

Book review

Risk assessment in geotechnical engineering. *G. A. Fenton and D. V. Griffiths. Chichester: Wiley, 2008. 461 pp. ISBN 978-0-470-17820-1, £100.00*

The book is structured in two parts: the first has a fairly comprehensive treatment of the theory required for application, which is covered in the second part. The presentation of Part 1: Theory is well managed and communicated in a clear and very readable manner given the subject matter, and it also clearly discusses the requirements and short-comings of each aspect. The content covers a wide range of theory from more well-known, simple probabilistic analysis through to more recent developments. This material will be very useful to anyone trying to get to grips with the application of quantitative probabilistic risk assessment. In Part 2: Practice, the application of the methods described in Part 1 to typical geotechnical problems (e.g. groundwater flow, bearing capacity, slope stability and liquefaction) is presented, with the main focus being the use of the random finite-element method (RFEM) in generating a view of the sensitivity of a problem from a statistical standpoint. Again the material is communicated very well and the treatment is quite honest in terms of the limited availability and reliability of many of the statistical parameters required to carry out the analyses. It becomes apparent from the discussion that the more complex probability theory presented in Part 1 is of limited use in a practical sense owing to the difficulties associated with reliably quantifying the required parameters – it will be interesting to see whether this is either a problem of lack of widespread use of the method, or simply a consequence of the nature of geotechnics.

While providing an excellent coverage of probability theory and an introduction into the possibilities of application of the RFEM, my thought was that the practicalities of

undertaking such analysis were not really dealt with: that is, the problems used to illustrate the method were naturally enough very simple, but it would have been useful to have been given an indication as to the computational and subsequent post-processing effort/time to generate the assessments, given that between 500 and 2000 ‘realisations’ were usually required, and what happens when you meet more realistic problems – is this ever likely to be commercially viable and get beyond the use by a few really keen adherents?

Also, the impact of the analytical method employed to generate the statistical data used in the assessment was not really discussed: that is, how do the modelling assumptions and details affect or even bias the outcome of the assessment? In this instance, for example, the uniform mesh used for the footing bearing capacity assessment triggered this question for me, given that it is fairly well documented that, for realistic finite-element prediction in this problem, it is not simply the number of elements but the grading of the mesh in the vicinity of the footing edges that has a significant impact on the final result. So, if the analysis is not giving you the ‘correct’ numerical solution what does this mean for your probabilistic analysis? Following on from this, if the method were used to generate partial factors for use in limit state design, are they only useful for the method of analysis being used given that they will presumably have built into them the modelling uncertainty associated with the particular calculation method being used? Again, some discussion of these types of issues might have strengthened this already excellent book further.

A really well-written treatise, however, for a subject that is not (in a day-to-day sense) that familiar to many, and deserving of a read to update yourself on probabilistic theory and how it might be applied.

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