

51st Rankine Lecture

Wednesday 16 March 2011

Geotechnical Stability Analysis

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ABSTRACT

Historically, geotechnical stability analysis has been performed by a variety of approximate methods that are based on the notion of limit equilibrium. Although they appeal to engineering intuition, these techniques have a number of major disadvantages, not the least of which is the need to presuppose an appropriate failure mechanism in advance. This feature can lead to inaccurate predictions of the true failure load, especially for cases involving layered materials, complex loading, or three-dimensional deformation.

This lecture will describe recent advances in stability analysis which avoid these shortcomings. Attention will be focused on new methods which combine the limit theorems of classical plasticity with finite elements to give rigorous upper and lower bounds on the failure load. These methods, known as finite element limit analysis, do not require assumptions to be made about the mode of failure, and use only simple strength parameters that are familiar to geotechnical engineers. The bounding properties of the solutions are invaluable in practice, and enable accurate solutions to be obtained through the use of an exact error estimate and automatic adaptive meshing procedures. The methods are extremely general and can deal with layered soil profiles, anisotropic strength characteristics, fissured soils, discontinuities, complicated boundary conditions, and complex loading in both two and three dimensions. Following a brief outline of the new techniques, stability solutions for a number of practical problems will be given including foundations, anchors, slopes, excavations, and tunnels.

Scott Sloan is Laureate Professor and Director of the Australian Research Council (ARC) Centre of Excellence in Geotechnical Science and Engineering at the University of Newcastle, NSW, Australia. He is a Fellow of both the Australian Academy of Science and the Academy of Technological Sciences and Engineering, and currently holds an ARC Laureate Fellowship. Scott is the recipient of various awards including the Telford Medal and Telford Premium from the ICE and the Thomas A Middlebrooks Award from the ASCE. He also delivered the 2003 E H Davis Memorial Lecture at the invitation of the Australian Geomechanics Society. Scott is currently editor-in-chief of *Computers and Geotechnics* and serves on the editorial boards of 5 other international journals. He is the author of over 220 papers in geotechnical engineering and regularly engages with industry through his role as a Visiting Senior Principal with Coffey Geotechnics.

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Lecture 17:30 -19:15 hours Tea from 17:00 hours

Main Lecture Theatre, Sherfield Building, Imperial College London, Exhibition Road, SW7 2AZ

All are welcome: No registration required

(For DINNER: see Separate Ticket Application Form)

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