

Separating Permanent and Induced Magnetic Signature: A Simple Approach

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Abstract : Magnetic signature detection provides sensitive detection of metal objects, especially in the natural environment. Our group is developing a tabletop setup for magnetic signatures of various small and model objects. A particular issue is the separation of permanent and induced magnetization. While the latter depends only on the composition and shape of the object, the former also depends on the magnetization history. With common deperming techniques, a significant permanent signature may still remain, which confuses measurements of the induced component. We investigate a basic technique of separating the two. Measurements were done by moving the object along an aluminum rail while the three field components are recorded by a detector attached near the center. This is done first with the rail parallel to the Earth magnetic field and then with anti-parallel orientation. The reversal changes the sign of the induced- but not the permanent magnetization so that the two can be separated. Our preliminary results on a small iron block show excellent reproducibility. A considerable permanent magnetization was indeed present, resulting in a complex asymmetric signature. After separation, a much more symmetric induced signature was obtained that can be studied in detail and compared with theoretical calculations.

Keywords : magnetic signature, data analysis, magnetization, deperming techniques

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