Reliability-Based Design of an Earth Slope Taking into Account Unsaturated Soil Properties

Authors : A. T. Siacara, A. T. Beck, M. M. Futai

Abstract : This paper shows how accurately and efficiently reliability analyses of geotechnical installations can be performed by directly coupling geotechnical software with a reliability solver. An earth slope is used as the study object. The limit equilibrium method of Morgenstern-Price is used to calculate factors of safety and find the critical slip surface. The deterministic software package Seep/W and Slope/W is coupled with the StRAnD reliability software. Reliability indexes of critical probabilistic surfaces are evaluated by the first-order reliability methods (FORM). By means of sensitivity analysis, the effective cohesion (c') is found to be the most relevant uncertain geotechnical parameter for slope equilibrium. The slope was tested using different geometries, taking into account unsaturated soil properties. Finally, a critical slip surface, identified in terms of minimum factor of safety, is shown here not to be the critical surface in terms of reliability index.

Keywords : slope, unsaturated, reliability, safety, seepage