多頻道表面波試驗程序標準化之研究

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中文摘要

近幾年來表面波法應用於探測淺層地層剪力波速技術研究日趨成熟。此量測技術屬非破壞性檢測，因無需開孔破壞地表土層故可快速且經濟地量測地下土層之剪力波速度，現已備受工程界之重視與應用。表面波亦為地表震測法中最容易產生且震幅亦最大之震波，因此在施測上較容易且快速。同時量測所得之取樣體積遠大於傳統之試驗方法，故可適用於大範圍工址之量測。

最近許多研究均顯示多頻道資料擷取配合波場轉換法較傳統雙頻道之頻譜分析法（SASW）為佳，多頻道表面波分析（MASW）可由單一施測得到寬頻及高訊號雜訊比之量測。然而，現場施測之幾何配置對於資料品質與頻寬影響甚大，通常需要經驗豐富的專家由現場測試方能取得較佳之配置，因此施測之便利性不佳，欠缺可依循之準則。本研究探討個別施測參數（如近站之距、受波器間距、測線展距等）對於頻散分析之影響並提出選取準則，由於施測參數改變之互制性，造成最佳之施測參數難以決定，本研究提出 Pseudo section 的概念，可擴展有效測線展距以配合足夠小的受波器間距，並提高側向空間解析度。在頻散曲線分過程中加入最佳化展距範圍之選取則可將近場效應與遠場效應對於震測資料的污染程度降至最低。配合以上所提出之測線幾何配置以及分析改良方式，提供 MASW 最佳施測程序標準化之依據。如此，現場蒐集震測資料時不因施測者不同以及施測地點不同造成施測程序上的差異。

Towards standardization of the multi-station surface wave testing

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Abstract

The surface wave method utilized in shear wave velocity profiling of the underground becomes more mature than ever in recent years, due to its non-intrusive feature and convenient operations. It is now widely used in site investigation and earthquake engineering. Among all the seismic methods, surface wave testing is easiest to perform since surface wave contains most of the energy in the seismograms. Being able to sample a very large volume, surface wave method is suitable for larger-scale site investigation.

Methods based on multi-station data and wavefield transform are recently reported to possess several advantages over traditional 2-station spectral analysis of surface wave (SASW) for surface wave analysis. In particular, multi-station recording permits a single survey of a broad depth range and high levels of redundancy with a single field configuration. However the field testing configuration plays a major role to ensure good data quality for constructing a dispersion curve with a wide range of frequencies. The adjustments of field configuration usually need experienced testers' "educational guess" after referring to the results from preliminary tests for ensuring the data quality. This guessing process makes the surface wave method an unfriendly technique for general field engineers. The effects of survey line parameters, such as near offset, receiver spacing, and offset range, are investigated and respective criteria for deciding the proper configuration are illustrated. Furthermore, a new concept called "pseudo-section" is introduced to synthesize a series of data for selecting optimum offset range for each frequency and increasing the lateral spatial resolution. This study will lead to an optimal standardization of the surface wave testing.