The Application of Computer Expert Systems Techniques in the Analyses of Seismic Refraction Data

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Thesis submitted in partial fulfillment of the requirements for the degree of Master of Science (Geology) at Yarmouk University.

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April, 1996
Abstract

The Seismic refraction method (SRM) has a wide application in the exploration of the shallow subsurface. The work with SRM involves collecting data from the field, process it, and interpret the data to produce mental pictures of the structures within the studied area. The processing and interpreting of SRM data is currently performed using personal computers. There are several software packages available to work with SRM. However, these packages have been developed using traditional programming techniques and are only applicable to cases of ideal subsurface conditions.

These ideal conditions involve assumptions which are not always realistic and may lead to erroneous results.

There are several non-traditional programming techniques which developed to solve the problems that the traditional techniques fail to solve. One of these effective techniques which depends on the simulation of the human thinking is the expert systems techniques. These techniques have been developed by the development of the artificial intelligence science.
Expert systems techniques can be used to create a system for SRM that has the ability to recognize a wide range of subsurface features under non-ideal conditions.

In this research we describe how to create an expert system for SRM using an efficient expert system techniques known as Rule-Based and Knowledge-Based approaches. A prototype of the proposed system has been implemented using Turbo Pascal and PDC Prolog languages. The implemented system which is given the name SEREX (SEismic Refraction EXpert System) has been tested using several sets of artificial real and data. These tests show the viability of SEREX to execute tasks properly under ideal and non-ideal conditions.

The proposed system is supported also with two important features of expert systems. These features are uncertainty considerations and an explanation facility.

The experimental investigation of the proposed system provides a valuable tools for automating seismic refraction technique. It also provides new opportunities for scientific researchers in this field.