地质雷达隧道超前地质预报检测信号的HHT分析法

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HILBERT-HUANG TRANSFORM METHOD FOR DETECTION SIGNAL OF TUNNEL GEOLOGICAL PREDICTION USING GROUND PENETRATING RADAR

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摘要 隧道工程建设因开挖而诱发的各种地质灾害时有发生，为确保隧道施工安全，目前普遍运用超前地质预报探明掌子面前方的地质情况，如何提高超前地质预报的判释水平显得尤为重要。针对隧道超前地质预报地质雷达信号的特点，采用HHT分析法提取原始图像各IMF分量的瞬时剖面图及其单道信号的瞬时幅值、瞬时相位、瞬时频率。结果表明，HHT分析法分解出的瞬时参数突显了原始信号的特征信息，能较好地定量识别不良地质体位置与形状，提高地质雷达原始图像解释的精度和可信程度。

关键词：   隧道工程   地质预报   地质雷达   EMD方法   HHT分析

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Abstract： Geological hazard accidents induced by excavation occur frequently in the course of tunnel constructions. In order to ensure tunnel construction safety，geological prediction for exploring potential geological conditions in front of tunnel face is widely adopted. Therefore，it is of vital importance to explore how to improve the interpretation level of geological prediction. Based on the characteristics of ground penetrating radar(GPR) signals in tunnel geological prediction，the Hilbert-Huang transform(HHT) method is used to extract instantaneous profiles of each IMF(intrinsic mode function) component in the original image and instantaneous parameters of the single trace signal，such as instantaneous amplitude，instantaneous phase and instantaneous frequency. The results show that instantaneous parameters decomposed by HHT method highlight the characteristics of the original signal，which can qualitatively identify the position and shape of catastrophic geological body，and improve the accuracy and credibility of the original image interpretation of ground penetrating radar.

Keywords： tunnelling engineering   geological prediction   ground penetrating radar   EMD method   HHT analysis