POLITECNICO DI TORINO
Dipartimento di Ingegneria dell'Ambiente, del Territorio e delle Infrastrutture

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Review of the dissertation

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The thesis deals with the interpretation of frequency domain data for hear surface Geophysical application. It offers a good scientific background on the method and focuses on the most modern techniques of data inversion. The candidate describes in detail the inversion procedures and he compares the performances of some inversion methods for 1D interpretation. The main interesting novelty refers on the introduction of a so-called quasi-2D inversion.

The quasi-2D approach illustrated by the candidate looks like the laterally constraints or mutually constraints method that has been introduced in the data process of electromagnetic data. The candidate here includes the constraints as a-priori information, which is the final model of the closer soundings. In this sense, the constraints are not the data but the model solutions of the closer soundings.

The candidate demonstrates the validity of the approach by applying the inversion on some synthetic and real data. The electromagnetic response has been also calibrated according with other geophysical methods and ground truth evidences. The results have been discussed with a good accuracy.

One of the major weakness issue of the thesis deals with the analysis of the synthetic data; particularly, the candidate builds up the synthetic data set as a series of 1D models and then invert the data sets by using the quasi-2D approach. According to this procedure, he is only able to check the robustness of the algorithm from a mathematical and statistical point of view, but the reliability of the method to model properly 2D features cannot be assessed. It would be more interesting to check the reliability of the method by performing the forward modelling using a 2D modeller and then invert the synthetic data set using the quasi-2D approach.

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As in the inversion deterministic approach the starting model is required, it should be interesting to analyse the sensitivity of the starting model on the final solution; as the final model of the inversion process is strongly affected by the starting point, it could be of great interest to compare the performance of stochastic approaches. The a priori information is given as a certain percentage of "seeds" (e.g. in the methods based on genetic algorithms or similar) that can be introduced in the searching model space; the effect of the starting model could be controlled by tuning this percentage.

I have appreciated the scientific rigour in the approach both in the analysis of the forward modelling of the electromagnetic response both in the description of the inversion procedures. The discussion has been limited to deterministic inversion methods; it would be interesting to explore the advantages or drawbacks of stochastic approaches that could be a frontier in near surface geophysics.

The overall high quality of the work is supported by papers published in peer review journal or presented at international conferences on applied geophysics. The manuscript is well written and well organised and the results have been critically analysed. I recommend this dissertation for the admission to the final defence.

Sincerely

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