International Conference on Contemporary Iran on Civil Engineering
Architecture and Urban Development
Iran Tehran - August 16, 2017

Reliability analysis of infinite slope with uncertainties of soil and geometric parameters

H.Abedi[1] , A.Zahmatkesh[1] , H.Rahmati*[2]

1. Islamic Azad university of Ferdows, Ferdows, Iran
2.Department of Civil and Environmental Engineering, Shiraz University of Technology, Shiraz, Iran
H.Rahmati@sutech .ac.ir

Abstract

Analysis of soil slope is an incredibly important branch of geotechnical engineering. The uncertainties associated with the effective parameters of infinite slope stability cause probabilistic analysis to be more realistic than deterministic. Probabilistic analysis of slope stability has received considerable attention in the literature. In this paper, the Monte Carlo Simulation (MCS) is used in a codded program for reliability assessment of infinite slope without seepage. The analyses are done in two categories, in first case the soil parameters, internal friction angle, cohesion and unit weight are selected as stochastic parameters. In the second case in additional of soil, the geometric parameters, height of the slope and angle with the horizon are considered as stochastic parameters. Comparison of the results shows that the reliability index of the second case is greater than first case.

Key words : Monte Carlo Simulation, Probabilistic analysis, Infinite slope, reliability index

1. Introduction

The problem of slope stability is a statically indeterminate problem. There are different methods of analysis available for engineers to assess the stability of slopes. It can be carried out by the Limit Equilibrium Method (LEM), the limit analysis method, the Finite Element Method (FEM) or the finite difference method. By far, most engineers still use the limit equilibrium method, with which they are more familiar. These methods are widely documented in geotechnical literature and use principles of static equilibrium to evaluate the balance of driving and resisting forces [e.g., [1–4]]. The factor of safety is defined as the ratio of resisting forces over driving forces, or, alternatively, as the shear strength divided by the calculated shear stresses. A factor of safety greater than one indicates a stable slope and a value less than one indicates impending failure. Therefore, these methods are restricted by the use of single valued parameters to describe the slope's characteristics. However, the inherent uncertainties of the characteristics which affect slope stability dictate that the slope stability problem is of a probabilistic nature rather than being deterministic. In general, the uncertainty in the stability of a slope is divided into three distinctive categories: soil parameter uncertainty, model uncertainty and human uncertainty [5]. Parameter uncertainty is the uncertainty in input parameters for analysis [6,7], model uncertainty is due to the limitation of theories and models used in performance prediction [8],while human uncertainty is due to human error [9]. In this research, parameter uncertainty is assessed.