PIPELINES MONITORING VIA MICROWAVE TOMOGRAPHY ENHANCED GPR SURVEYS

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ABSTRACT

Monitoring pipelines integrity and leakages detection deserve huge attention in the frame of effective management of hydraulic structures as well as for planning maintenance actions with the final aim to not waste water resources. These diagnostic activities demand for state of art technologies able to survey subsurface infrastructures quickly, accurately and in a non-invasive way. In this frame, the use of ground penetrating radar (GPR) systems are worth to be considered due to their capability of exploiting radio frequencies and microwave signals to achieve space-time maps, known as radargrams, providing images which account for the underground features [1]. However, since the raw-radargrams gathered during GPR measurement campaigns are usually not easy to be interpreted, the usability of the results depends on the users expertise [1]. Moreover, the complexity of the scenario under test may significantly impact the prompt detection of leakages and accurate monitoring of their time evolution.

With respect to the frame at hand, this communication aims at discussing the advantages offered by the use of a microwave tomography reconstruction approach, which adopts the Born approximation to model the underlining scattering phenomenon and the truncated Singular Value Decomposition to obtain a regularized solution of the involved linear inverse problem [2]. Moreover, to improve leakage detection and monitoring, an application oriented tomographic approach, which accounts for a priori information on the surveyed scenario by following the hint proposed in [3], is described and its reconstruction capabilities are assessed against experimental data gathered in laboratory controlled conditions at the Department of Geophysics of the University of São Paulo, Brazil [4].

Keywords: Pipelines Monitoring, Ground Penetrating Radar, Microwave Tomography