

地聲探測器應用於土石流監測之研究

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摘 要 本研究以地聲探測器 (Geophone) 量測土石碰撞時所產生之地聲, 實驗所得地聲之時域訊號利用快速傅立葉轉換 (FFT) 及 Gabor Transform 轉換為頻域訊號及時間-頻率訊號, 以探討土石地聲之頻率、傳遞速率及隨距離衰減特性。本研究之實驗分為兩部份, 第一部份是於實驗室內量測石頭以自由落體方式撞擊水槽內之土石材料所產生之地聲。此部份之實驗主要是探討地聲探測器傾斜不同角度時所測得地聲訊號之差異。這些資訊可提供土石流觀測示範站中地聲探測器安裝及接收訊號之參考。第二部份的實驗係在農委會水土保持局所建置之土石流示範觀測站—南投縣信義鄉豐丘村豐丘野溪觀測站, 進行現場土石碰撞及滾動地聲觀測試驗, 以了解實際河床中土石地聲之頻率、傳遞速率及隨距離衰減特性。實驗結果顯示石頭撞擊豐丘野溪河床或在河床上滾動所產生的地聲頻率在 10 到 150 Hz 之間, 而地聲之傳遞速率約為 1000 m/s。

關鍵詞：地聲探測器、土石地聲、頻率、傳遞速率、衰減特性、土石流示範觀測站。

Monitoring the Underground Sound of Debris Flows Using Geophones

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ABSTRACT The purpose of this study is to investigate the underground sound generated by debris flows by using geophones. The main characteristics of underground sounds are discussed in terms of the frequencies, the propagation speed and the decay rate. The time-domain signals of underground sounds were transformed into the frequency domain by using the Fast Fourier Transform and into the Time-Frequency domain by using the Gabor transform. The experiments were divided into two parts. The first part consisted of measuring the underground sound caused by a free-falling rock hitting a bed of gravel in a tank. Effects of the inclination angle of the geophone on the recorded signals were tested. In the second part, the same instrumentation as in the first part was applied to measure the underground sound produced by a free-falling rock hitting a riverbed. The field experiments were performed at the Fong-Qiu Debris Flow Observation Station, Hsin-Yi Hsiang, Nan-Tou County. The field experimental

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data show that the frequency of the underground sound is in the range of 10-150 Hz and the propagation speed is about 1000 m/s.

Key Words: geophones, underground sound, frequency, propagation speed, decay rate, debris flow observation station.