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瞬变电磁传感器阻尼特性的标定研究

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Calibration study on the damping characteristics of TEM sensor

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摘要

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摘要 传统瞬变电磁法(TEM)认为临界阻尼匹配时传感器响应快、无振荡,为最佳匹配方式.本文通过建立基于标定环的TEM系统标定模型,理论证明当略欠阻尼匹配时传感器响应最快、时域畸变最小,为最佳匹配方式.本文采用基于实测数据的背景场剔除方法将一次场和大地响应剔除,通过对不同阻尼状态下标定环早期响应畸变的定量评价,实验证明传感器在略欠阻尼匹配状态下二次场响应畸变最小.本文理论和标定实验均证明,在纯二次场观测方式下,采用略欠阻尼匹配方式能够显著降低早期响应畸变、提高系统浅层探测能力,是浅层探测时传感器最佳匹配方式.

关键词 瞬变电磁, 传感器, 标定, 响应畸变, 阻尼特性

Abstract: The traditional electromagnetic method (TEM) believed that the critical damping state is the best way to match the transient electromagnetic sensor for its rapid response and no-oscillation. In this paper, a calibration model is established for TEM system based on a conductivity loop. Calculated results indicate that an under-damping state is the best way to match the TEM sensor for the rapidest response and the smallest distortion in early time. In order to verify the theoretical conclusion, we adopt the "background field rejecting method" based on measured data to remove the primary response and the earth's response from the total responses. A quantitative method is adopted to evaluate the response distortion of the conductivity loop in early time under different damping states. Measured results agree well with theoretical results. We conclude that the under-damping state is the best way to match the TEM sensor for its smallest response distortion in early time and its improved ability in shallow layer detection, particularly, when the background fields are removed from the total responses.

Keywords Transient electromagnetic method (TEM), Sensor, Calibration, Response distortion, Damping characteristic

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