Mech, 21*(4-5), 283-292.

Oñate, E., Owen, D.R.J. (2011). *Particle-Based Methods.* Springer. a
[http://dx.doi.org/10.1007/978-94-007-0735-1]

Oñate, E., Owen, D.R.J. (2011). *Particle-based Methods II Fundamentals and Applications, International Center for Numerical Methods in Engineering.* CIMNE. b

Onwubolu, G., Davendra, D. (2009). *Differential Evolution: A Handbook for Global Permutation-Based Combinatorial Optimization.* Springer.
[http://dx.doi.org/10.1007/978-3-540-92151-6]

O'Sullivan, C. (2002). *The application of discrete element modelling to finite deformation problems in geomechanics.*

O□Sullivan, C. (2011). *Particulate Discrete Element Modelling.* Spon Press.

Ourique, C.O., Biscaia, E.C., Pinto, J.C. (2002). The use of particle swarm optimization for dynamic analysis in chemical processes. *Comput. Chem. Eng, 26*, 1783-1793.
[http://dx.doi.org/10.1016/S0098-1354(02)00153-9]

Owen, D.R.J., Hinton, E. (1980). *Finite element in Plasticity.* Pineridge Press Limited.

Paice, G.M., Griffiths, D.V., Fenton, A. (1996). Finite element modeling of settlements on spatially random soil. *J. Geotech. Eng, 122*(9), 777-779.
[http://dx.doi.org/10.1061/(ASCE)0733-9410(1996)122:9(777)]

Pan, J. (1980). *Analysis of Stability and Landslide for Structures* (pp. 25-28). Beijing: Hydraulic Press. (in

Chinese)

Paradalos, P.M. (1993). *Complexity in numerical optimization.* Utopia Press.
[http://dx.doi.org/10.1142/2041]

Pardalos, P.M., Du, D.Z., Graham, R.L. (2005). *Handbook of Combinatorial Optimization.* Springer.

Patera, A. T. (1984). ), A spectral element method for fluid dynamics: laminar flow in a channel expansion. *J. Comput. Phys,* 468-488.

Pearce, C., Bicanic, N., Thavalingham, A., Liao, Z.H. (1999). On the DDA framework for modelling concrete fracture.

Peck, R.B. (1973). Influence of non-technical factors on the quality of embankment dams. *Embankment Dam Engineering, Casagrande Volume* John Wiley.

Pepper, D.W., Heinrich, J.C. (2006). *The Finite Element Method Basic Concepts and Applications* CRC Press.

Phoon, K., Kulhawy, F.H. (1999). Characterization of geotechnical variability. *Can. Geotech. J, 36*(4), 612-624. a
[http://dx.doi.org/10.1139/t99-038]

Phoon, K., Kulhawy, F.H. (1999). Evaluation of geotechnical property variability. *Can. Geotech. J, 36*(4), 625-639. b
[http://dx.doi.org/10.1139/t99-039]

Phoon, K.K., Ching, J. (2015). *Risk and reliability in geotechnical engineering.* CRC Press.

Pillo, G.D., Roma, M. (2006). *Large scale nonlinear optimization.* Springer.
[http://dx.doi.org/10.1007/0-387-30065-1]

Plewa, T., Linde, T., Weirs, V.G. (2003). Adaptive mesh refinement - theory and applications *Proceedings of the Chicago Workshop on Adaptive Mesh Refinement Methods.*Sept. 3-5, 2003

Polidori, D.C., Beck, J.L., Papadimitriou, C. (1999). New approximations for reliability integrals. *J. Eng. Mech, 125*(4), 466-475.
[http://dx.doi.org/10.1061/(ASCE)0733-9399(1999)125:4(466)]

Pozrikidis, C. (2014). *Introduction to Finite and Spectral Element Methods Using MATLAB* Chapman and Hall.

Prandtl, L. (1920). Uber die Harte plasticher Korper, Nachrichten von der Koniglichen Gesellschaften, Gottingen, Math.-phys. Klasse, p.74-85.

Prater, E.G. (1977). An examination of some theories of earth pressure on shaft lining. *Can. Geotech. J, 14*(1), 91-106.
[http://dx.doi.org/10.1139/t77-007]

Press, W.H., Teukolsky, S.A., Vetterling, W.T., Flannery, B.P. Numerical recipes in Fortran 90. .Cambridge University Press.

Pugsley, A. (1955). Report on structural safety. *Struct. Eng, 33*(5), 141-149.

Qiu, X.J. (1996). Manifold method without use of penalty springs.

Rackwitz, R., Fiessler, B. (1978). Structural reliability under combined random load sequences. *Comp. & Struct, 9*, 484-494.
[http://dx.doi.org/10.1016/0045-7949(78)90046-9]

Rackwitz, R. (2001). Reliability analysis: A review and some perspectives. *Struct. Saf, 23*(4), 365-395.
[http://dx.doi.org/10.1016/S0167-4730(02)00009-7]

Rao, S.S. (2018). *The finite element method in engineering* (6th ed.). London: Butterworth Heinemann.

Rao, S.S. (2009). *Engineering Optimization.* Wiley.
[http://dx.doi.org/10.1002/9780470549124]

Rassam, D.W., Williams, D.J. (1999). 3-dimensional effects on slope stability of high waste rock dumps. *International Journal of Surface Mining, 13*, 19-24.
[http://dx.doi.org/10.1080/09208119908944197]

Ravindra, M.K., Galambos, T.V. (1978). Load and resistance factor design for steel. *J. Struct. Div, 104*(ST9), 1427-1441.

Reale, C., Xue, J.F., Pan, Z.M., Gavin, K. (2015). Deterministic and probabilistic multi-modal analysis of slope stability. *Comput. Geotech, 66*, 172-179.
[http://dx.doi.org/10.1016/j.compgeo.2015.01.017]

Reddy, J.N. (2000). *Theory and Analysis of Elastic Plates.* Taylor and Francis.

Reddy, J.N. (2015). *An Introduction to Nonlinear Finite Element Analysis.* Oxford University Press.

Rees, D.W.A. (2006). *Basic engineering plasticity.* Elsevier.

Reissner, H. (1924). Zum Erddruckproblem In: Biezeno, C.B., Burgers, J.M., (Eds.), *Proc. 1st Int. Congress for Applied Mechanics,* Delft295-311.

Reissner, H. (1924). Zum Erddruckproblem In: Biezeno, C.B., Burgers, J.M., (Eds.), *Proc. 1st Int. Congress for Applied Mechanics,* Delft295-311.

Revilla, J., Castillo, E. (1977). The calculus of variations applied to stability of slopes. *Geotechnique, 27*, 1-11.
[http://dx.doi.org/10.1680/geot.1977.27.1.1]

Rodriguez, R.J., Sitar, N., Chacon, J. (2006). System reliability approach to rock slope stability. *Int. J. Rock Mech. Min. Sci.*
[http://dx.doi.org/10.1016/j.ijrmms.2005.11.011]

Rosenblueth, E. (1981). Two-point estimates in probabilities. *Appl. Math. Model, 5*(2), 329-335.
[http://dx.doi.org/10.1016/S0307-904X(81)80054-6]

Rourke, J. (1998). *Computational Geometry in C* Cambridge University Press.
[http://dx.doi.org/10.1017/CBO9780511804120]

Sarhosis, V., Bagi, K., Lemos, J.V., Milani, G. (2016). *Computational Modeling of Masonry Structures Using the Discrete Element Method.* Engineering Science Reference.
[http://dx.doi.org/10.4018/978-1-5225-0231-9]

Sarma, S.K., Tan, D. (2006). Determination of critical slip surface in slope analysis. *Geotechnique, 56*(8),

539-550.
[http://dx.doi.org/10.1680/geot.2006.56.8.539]

Schultze, E. (1975). Some aspects concerning the application of statistics and probability to foundation structures *Proceedings of the 2nd International Conference on Applications of Statistics and Probability in Soil and Structural Engineering,* Aachen457-494.

Senders, J.W., Moray, N.P. (1991). *Human Error: Cause, Prediction and Reduction.* New Jersey: Lawrence Erlbaum Associates.

Sherali, H.D., Terlaky, T., Ye, Y. (2016). *Advances in Stochastic and Deterministic Global Optimization.* Springer.

Shi, G.H., Goodman, R.E. (1985). Two dimensional discontinuous deformation analysis. *Int. J. Numer. Anal. Methods Geomech, 39*, 541-556.
[http://dx.doi.org/10.1002/nag.1610090604]

Shi, G.H. (1988). *DDA-a new numerical model for the static and dynamics of block system.*

Sh, G.H. (1993). Block system modelling by discontinuous deformation analysis. *Comput. Mech,* 11.

Shinozuka, M., Deodatis, G. (1988). Response variability of stochastic finite-element systems. *J. Eng. Mech, 114*(3), 499-519.
[http://dx.doi.org/10.1061/(ASCE)0733-9399(1988)114:3(499)]

Shooman, M. (1968). *Probabilistic Reliability an Engineering Approach.* McGraw Hill.

Shyu, K., Salami, M.R. (1995). Manifold with four-node isoparametric finite element method. *Work Forum on Manifold Method of Material, California, USA, V1*, 165-182.

Silvestrini, R.T., Montgomery, D.C., Jones, B. (2013). Comparing computer experiments for the Gaussian process model using integrated prediction variance. *Qual. Eng, 25*(2), 164-174.
[http://dx.doi.org/10.1080/08982112.2012.758284]

Sloan, S.W. (1988). Lower bound limit analysis using finite elements and linear programming. *Int. J. Numer. Anal. Methods Geomech, 12*(1), 61-77.
[http://dx.doi.org/10.1002/nag.1610120105]

Sloan, S.W. (1989). Upper bound limit analysis using finite-elements and linear-programming. *Int. J. Numer. Anal. Methods Geomech, 13*(3), 263-282.
[http://dx.doi.org/10.1002/nag.1610130304]

Sloan, S.W., Randolph, M.F. (1983). Automatic element reordering for finite element analysis with frontal solution schemes. *Int. J. Numer. Methods Eng, 19*, 1153-1181.
[http://dx.doi.org/10.1002/nme.1620190805]

Sloan, S.W. (1989). A Fortran program for profile and wavefront reduction. *Int. J. Numer. Methods Eng, 28*, 2651-2679.
[http://dx.doi.org/10.1002/nme.1620281111]

Smith, I.M., Griffiths, D.V., Margetts, L. (2014). *Programming the Finite Element Method* John Wiley.

Smith, C., Gilbert, M. (2007). Application of discontinuity layout optimization to plane plasticity problems. *Proc. R. Soc. A, 463*(2086), 2461-2484.

[http://dx.doi.org/10.1098/rspa.2006.1788]

Stuedlein, A., Kramer, S., Arduino, P., Holtz, R. (2012). Geotechnical characterization and random field modeling of desiccated clay. *J. Geotech. Geoenviron. Eng, 138*(11), 1301-1313.
[http://dx.doi.org/10.1061/(ASCE)GT.1943-5606.0000723]

Sokolovskii, V.V. (1965). *Statics of Granular Media.* Pergamon Press.

Solnon, C. (2010). *Ant Colony Optimization and Constraint Programming.* ISTE Ltd.

Soubra, A.H. (2000). Static and seismic passive earth pressure coefficients on rigid retaining structures. *Can. Geotech. J, 37*, 463-478.
[http://dx.doi.org/10.1139/t99-117]

Sowers, G.F. (1991). *The human factor in failures.* Civil Engineering, ASCE, March, p. 72-73.

Spanos, P.D., Ghanem, R. (1989). Stochastic finite element expansion for random medium. *J. Eng. Mech, 115*(5), 1035-1053.
[http://dx.doi.org/10.1061/(ASCE)0733-9399(1989)115:5(1035)]

Spencer, E. (1967). A method of analysis of the stability of embankments assuming parallel inter-slice forces. *Geotechnique, 17*, 11-26.
[http://dx.doi.org/10.1680/geot.1967.17.1.11]

Strack, O.D.L., Cundall, P.A. (1984). *Fundamental studies of fabrics in granular materials, Interim report to National Science Foundation, NSF CEE-8310729.* Department of Civil and Mineral Engineering, University of Minnesota.

Suchomel, R., Masin, D. (2010). Comparison of different probabilistic methods for predicting stability of a slope in spatially variable c- soil. *Comput. Geotech, 37*(1), 132-140.
[http://dx.doi.org/10.1016/j.compgeo.2009.08.005]

Sudret, B., Der Kiureghian, A. (2002). Comparison of finite element reliability methods. *Probab. Eng. Mech, 17*, 337-348.
[http://dx.doi.org/10.1016/S0266-8920(02)00031-0]

Sukumar, N., Moran, B. (2001). Natural neighbour Galerkin Methods. *Int. J. Numer. Methods Eng, 50*, 1-27.
[http://dx.doi.org/10.1002/1097-0207(20010110)50:1<1::AID-NME14>3.0.CO;2-P]

Sulsky, D., Chen, Z., Schreyer, H. (1994). A particle method for history-dependent materials. *Comput. Methods Appl. Mech. Eng, 118*(1-2), 179-196.
[http://dx.doi.org/10.1016/0045-7825(94)90112-0]

Sze, K.Y. (2002). Three-dimensional continuum finite element models for plate/shell analysis. *Prog. Struct. Eng. Mater, 4*, 400-407.
[http://dx.doi.org/10.1002/pse.133]

Szilard, R. (2004). *Theory and Applications of Plates Analysis of Plates.* John Wiley.
[http://dx.doi.org/10.1002/9780470172872]

Talbi, E.G., Nakib, A. (2019). *Bioinspired Heuristics for Optimization.* Springer.
[http://dx.doi.org/10.1007/978-3-319-95104-1]

(1985). Some considerations of an acceptable level of risk in the Netherlands. Report by TAW workgroup 10, “Probabilistic methods”.

Temme, Y., Goh, C.K. (2010). *Computational Intelligence in Expensive Optimization Problems.* Springer.

Thapa, B. (1996). Joint shear displacement-dilation analysis using in-situ opposing profiles. *Proceedings of 35th U.S. Symposium on Rock Mechanics,* Lake Tahoe, CA, USA44-51.

Thornton, C. (2015). *Granular Dynamics, Contact Mechanics and Particle System Simulations.* Springer. [http://dx.doi.org/10.1007/978-3-319-18711-2]

Thornton, C., Randall, C.W. (1988). *Applications of theoretical contact mechanics to solid particle system simulations, Mechanics of granular materials.* Elsevier Science Publishing.

Timoshenko, S., Krieger, W. (1959). *Theory of Plates and Shells.* McGraw-Hill.

Ting, J.M., Corkum, B.T., Kauffman, C.R. (1989). Discrete element model for soil mechanics. *J. Geotech. Eng, 115*(3), 379-398. [http://dx.doi.org/10.1061/(ASCE)0733-9410(1989)115:3(379)]

Tiwari, R.C., Bhandary, N.P., Yatabe, R. (2014). Spectral element analysis to evaluate the stability of long and steep slopes. *Acta Geotech, 2014*(9), 753-770. [http://dx.doi.org/10.1007/s11440-013-0292-x]

Tiwari, R.C., Bhandary, N.P., Yatabe, R. (2015). 3-D elasto-plastic spectral element application to evaluate the stability of large-scale landslides. *Geomechanics and Geoengineering, 10*(4), 271-289. [http://dx.doi.org/10.1080/17486025.2014.985337]

Tiwari, R.C. (2015). *3D Slope Stability Modeling: Numerical Methods and Applications: Slope stability, Prog. Failure, Finite-element method, Spectral-element method, Vegetation, Stability charts, Excavation.* LAP LAMBERT Academic Publishing.

Tsay, R.J., Chiou, Y.J., Chuang, W.L. (1999). Crack growth prediction by manifold method. *J. Eng. Mech, 125*, 884-890. [http://dx.doi.org/10.1061/(ASCE)0733-9399(1999)125:8(884)]

Tuy, H. (1998). *Convex analysis and global optimization.* Kluwer Academic Publishers. [http://dx.doi.org/10.1007/978-1-4757-2809-5]

Tvedt, L. (1990). Distribution of quadratic forms in normal space: Application to structural reliability. *J. Eng. Mech, 116*(6), 1183-1197. [http://dx.doi.org/10.1061/(ASCE)0733-9399(1990)116:6(1183)]

Ugai, K. (1988). 3-D Slope Stability Analysis by Slice Methods *Proceedings of the 6th International Conference on Numerical Methods in Geomechanics,* Innsbruck, Austria1369-1374.

Ugai, K., Leshchinsky, D. (1995). Three-dimensional limit equilibrium and finite element analysis: a comparison of results. *Soil Found, 35*(4), 1-7. [http://dx.doi.org/10.3208/sandf.35.4_1]

Urugal, A.C. (1999). *Stress in Plates and Shells* McGraw-Hill.

Vahedifard, F., Leshchinsky, B., Sehat, S., Leshchinsky, D. (2014). Impact of Cohesion on Seismic Design of Geosynthetic-Reinforced Earth Structures. *J. Geotech. Geoenviron. Eng, 140*(6)04014016 [http://dx.doi.org/10.1061/(ASCE)GT.1943-5606.0001099]

Vanmarcke, E.H. (1977). Probabilistic modeling of soil profiles. *J. Geotech. Eng, 103*(11), 1227-1246. a

Vanmarcke, E.H. (1977). Reliability of earth slopes. *J. Geotech. Eng, 103*(11), 1247-1265. b

Vanmarcke, E., Grigoriu, M. (1983). Stochastic finite element analysis of simple beams. *J. Eng. Mech, 109*(5), 1203-1214.
[http://dx.doi.org/10.1061/(ASCE)0733-9399(1983)109:5(1203)]

Vanmarcke, E.H. (2010). *Random Fields: Analysis and Synthesis (revised and expanded).* New ed. World Scientific Publishing Co. Pte. Ltd.Singapore.:

Vesic, A.S. (1973). Analysis of ultimate loads for shallow foundations. *Journal of Soil Mechanics and Foundations Division, ACSE, 99*(SM1), 45-73.

Verlet, L. (1967). Computer "Experiments" on Classical Fluids. I. Thermodynamical Properties of Lennard-Jones Molecules'. *Phys. Rev, 159*, 98-103.
[http://dx.doi.org/10.1103/PhysRev.159.98]

Vick, S.G. (1995). *Geotechnical risk and reliability - from theory to practice in dam safety.* In The Earth, Engineers and Education - Whitman Symposium, Massachusetts Institute of Technology, p. 45-58.

Vrijling, J.K., van Hengel, W., Houben, R.J. (1998). *Acceptable risk as a basic for design. Journal of Reliability Engineering and System Safety* Elsevier.

Walton, O.R. (1982). Explicit particle dynamics model for granular materials, The 4th International Conference on Numerical Methods in Geomechanics, p.1261-1268.

Wang, S.F. (2000). *Research on numerical manifold method of discontinuous and nonlinear deformation analysis for rockmass.*

Wang, Y. (2012). Uncertain parameter sensitivity in Monte Carlo simulation by sample Reassembling. *Comput. Geotech, 46*, 39-47.
[http://dx.doi.org/10.1016/j.compgeo.2012.05.014]

Wang, Y. (2013). Mcs-based probabilistic design of embedded sheet pile walls. *Georisk, 7*(3), 151-162.
[http://dx.doi.org/10.1080/17499518.2013.765286]

Wang, Y., Cao, Z.J., Au, S.K. (2010). Efficient Monte Carlo simulation of parameter sensitivity in probabilistic slope stability analysis. *Comput. Geotech, 37*(7-8), 1015-1022.
[http://dx.doi.org/10.1016/j.compgeo.2010.08.010]

Wang, Y., Cao, Z.J., Au, S.K. (2011). Practical reliability analysis of slope stability by advanced Monte Carlo simulations in a spreadsheet. *Can. Geotech. J, 48*, 162-172.
[http://dx.doi.org/10.1139/T10-044]

Wang, C.Y., Sheng, J., Chen, M.H., Chuang, C.C. (1995). Approximation theories for the manifold method. *Work Forum on Manifold Method of Material, California, USA, 1*, 61-86.

Wang, Q., Shi, X.W. (2009). An improved algorithm for matrix bandwidth and profile reduction in finite element analysis. *Progress In Electromagnetics Research Letters, 9*, 29-38.
[http://dx.doi.org/10.2528/PIERL09042305]

Wang, S.L., Ge, X.R., Zhang, G. (1999). Manifold method with four physical covers forming an element and its application. *The Third International Conference on Analysis of Discontinuous Deformation from Theory to Practice,* Vail, Colorado, USA193-201.

Wang, S.F., Zhu, W.S., Li, S.C., Qiu, X.B. (2001). Numerical manifold method considering lateral effect and its application. *Chinese Journal of Rock Mechanics and Engineering, 20*(3), 297-300.

Wang, S.F., Zhu, W.S., Li, S.C., Chen, S.H. (2002). Numerical manifold method of elastoplastic analysis for rockmass. *Chinese Journal of Rock Mechanics and Engineering, 21*(6), 900-904. a

Wang, S.F., Zhu, W.S., Li, S.C., Chen, S.H. (2002). Numerical manifold method of deformation analysis for bolt supported rockmass. *Chinese Journal of Rock Mechanics and Engineering, 21*(8), 1120-1123. b

Wang, Z.Y., Wang, S.J., Yang, Z.F. (1997). Manifold method in analysis of large deformation for rock. *Chinese Journal of Rock Mechanics and Engineering, 16*(5), 513-516.

Wang, C.M., Reddy, J.N., Lee, K.H. (2000). *Shear deformable beams and plates.* Elsevier.

Wang, L., Liu, B. (2008). *Particle swarm optimization and scheduling algorithms.* China: Tsinghua University Press.

Wei, W.B., Cheng, Y.M., Li, L. (2009). Three-dimensional slope failure by strength reduction and limit equilibrium methods. *Comput. Geotech, 36*, 70-80.
[http://dx.doi.org/10.1016/j.compgeo.2008.03.003]

Wei, W.B., Cheng, Y.M. (2009). Soil nailed slope by strength reduction and limit equilibrium methods. *Comput. Geotech, 37*, 602-618.
[http://dx.doi.org/10.1016/j.compgeo.2010.03.008]

Wei, W.B., Cheng, Y.M. (2009). Strength reduction analysis for slope reinforced with one row of piles. *Comput. Geotech, 36*, 1176-1185.
[http://dx.doi.org/10.1016/j.compgeo.2009.05.004]

Wei, W.B., Cheng, Y.M. (2010). Stability analysis of slope with water flow by strength reduction method. *Soil Found, 50*(1), 83-92.
[http://dx.doi.org/10.3208/sandf.50.83]

Wilson, E.L., Taylor, R.L., Doherty, W., Ghaboussi, J. (1973). *Incompatible Displacement Models, Numerical and Computer Methods in Structural Mechanics.* Academic press.

Wolff, T.F. (1985).

Wolff, T.F. (1991). Embankment reliability versus factor of safety - Before and after slide repair. *Int. J. Numer. Anal. Methods Geomech, 15*(1), 41-50.
[http://dx.doi.org/10.1002/nag.1610150104]

Wriggers, P., Panagiotopoulos, P. (1999). *New developments in contact problems.* Springer.
[http://dx.doi.org/10.1007/978-3-7091-2496-3]

Wu, H.Y. (2012). *Discrete Element Modelling of Particulate Media.* RSC Publishing.
[http://dx.doi.org/10.1039/9781849735032]

Wu, T.H. (2008). *Reliability analysis of slopes, Reliability based design in geotechnical engineering: Computations and Applications* (pp. 413-447). London: Taylor and Francis.

Wu, L.Y., Tsai, Y.F. (2004). Analysis of Earth Pressure for Retaining Wall and Ultimate Bearing Capacity for Shallow Foundation by Variational method. *J. Mech, 20*, 45-55.

Wu, LY, Tsai, YF (2005). Variational Stability Analysis of Cohesive Slope by Applying Boundary integral Equation Method. *Journal of Mechanics, 21*, 187-195.

Wu, Z.J., Wang, S.L., Ge, X.R. (2009). Slope reliability analysis by random FEM under constraint random field. *Chincese Journal of Rock and Soil Mechanics, 30*(10), 3086-3092.

Xing, Y.F., Liu, B.O., Liu, G. (2010). A differential quadrature finite element method. *Int. J. Appl. Mech, 02*, 207.
[http://dx.doi.org/10.1142/S1758825110000470]

Xu, B., Low, B.K. (2006). Probabilistic stability analyses of embankments based on finite-element method. *J. Geotech. Geoenviron. Eng, 132*(11), 1444-1454.
[http://dx.doi.org/10.1061/(ASCE)1090-0241(2006)132:11(1444)]

Xue, J.F., Gavin, K. (2007). Simultaneous Determination of Critical Slip Surface and Reliability Index for Slopes. *J. Geotech. Geoenviron. Eng, 133*(7), 878-886.
[http://dx.doi.org/10.1061/(ASCE)1090-0241(2007)133:7(878)]

Yang, Y., Huang, R.Q., Cheng, Y.M., Wang, J.F. (2014). Investigation of the Deformable Behavior of Loose and Dense Sand through DEM. *Adv. Mat. Res, 871*, 124-128.

Yang, Y., Cheng, Y.M. (2014). The fractal features of contact force chains for crushable granular materials under confined compression. *Proceedings of ASCE Engineering Mechanics Institute International Conference,* Hong Kong7-9.

Yang, Y., Cheng, Y.M. (2015). A fractal model of contact force distribution and the unified coordination distribution for crushable granular materials under confined compression. *Powder Technol, 279*, 1-9.
[http://dx.doi.org/10.1016/j.powtec.2015.03.006]

Yang, Y., Cheng, Y.M. (2016). Quantified evaluation of particle shape effects from micro-to-macro scales for non-convex grains. *Particuology, 25*, 23-35.
[http://dx.doi.org/10.1016/j.partic.2015.01.008]

Yang, Y., Cheng, Y.M. (2016). Exploring the contact types within mixtures of different shapes at the steady state by DEM. *Powder Technol, 301*, 440-448.
[http://dx.doi.org/10.1016/j.powtec.2016.06.016]

Yang, Y., Cheng, Y.M. (2017). The effects of rolling resistance and non-convex particle on the mechanics of the undrained granular assembles in 2D. *Powder Technol, 318*, 528-542.
[http://dx.doi.org/10.1016/j.powtec.2017.06.027]

Yang, Y., Cheng, Y.M., Sun, Q.C. (2018). Revisiting the confined comminution of granular materials with the consideration of the initial particle size distributions and repetitive loadings. *Powder Technol, 329*, 149-157.
[http://dx.doi.org/10.1016/j.powtec.2018.01.045]

Yang, Y.S. (2010). *Engineering Optimization An Introduction with Metaheuristic Applications.* Wiley.
[http://dx.doi.org/10.1002/9780470640425]

Yeung, M., Klein, S.J., Max, M. (1994). Application of the discontinuous deformation analysis to the evaluation of rock reinforcement for tunnel stabilization. *Proceedings of the First North American Rock Mechanics Symposium,* Austin, TX607-614.

Yi, P., Wei, K.T., Kong, X.J., Zhu, Z. (2015). Cumulative PSO-Kriging model for slope reliability analysis.

*Probab. Eng. Mech, 39*, 39-45.
[http://dx.doi.org/10.1016/j.probengmech.2014.12.001]

Yim, S.C. (2007). *3-D Wave-Structure Interaction with Coastal Sediments-A Multi-Physics/Multi-Soluti-n-Techniques Approach.* Corvallis: Defense Technical Information Center.

Yin, P.Y. (2004). A discrete particle swarm algorithm for optimal polygonal approximation of digital curves. *J. Vis. Commun. Image Represent, 15*, 241-260.
[http://dx.doi.org/10.1016/j.jvcir.2003.12.001]

Yu, H.S., Salgado, R., Sloan, S.W., Kim, J.M. (1998). Limit analysis versus limit equilibrium for slope stability. *J. Geotech. Geoenviron. Eng, 124*(1), 1-11.
[http://dx.doi.org/10.1061/(ASCE)1090-0241(1998)124:1(1)]

Yu, H.S. (2006). *Plasticity and geotechnics.* Springer.

Yu, X.J., Gen, M.S. (2010). *Introduction to Evolutionary Algorithms.* Springer.
[http://dx.doi.org/10.1007/978-1-84996-129-5]

Yuan, X., Lu, Z., Zhou, C., Yue, Z. (2013). A novel adaptive importance sampling algorithm based on markov chain and low-discrepancy sequence. *Aerosp. Sci. Technol, 29*(1), 253-261.
[http://dx.doi.org/10.1016/j.ast.2013.03.008]

Zelinka, I., Snasel, V., Abraham, A. (2013). *Handbook of Optimization From Classical to Modern Approach.* Springer.
[http://dx.doi.org/10.1007/978-3-642-30504-7]

Zhang, X. (1988). Three-dimensional stability analysis of concave slopes in plan view. *J. Geotech. Eng, 114*(6), 658-671.
[http://dx.doi.org/10.1061/(ASCE)0733-9410(1988)114:6(658)]

Zhang, X. (1999). Slope stability analysis based on the rigid finite element method. *Geotechnique, 49*(5), 585-593.
[http://dx.doi.org/10.1680/geot.1999.49.5.585]

Zhang, Y.H., Zhu, W.S., Qiu, X.B., Li, S.C. (1998). The application of DDA method on the excavation of the ground factory of Xiledu hydropower station. *Chinese Journal of Rock Mechanics and Engineering, 18*, 945-947.

Zhang, X.W., Cai, Y.C., Liao, L.C. (2000). Auto mesh algorithm of the finite cover system in the numerical manifold method. *Chinese Journal of Chongqing University, 23*(1), 28-31. [Natural Science Edition].

Zhang, X., Sanderson, D.J. (2002). *Numerical Modelling and Analysis of Fluid Flow and Deformation of Fractured Rock Masses.* Elsevier.

Zhang, G.X., Sigiura, Y., Hasegawa, H. (1997). Crack propagation and thermal fracture analysis by manifold method. *Proceedings of the Second International Conference on Analysis of Discontinuous Deformation,* Kyoto, Japan282-297.

Zhang, G.X., Sugiura, Y., Saito, K. (1999). Application of manifold method to jointed dam foundation. *The Third International Conference on Analysis of Discontinuous Deformation from Theory to Practice,* Vail, Colorado, USA211-220.

Zhang, J., Huang, H.W., Phoon, K.K. (2013). Application of the Kriging-Based Response Surface Method to the System Reliability of Soil Slopes. *J. Geotech. Geoenviron. Eng, 139*(4), 651-655.

[http://dx.doi.org/10.1061/(ASCE)GT.1943-5606.0000801]

Zhang, X., Chen, Z., Liu, Y. (2017). *The Material Point Method: A Continuum-Based Particle Method for Extreme Loading Cases.* Tsinghua University Press Computational Mechanics Series.
[http://dx.doi.org/10.1016/B978-0-12-407716-4.00003-X]

Zhang, J., Zhang, L.M., Tang, W.H. (2011). New methods for system reliability analysis of soil slopes. *Can. Geotech. J, 48*(7), 1138-1148.
[http://dx.doi.org/10.1139/t11-009]

Zhang, J., Huang, H.W., Juang, C.H., Li, D.Q. (2013). Extension of Hassan and Wolff method for system reliability analysis of soil slopes. *Eng. Geol, 60*, 81-88.
[http://dx.doi.org/10.1016/j.enggeo.2013.03.029]

Zhang, W.G., Goh, A.T.C. (2013). Multivariate adaptive regression splines for analysis of geotechnical engineering systems. *Comput. Geotech, 48*, 82-95.
[http://dx.doi.org/10.1016/j.compgeo.2012.09.016]

Zhao, J., Ohnishi, Y., Zhao, G.F., Sasaki, T. (2011). Advances in Discontinuous Numerical Methods and Applications in Geomechanics and Geoengineering *Proceedings of the 10th International Conference on advances in Discontinuous numerical methods and applications in geomechanics and geoengineering, ICADD 10.*Honululu, Hawaii6□8 Dec.

Zhao, H.B. (2008). Slope reliability analysis using a support vector machine. *Comput. Geotech, 35*(3), 459-467.
[http://dx.doi.org/10.1016/j.compgeo.2007.08.002]

Zhao, W., Wang, W., Dai, H., Xue, G. (2010). Structural reliability analysis based on the cokriging technique. *IOP Conf. Series Mater. Sci. Eng, 10*012204
[http://dx.doi.org/10.1088/1757-899X/10/1/012204]

Zhao, Y.G., Ono, T. (1999). New approximations for SORM: Part 1. *J. Eng. Mech, 125*(1), 79-85. a
[http://dx.doi.org/10.1061/(ASCE)0733-9399(1999)125:1(79)]

Zhao, W., Wang, W. (2011). Application of cokriging technique to structural reliability analysis. *2011 International Conference,* 170-174.
[http://dx.doi.org/10.1109/ICFCSA.2011.46]

Zhao, Y.G., Ono, T. (1999). New approximations for SORM: Part 2. *J. Eng. Mech, 125*(1), 86-93. b
[http://dx.doi.org/10.1061/(ASCE)0733-9399(1999)125:1(86)]

Zheng, H., Zhou, C.B., Liu, D.F. (2009). A robust solution procedure for the rigorous methods of slices. *Soil Found, 49*(4), 537-544.
[http://dx.doi.org/10.3208/sandf.49.537]

Zhou, J.L., Tits, A.L. (1992). *User's Guide for FSQP Version 3.0c: A FORTRAN Code for Solving Constrained Nonlinear (Minimax) Optimization Problems, Generating Iterates Satisfying All Inequality and Linear Constraints, Technical research report.* University of Maryland.

Zhou, W.Y., Yang, Q., Kou, X.D. (1997). Development of high order manifold method. *Proceedings of the Second International Conference on Analysis of Discontinuous Deformation,* Kyoto, Japan274-281.

Zhou, W.Y., Kou, X.D., Yang, R.Q. (1999). Crack propagation by manifold method coupled with element free method. *The Third International Conference on Analysis of Discontinuous Deformation from Theory to Practice,* Vail, Colorado, USA283-289.

Zhu, Y.W. (1999). Augment manifold method in big deformation of rock. *Chinese Journal of Rock Mechanics and Engineering, 18*(1), 1-5.

Zhu, B.F. (2018). *The Finite Element Method, Fundamentals and Applications in Civil, Hydraulic, Mechanical and Aeronautical Engineering.* Tsinghua University Press.

Zhu, D.Y., Lee, C.F., Qian, Q.H., Zou, Z.S., Sun, F. (2001). A new procedure for computing the factor of safety using the Morgenstern–Price's method. *Can. Geotech. J, 38*(4), 882-888. [http://dx.doi.org/10.1139/t01-002]

Zhu, D.Y., Lee, C.F., Jiang, H.D. (2003). Generalised framework of limit equilibrium methods for slope stability analysis. *Geotechnique, 53*(4), 377-395. [http://dx.doi.org/10.1680/geot.2003.53.4.377]

Zhu, T., Atluri, S.N. (1998). A modified collocation method and a penalty formulation for enforcing the essential boundary conditions in the element free Galerkin method. *Comput. Mech, 21*(3), 211-222. [http://dx.doi.org/10.1007/s004660050296]

Zolfaghari, A.R., Heath, A.C., McCombie, P.F. (2005). Simple genetic algorithm search for critical non-circular failure surface in slope stability analysis. *Comput. Geotech, 32*(3), 139-152. [http://dx.doi.org/10.1016/j.compgeo.2005.02.001]

Zoyama, A.Y. (2006). *Handbook of nature-inspired and innovative computing.* Springer. [http://dx.doi.org/10.1007/0-387-27705-6]

Zienkiewicz, O.C., Taylor, R.L., Zhu, J.Z. (2011). *The finite element method: Its basis and fundamentals* ($6^{th}$ ed.). London: Butterworth Heinemann.

# SUBJECT INDEX

## A



## B



Y.M. Cheng, J. H. Wang, L. Liang, W. H. Fung Ivan (Eds.)

## C



## D

# E

## F

## G



## H

## M



## N

## O



## P

## Q



## R



## S

## T

## U



## V



## W



## Y



## Z

## Y. M. Cheng

Prof. Cheng has worked in various design and construction works in soft ground tunneling, rock tunneling, various types of bridges, deep excavation and lateral supports, soil stabilization, ground treatment works and other geotechnical works before joining the university. His research interests include geotechnical engineering, structural engineering, numerical methods and monitoring system.

Prof. Cheng has participated in the Foundation Code 2017 in Hong Kong as well as the Foundation Handbook in Hong Kong. Besides that, he is also one of the members of various professional bodies as well as one of the advisors to several government departments. Besides research, Prof. Cheng has also participated in various large scale construction works in Hong Kong, Macau, China, Taiwan, Europe, Egypt and Australia.

To date, Prof. Cheng has published 7 books and has received 3 Best Paper Awards from different journals. Prof. Cheng has also developed several patents which include SLOPE 2000, SLOPE3D, PLATE, GeoSuite and IOT monitoring system.