Geophysical Research Abstracts
Vol. 16, EGU2014-7809-2, 2014
EGU General Assembly 2014

GPR Technologies and Methodologies in Italy: A Review

Andrea Benedetto (1), Fabrizio Frezza (2), Guido Manacorda (3), Andrea Massa (4), and Lara Pajewski (3)

(1) University of Roma Tre, Rome, Italy, (2) University of Roma "La Sapienza", Rome, Italy, (3) IDS Ingegneria dei Sistemi SpA, Pisa, Italy, (4) ELEDIA Research Center@DISI, University of Trento, Trento, Italy

GPR techniques and technologies have been subject of intense research activities at the Italian level in the last 15 years because of their potential applications specifically to civil engineering. More in detail, several innovative approaches and models have been developed to inspect road pavements to measure the thickness of their layers as well as to diagnose or prevent damage. Moreover, new frontiers in bridge inspection as well as in geotechnical applications such as slides and flows have been investigated using GPR. From the methodological viewpoint, innovative techniques have been developed to solve GPR forward-scattering problems, as well to locate and classify subsurface targets in real-time and to retrieve their properties through multi-resolution strategies, and linear and non-linear methodologies. Furthermore, the application of GPR and other non-destructive testing methods in archaeological prospecting, cultural heritage diagnostics, and in the localization and detection of vital signs of trapped people has been widely investigated. More recently, new theoretical and empirical paradigms regarding water moisture evaluation in various porous media and soil characterization have been published as the results of long terms research activities. Pioneer studies are also currently under development with the scope to correlate GPR measurement with mechanical characteristics of bound and unbound construction materials. In such a framework, this abstract will be aimed at reviewing some of the most recent advances of GPR techniques and technologies within the Italian industrial and academic communities [also including their application within international projects such as FP7 ISTIMES (http://www.istimes.eu)], and at envisaging some of the most promising research trends currently under development.

Acknowledgment - This work was supported by COST Action TU1208 “Civil Engineering Applications of Ground Penetrating Radar”

References

[1] M. Balsi, S. Esposito, F. Frezza, P. Nocito, L. Porrini, L. Pajewski, G. Schettini e C. Twizere, “FDTD Simulation of GPR Measurements in a Laboratory Sandbox for Landmine Detection”, Proc. IWAGPR 2009, Granada, Spagna, 27-29 maggio 2009, pp. 45-49.

[2] M. Balsi, S. Esposito, F. Frezza, P. Nocito, P. M. Barone, S. E. Lauro, E. Mattei, E. Pettinelli, G. Schettini e C. Twizere, “GPR Measurements and FDTD Simulations for Landmine Detection”, Proc. XIII International Conference on Ground Penetrating Radar, 21-25 giugno 2010, Lecce, pp. 865-869.

[3] M. Balsi, P. M. Barone, S. Esposito, F. Frezza, S. E. Lauro, P. Nocito, E. Pettinelli, G. Schettini e C. Twizere, “FDTD Simulations and GPR Measurements for Land Mine Detection in a Controlled Environment”, Atti XVIII Riunione Nazionale di Elettromagnetismo, Benevento, 6-10 settembre 2010, pp. 59-65.

[4] M. Salucci, D. Sartori, N. Anselmi, A. Randazzo, G. Oliveri, and A. Massa, “Imaging buried objects within the second-order born approximation through a multiresolution regularized Inexact-Newton method”, 2013 International Symposium on Electromagnetic Theory (EMTS), (Hiroshima, Japan), May 20-24 2013.

[5] L. Lizzi, F. Viani, P. Rocca, G. Oliveri, M. Benedetti and A. Massa, “Three-dimensional real-time localization of subsurface objects - From theory to experimental validation,” 2009 IEEE International Geoscience and Remote Sensing Symposium, vol. 2, pp. II-121-II-124, 12-17 July 2009.

[6] S. Meschino, L. Pajewski, M. Pastorino, A. Randazzo, and G. Schettini, “Detection of Subsurface Metallic Utilities by Means of a SAP Technique: Comparing MUSIC- and SVM-Based Approaches”, J. Appl. Geophy., vol. 97, pp. 60-68, Oct. 2013.

[7] M. Pastorino, and A. Randazzo, “Buried object detection by an Inexact-Newton applied to nonlinear inverse scattering”, Int. J. of Microwave Sci. Technol., vol. 2012, Article ID 637301, 7 pages, 2012.

[8] F. Soldovieri and L. Crocco, "Electromagnetic Tomography", in Subsurface Sensing, A. S. Turk, K. A. Ho-

caoglu, A. A. Vertiy ed., Wiley Series in Microwave and Optical Engineering (Volume 1), Sept. 2011, John Wiley & Sons, NY.

[9] I. Catapano, L. Crocco, Y. Krellmann, G. Triltzsch, F. Soldovieri, "A Tomographic Approach for Helicopter-Borne Ground Penetrating Radar Imaging", IEEE Geosci. Rem. Sensing Lett., vol. 9, p. 378-382, 2012.