

论文

快速蒙特卡罗法及其在土坡可靠度分析中的应用

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摘要:

为了合理地进行土坡稳定可靠度分析, 提出了一种快速确定土坡概率性临界滑动面(具有最小可靠度指标的滑动面)的策略, 其思路为: 随机生成大量可行滑动面, 并分别计算这些滑动面与确定性临界滑动面之间的相关系数, 给定一系列相关系数的区间, 将相关系数位于某区间的滑动面分为一组, 对该组滑动面应用快速蒙特卡罗法(两次抽样)计算滑动面的“伪”可靠度指标, 挑选“伪”可靠度指标最小的滑动面作为该组的代表性滑动面, 然后综合比较各组代表性滑动面的可靠度指标, 可靠度指标最小的滑动面即为概率性临界滑动面。算例分析结果表明: 快速蒙特卡罗法可以快速找到土坡概率性临界滑动面, 可用于土坡可靠度分析。

关键词: 土坡稳定; 可靠度分析; 蒙特卡罗法; 极限平衡法; 可靠度指标

Fast Monte-Carlo method and its application in the soil slope reliability analysis

Abstract:

In order to rationally perform the slope stability analysis, a fast procedure to determine the critical reliability slip surface(with the minimum reliability index) was proposed in this paper.The steps are as follows: a large number of potential slip surfaces are randomly generated and the correlation coefficients between the safety factors of potential slip surfaces and the deterministic critical slip surface are calculated.Based on the calculated coefficients, the slip surfaces whose correlation coefficients fall within a prescribed interval are categorized into one slip surface group.The ‘pseudo’ reliability indices of slip surfaces within one slip surface group are then calculated by fast Monte-Carlo method with only two samplings.The slip surface with the minimum ‘pseudo’ reliability index is regarded as the representative slip surface of the group.The critical reliability slip surface can be obtained by comparing those representative slip surfaces from all the slip surface groups.The case studies have shown that the fast Monte-Carlo method is applicable to soil slope reliability analysis.

Keywords: soil slope stability; reliability analysis; Monte-Carlo method; limit equilibrium method; reliability index

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