# Detection and Location of Underground Power Cable using Magnetic Field Technologies

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The location of buried underground electricity cables is becoming a major engineering and social issue worldwide. Records of utility locations are relatively scant, and even when records are available, they almost always refer to positions relative to ground-level physical features that may no longer exist or that may have been moved or altered. The lack of accurate positioning records of existing services can cause engineering and construction delays and safety hazards when new construction, repairs, or upgrades are necessary. Hitting unknown underground obstructions has the potential to cause property damage, injuries and, even deaths. Thus, before commencing excavation or other work where power or other cables may be buried, it is important to determine the location of the cables to ensure that they are not damaged during the work.

This paper describes the use of an array of passive magnetic sensors (induction coils) together with signal processing techniques to detect and locate underground power cables. The array consists of seven identical coils mounted on a support frame; one of these coils was previously tested under laboratory conditions, and relevant results have been published in [1]. A measurement system was constructed that uses a battery powered data acquisition system with two NI 9239 modules connected to the coil array, and controlled by a laptop. The system is designed to measure the magnetic field of an underground power cable at a number of points above the ground.

A 3 by 3 m test area was chosen in one of our campus car parks. This area was chosen because the university's utility map shows an isolated power cable there. Measurements were taken with the array in 16 different test positions, and compared with the values predicted for a long straight horizontal cable at various positions. Finally, error maps were plotted for different Z-coordinate values, showing the minimum fitting error for each position in this plane. One such map is shown in Figure 1; the low error values of 4-5% give a high degree of confidence that most of the measured signal is due to a cable near to these positions. This view is supported by the fact that the university's utility map shows the cable at X = 1.4 m, and by amplitude measurements taken with a hand-held magnetic field meter.

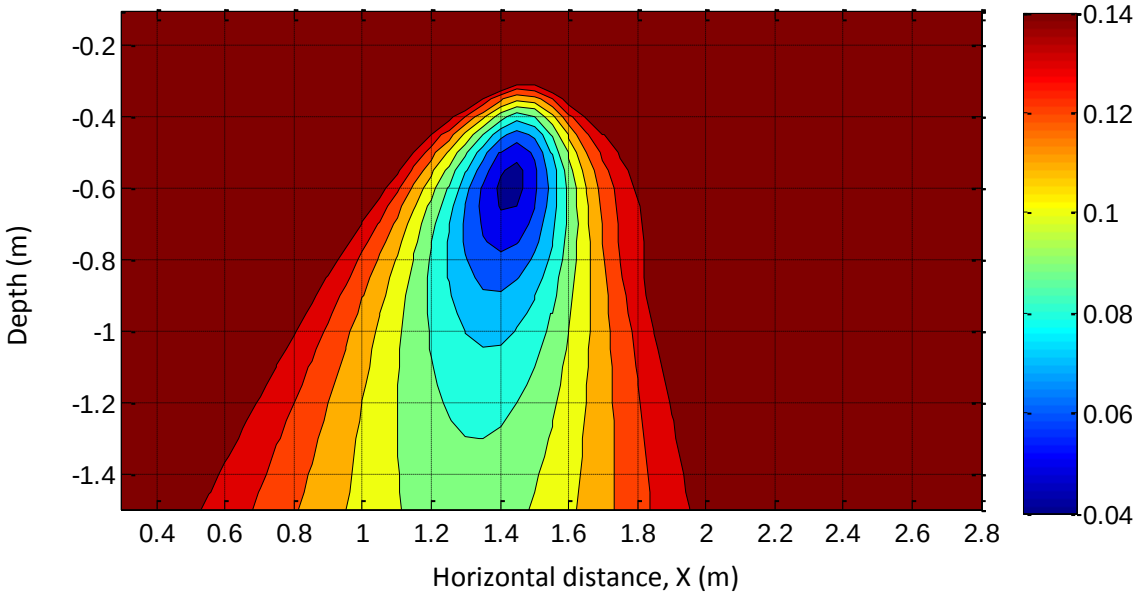


Figure 1: a typical result for car park tests at Z = 2m.
(possible cable position is X=1.4 m and Depth = 0.6m. 96% accuracy)

[1] P. Wang, P. Lewin, K. Goddard, and S. Swingler, "Design and testing of an induction coil for measuring the magnetic fields of underground power cable", *IEEE International Symposium on Electrical Insulation*, San Diego, California, USA 2010