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台湾集集地震九份二山滑坡发生机制的三维数值模拟分析

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3-D DISTINCT ELEMENT MODELING OF SLIDING PROCESS AND DEPOSITING BEHAVIOR IN JIUFENGERSHAN LANDSLIDE INDUCED BY 1999 TAIWAN CHI-CHI EARTHQUAKE

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- 摘要
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全文: PDF (17452 KB) HTML (KB) 输出: BibTeX | EndNote (RIS) 背景资料

摘要 台湾九份二山滑坡体积约$4\times10^7m^3$,是1999年集集地震所诱发的大型滑坡之一。该滑坡造成了巨大的生命财产损失,引起了众多研究者的关注,但由于地质地貌条件等多因素的影响,对该滑坡的研究特别是有关滑行机制问题等还有许多争议。本文作者基于颗粒体离散元素法,对九份二山滑坡的传送与堆积过程进行了仿真模拟,并由此分析探讨了滑坡的崩滑机制。模拟分析结果表明:滑坡体滑动时的摩擦系数为0.05,其最快速度可达$50m\cdot s^{-1}$; 由于受地貌地形的影响,滑坡体滑行距离并不长,最大为1148m。滑坡过程模拟同时显示:该滑坡由于受滑坡前缘和滑坡面的几何形状影响,滑坡的崩滑机制并非单一的剪出破坏或拱曲作用,而是在滑坡体西南部区域以拱曲作用为主,在滑坡块体的东北部以剪出作用为主,并非二维模拟结果所显示的那样仅仅是拱曲破坏机制。本实例研究表明在分析大型山崩滑坡的崩滑机制时,除了要考虑崩塌物的特性及构造特征外,还需要考虑滑坡体周边的地形地貌特征和滑动面的几何特征。

关键词: 九份二山滑坡 运行堆积过程 滑行机制 数值模拟

Abstract: The Jiufengershan landslide with the volume of $4107m^3$ is one of the huge landslides induced by the 1999 Taiwan Chi-Chi Earthquake. The collapse mechanism of this landslide may be shear out or buckling, which is an argument need to be further. This paper demonstrates that there might be different failure mechanisms that could happen in the landslide block at a reasonable friction coefficient of 0.05 by the 3-D models. Taking toe particles into account, the collapse mechanism is dominated by buckling with short run-out distance in the southern section. On the other hand, the mechanism is dominated by shear out with long run-out distance in the northern section. Thus, the mechanisms of large landslides are probably not unitary, and complex failure mechanisms might be existed due to the complex topographic features. Our result suggests that, in addition to the property of the landslide and the tectonics, the geomorphologic conditions and the geometric features of the landslide face can also play an important role in the occurrence and landsliding process of earthquake-triggered landslide.

Key words: Jiufengershan landslide Sliding process and depositing behavior Mechanism Numerical Simulation

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