The Magnetic Polarizability Tensor for the Classification and Characterisation of Different Metallic Objects

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Low frequency metal detection is important for applications including terrorist object identification, such as knives and firearms; scrap metal sorting, archaeological surveys, and the identification of unexploded ordinance. However, current metal detectors are not able to distinguish between different shapes, small objects buried at shallow depths, and larger objects buried at greater depths. It is known that a hidden conducting object can be characterised by a complex symmetric rank 2 Magnetic Polarizability Tensor (MPT), which is a function of the object's size, shape, conductivity, permeability, and the frequency of excitation. The MPT provides an ideal object characterisation, which can be combined with a machine learning classifier. We present ongoing work concerning using finite element simulations for the classification and characterisation of small metallic objects when testing with measured MPT signatures, their validity, and the challenges associated with introducing high permeability objects.

References:

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