

3-D AUTOMATIC SETUP OF ERT (ELECTRICAL RESISTIVITY TOMOGRAPHY) SYSTEM

The paper presents results of work on 3-D the surface scanning system using ERT method. The construction of automatic laboratory system for imaging of the internal structure and heterogeneity of concrete structures by ERT method, using a multi-electrode surface scanner of electrical conductivity of concrete objects will be used to model tests and actual concrete structures by multi-point and non-contact method for measuring the electrical conductivity of concrete structures, in particular.

Key words: electrical resistivity tomography; concrete; vertical electrical soundings; surface scanning system.

Electrical Resistivity Tomography (ERT) belonging to non-destructive methods is widely used in geophysics, medical imaging and is increasingly being used in imaging and assessment of concrete structures. The importance of ERT in the case study of concrete structures is a large due to the fact that many factors determine the condition of the concrete, has a significant impact on its electrical conductivity. The construction of automatic laboratory system for imaging of the internal structure and heterogeneity of concrete structures by ERT method, using a multi-electrode surface scanner of electrical conductivity of concrete objects will be used to model tests and actual concrete structures by multi-point and non-contact method for measuring the electrical conductivity of concrete structures. Designed and constructed the laboratory surface scanner will be the basis for the development of a prototype scanner for field studies of actual concrete structures. Imaging the internal structure of the object will be based on the location of model inhomogeneities and its physical and geometrical parameters, rather than the electrical conductivity at each point of the inner object, as is standard ERT method. Software for imaging the internal structure and heterogeneity of concrete structures using ERT method will provide a basis for evaluation of morphological characteristics and materials of different type than the concrete structures.

3-D the surface scanning system will enable:

development of ERT techniques to analysis of the impact of procedures of the surface and inspection scan on the efficiency and quality of imaging; construction of a laboratory system for heterogeneity imaging of concrete objects; developing of scanning methods and the identification of heterogeneity; laboratory studies for the identification of model elements of heterogeneity.

Project of 3-D the surface scanning system include: design and construction of the laboratory multielectrode surface conductivity scanner of objects; design of the communication system of the laboratory surface conductivity scanner of objects with the control unit and design of a transmission and data acquisition system; develop a control program of the laboratory surface electrical conductivity scanner of objects; optimization of the scanning procedure; resolution assessment of the identifying internal structure of objects method based on surface and subsurface electrical conductivity scan; determine of location and heterogeneity parameters of model concrete elements in the laboratory tub by ERT method; GUI development: a control program of the surface laboratory scanner, transmission and data acquisition, identification and visualization of internal structure and heterogeneity of object; identification of the internal structure and heterogeneity of selected elements of concrete structures by computer tomography method.

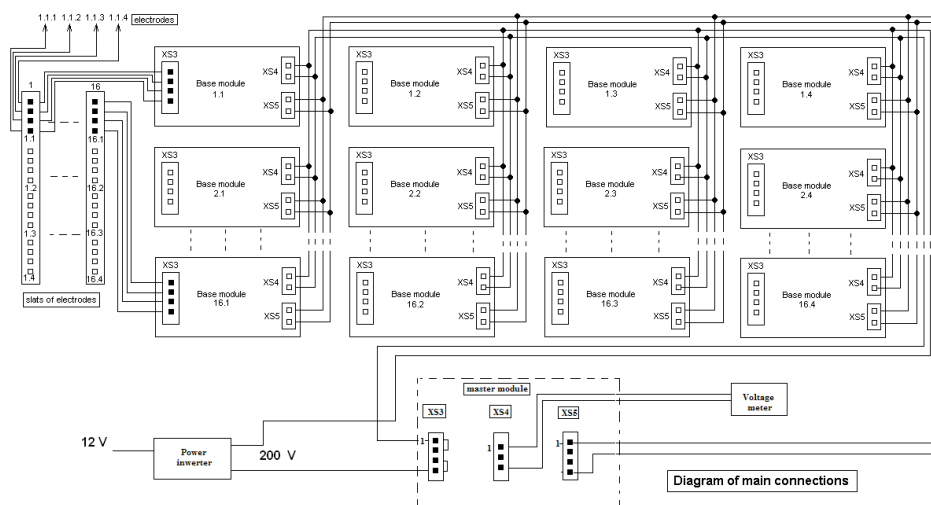


Fig.1. 3-D the surface scanner –diagram of main connections

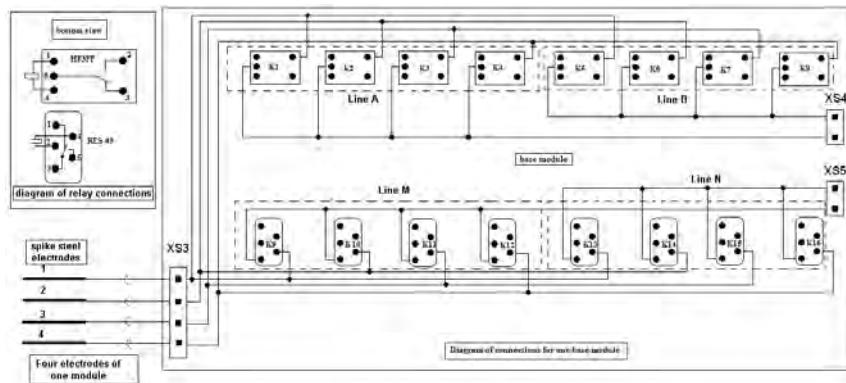


Fig 2. System of electromechanical relays in base module

According to the general project assumptions, the surface scanning system have module structure allowing development of the system without changing the system software. The scanner is composed of: scanner control system containing of 64 base modules and central module, feed system, meter circuit, personal computer, commutation systems and 256 electrodes (see Fig.1.).

Number of modules base as an essential element of the scanner is a function of the number of electrodes according to relation: number of electrodes = the base module*4. The main part of the base module is a microprocessor which control the running of four electrodes through the arrangement of electromechanical relays (see Fig.2.). Electrodes play both feeding and measuring role and are autonomic elements of the system. The central module identifies the base modules and controls all of elements of the scanner. The feed system using a DC voltage source

is able to generate electricity in the frequency range from 0 to 1 kHz with an amplitude controlled signal. Microprocessor-controlled meter circuit has the ability to measure three quantities: current, voltage and impedance with an accuracy of one hundred-thousandth of the primary. unit. Configuration of electrodes is determine in the process of base module identification. Each of base modules contains a unique number inflicted by DIP-Swich, allowing any geometry of electrodes.

References

- Zohdy A.A.R. Application of surface geophysics to ground-water investigations. // USGS, Book 2, Collection of Environmental Data. USA –1974.
- Parasnis D.S. Principles of Applied Geophysics // Chapman&Hall. London UK, 1984.
- Matveev, V.K.. Interpretation of electromagnetic sounding. (In Russian.) // Nedra, Moscow. 1974.

АВТОМАТИЧНА УСТАНОВКА ДЛЯ 3Д ЕЛЕКТРОТОМОГРАФІЇ

Я. Луковскі, О. Підвірний

Представлено результати роботи над системою тривимірною поверхневого сканування методом електрорезистивної томографії. Сконструйована автоматична лабораторна система для візуалізації внутрішньої структури та неоднорідностей бетонних конструкцій методом електрорезистивної томографії, що використовує багатоелектродний поверхневий сканер електропровідності бетонних об'єктів, буде використана для модельних випробовувань та дослідження реальних бетонних конструкцій зокрема.

Ключові слова: електрорезистивна томографія; бетон; вертикальні електричні зондування; система поверхневого сканування.

АВТОМАТИЧЕСКАЯ УСТАНОВКА ДЛЯ 3Д ЭЛЕКТРОТОМОГРАФИИ

Я. Луковски, О. Пидвирный

Представлено результати роботи над системою трьохмерного поверхневого сканування методом електрорезистивної томографії. Сконструйована автоматична лабораторна система для візуалізації внутрішньої структури та неоднорідностей бетонних конструкцій методом електрорезистивної томографії, яка використовує багатоелектродний поверхневий сканер електропровідності бетонних об'єктів, буде використана для модельних випробовувань та дослідження реальних бетонних конструкцій зокрема.

Ключевые слова: електрорезистивна томографія, бетон, вертикальні електричні зондування, система поверхневого сканування.

¹ Kazimierz Wielki University in Bydgoszcz, Poland

² Carpathian Branch of Institute of Geophysics in Lviv, Ukraine