**OPTIMIZATION BASED FINITE ELEMENT SYSTEM FOR GEOTECHNCIAL STABILITY ANALYSIS**

Andrei V Lyamin

*Centre for Geotechnical Science and Engineering, University of Newcastle, NSW, Australia*

**ABSTRACT**

Computational limit analysis has long been recognized as a powerful tool for assessing the stability of geostructures such as foundations, slopes, retaining walls, etc. While most of the developments have taken place within the academic community, computational limit analysis has now reached a level of maturity where its application to geotechnical engineering practice is not only feasible but in fact associated with numerous advantages over more traditional methods such as conventional displacement based finite element analysis.

In contrast to conventional finite element analysis, computational limit analysis does not require the entire load-displacement behaviour to be traced. Rather, the limit load is determined directly in a single calculation. In addition, it is possible to compute upper and lower bounds on both the limit load and the material strength, thereby bracketing the true limit solutions from above and below. Moreover, robust and powerful mesh adaptivity procedures and solution algorithms have been developed and refined. Together, these provide a computational framework with unparalleled robustness and efficiency.

While stability and bearing capacity calculations are important elements of geotechnical analysis and design, deformations under working loads also need to be assessed. Computational limit analysis has traditionally been viewed as offering very little in this regard. However, it turns out that it is possible to extend the basic computational limit analysis framework to cover also deformation analysis.

Recently, an effort has been undertaken to bring these tools into a form where they can be used by practicing engineers on a routine basis. The result is the software, which covers most of the analysis types required for geotechnical design including limit analysis, seepage, elastoplasticity, strength reduction and staged construction analysis.

The presentation will cover both the theoretical foundations of limit analysis and its extensions and their application to a range of typical geotechnical problems.

**SPEAKER BIO**

Andrei Lyamin, born in Korolev, Russia, obtained BSc degrees in physics from the Moscow Institute of Physics and Technology in 1985 and in applied mathematics from the Moscow Defence Academy in 1987. In 1993, he moved to Australia and obtained a PhD in computational geomechanics from the University of Newcastle in 2000. Areas of expertise include scientific computing, nonlinear optimization, and theoretical and computational mechanics. He is currently a Professor of Civil Engineering and Principle Researcher for the Priority Research Centre for Geotechnical Science and Engineering at the University of Newcastle, Australia. Major research interest - developing optimization based software for geotechnical engineering practice.