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A tomographic approach for full 3D imaging of hidden objects from GPR data

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The demand for accurate non invasive subsurface surveys able to provide reliable and high resolution images of probed regions motivates an on-going interest in improving the performances of Ground Penetrating Radar (GPR) systems both in terms of hardware design and data processing.
As far as data processing is concerned, this communication aims at proposing a full 3D tomographic approach able to account for the vectorial nature of the scattering phenomenon and then to provide reliable and accurate reconstructions of targets, whose size is comparable with the probing wavelength in all the spatial directions.
The proposed approach exploits the Born approximation to model the scattering phenomenon and then it faces the imaging as a linear inverse scattering problem. Such a problem is effectively solved by exploiting the truncated Singular Value Decomposition of the operator relating the measured scattered fields to the unknown contrast function, which encodes the electric features of the targets with respect the hosting medium. Moreover, the imaging procedure is specifically formulated to work with multi-monostatic, multifrequency and single polarization data, which are the data made available by the commonly used GPR systems. However, it can be easily extended to more sophisticated subsurface radar exploiting array and multi-polarization measurement configurations.
Mathematical details and examples assessing the achievable reconstruction capabilities when the data are collected by means of standard and enhanced GPR systems will be provided at the conference. In addition, the improvements related to the use of multi-polarization data will be discussed.

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