

地震衝擊風險三維化動態分析模型研發

Research on three-dimension dynamic analysis model for earthquake impact assessment

主管單位：國家災害防救科技中心

柯孝勳¹ 吳秉儒¹ 吳子修¹ 許智豪¹
Ke, Siao-Syun¹ Wu, Bing-Ru¹ Wu, Tzu-hsiu¹ Hsu, Chih-Hao¹
¹國家災害防救科技中心

摘要

為深化相關地震衝擊分析研究工作，本研究發展多維度建物地震衝擊動力分析技術，透過簡化建物三維動力分析模型，結合建物耐震屬性資料庫，對建物多邊形模型與耐震屬性加值分析，建構城市建築群地震衝擊動力評估方法，計算城市中每棟建築物受震反應。

此外，多維度、可視化展示為現今趨勢，本研究亦使用高性能動態模擬技術，開發多維度地震衝擊動力分析展示平台 MDUES，不僅可完整記錄空間屬性資料外，亦可提升地震災害模擬結果視覺化展示的細緻度。

本研究並實際應用相關技術進行長周期地震衝擊分析範例，模擬三維建物動態受震歷時的反應，展示地震災害情境下，分析建物致災空間風險及不同場域之衝擊議題。

關鍵詞：建物地震衝擊動力分析、三維建物多邊形模型、視覺化動態模擬平台、長周期地震衝擊

Abstract

Earthquakes can cause severe damage and substantial economic losses to modern cities. Therefore, accurate and efficient simulations of seismic damage to buildings have become an indispensable part of earthquake hazard mitigation efforts worldwide. Precise simulation results can help highlight potential seismic damages and serve as a basic reference for urban planning and post-earthquake rescue operations. In urban areas, simulation of structural dynamic responses under earthquake is crucial in emergency response planning. Multidimensional visualization of earthquakes is a current trend in simulation. In this study, a dynamic, multidimensional simulation method for analyzing impacts on to buildings was developed. The method employs three-dimensional dynamic analysis and data from a seismic capacity database. High-performance computing is applied to a polygonal model, seismic capacity data are analyzed, and the seismic response of each building in an urban environment is calculated. Thus, in this study, the multidimensional urban earthquake impact simulation

(MDUES) platform was established. The MDUES enables long-period earthquake impact analysis, simulation of the seismic responses of buildings in three dimensions, and visualization of the disaster risks and impact on a specified area. In summary, simulating structural seismic responses in urban settings necessitates careful examination of the characteristics of ground and building motion, and the outcomes of such analysis can provide a crucial reference for city planning, post-earthquake rescue operations, and seismic damage assessment.

Keywords : Structural seismic response simulation, multi-scale models for urban building, visualization display simulation, long-period earthquakes