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Applications of GPR in archaeological prospecting and cultural heritage diagnostics: Research Perspectives in COST Action TU1208

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Ground Penetrating Radar (GPR) is a safe, non-destructive and non-invasive imaging technique that can be effectively used for advanced inspection of composite structures and for diagnostics affecting the whole life-cycle of civil engineering works. GPR can also be successfully employed in archaeological prospecting and cultural heritage diagnostics. In many Countries, where the archeological patrimony is an outstanding value (as Egypt, Israel, Greece, Central and South America), GPR is usually employed both as a diagnostic tool for the preventive detection of archeological structures and as the most advanced instrument able to prospect geometry and shape of underground valuable sites. However many uncertainties persist, because of several difficulties and ambiguities due to the complexity of the image processing in heterogeneous environment.

It is possible to identify three main areas, in GPR field, that have to be addressed in order to promote the use of this technology in archaeological prospecting and cultural heritage diagnostics. These are: a) increase of the system sensitivity to enable the usability in a wider range of conditions, archeological sites are often located in impervious and critical environments; b) research novel data processing algorithms/analysis tools for the interpretation of GPR results; c) contribute to the development of new standards and guidelines and to training of end users, that will also help to increase the awareness of operators. It is also important to further investigate and promote a combined use of GPR with other non-invasive advanced techniques, typically used in the archeological investigation.

In this framework, the COST Action TU1208 "Civil Engineering Applications of Ground Penetrating Radar", proposed by a research team of "Roma Tre" University, Rome, Italy, has been approved in November 2012 and is going to start in April 2013. It is a 4-years ambitious project already involving 17 European Countries (AT, BE, CH, CZ, DE, EL, ES, FI, FR, HR, IT, NL, NO, PL, PT, TR, UK), as well as Australia and U.S.A. The project will be developed within the frame of a unique approach, based on the integrated contribution of University researchers, software developers, geophysics experts, Non-Destructive Testing equipment designers and producers, end users from private companies and public agencies.

The main objective of the COST Action TU1208 is to exchange and increase scientific-technical knowledge and experience of GPR techniques, whilst promoting the effective use of this safe and non-destructive technique.

In this interdisciplinary Action, advantages and limitations of GPR will be highlighted, leading to the identification of gaps in knowledge and technology. Protocols and guidelines for European Standards will be developed, for an effective use of GPR in various applications. A novel GPR will be designed and realized: a multi-static system, with dedicated software and calibration procedures, able to construct real-time lane three-dimensional high resolution images of investigated areas. Advanced electromagnetic-scattering and data-processing techniques will be developed. Freeware software will be released, for inspection and monitoring of complex structures, buried-target localization, shape reconstruction and estimation of physical parameters.

Particular interest will be devoted to the combined use of GPR, together with other advanced and non-invasive sensing techniques, for a multi depth, multi-resolution and multi-scale monitoring of archaeological, architectural and artistic heritage (Working Group 4). Novel procedures and techniques will be developed and tested for the study and preservation of historical buildings, bridges, monuments, sculptures, paintings, frescoes, as well as for the mapping of sites and structures present in the subsoil.

During the Action lifetime, a three-years high level training program will be organized. Mobility of early career researchers will be encouraged.

The scientific work-plan of the COST Action TU1208 is open, to ensure that experts all over the world, who did not participate in the preparation of the proposal but are interested in the project, may join the Action and participate in its activities. More information about the project can be found at http://www.cost.eu/domains_actions/tud/Actions/TU1208.