Core Laboratory Measurements of Ultrasound Tomography using The Robot RTDs-U100 Magnetic

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Introduction

In recent years, there have been rapid developments in technology which have emerge geophysical methods as one of the research alternatives. Some research requires non-destructive test to determine characteristics of an object. The field of non-destructive testing involves the identification and characterization of damages on the surface and interior of materials without cutting apart or otherwise altering the material [1]. Numerous technique are used in non-destructive testing, including ultrasound tomography method. Ultrasound tomography is described as the process of reconstructing cross-sectional image of the internal structure of an object by analyzing the propagation of ultrasound wave through it [2]. Some applications of ultrasound tomography are to study shale gas¸ shear wave anisotropy and pore pressure. The method utilizes core specimens at laboratory scale from previous drilling. In practice, the core measurement using ultrasound tomography is still using the conventional method which is manually drag the position of transducer and receiver sensors. This manual measurement is impractical and requires a lot of time. It also give different results from one researcher to another, due to the lack of uniformity and high subjectivity of the researcher during conventional measurement. Therefore, a tool that can help to optimize the performance of ultrasound tomography measurements is needed. Armed with technology, a combination of simple robotic application and a supporting tool can be a solution to get better data quality and takes less time. Robotic instrument with magnetic sensor can be arranged in accordance with our needs, in order to get fast, precise and uniform ultrasound tomography data.

Design Measurements

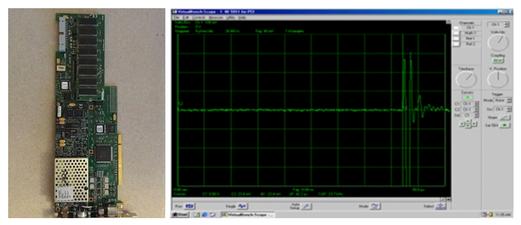
The measurements were made of data consisting of 16 points of measurement data. The measurement system used Transducer V103RM (P wave), 5072PR pulser receiver, preamplifier 5676, and NI-PCI digital oscilloscope 5911. DC motor HJxxxx, high torque, low speed

Transducer

Pulser

Preamplifier

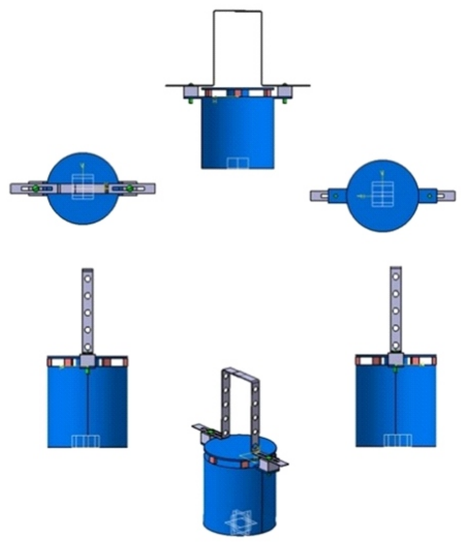
Oscilloscope



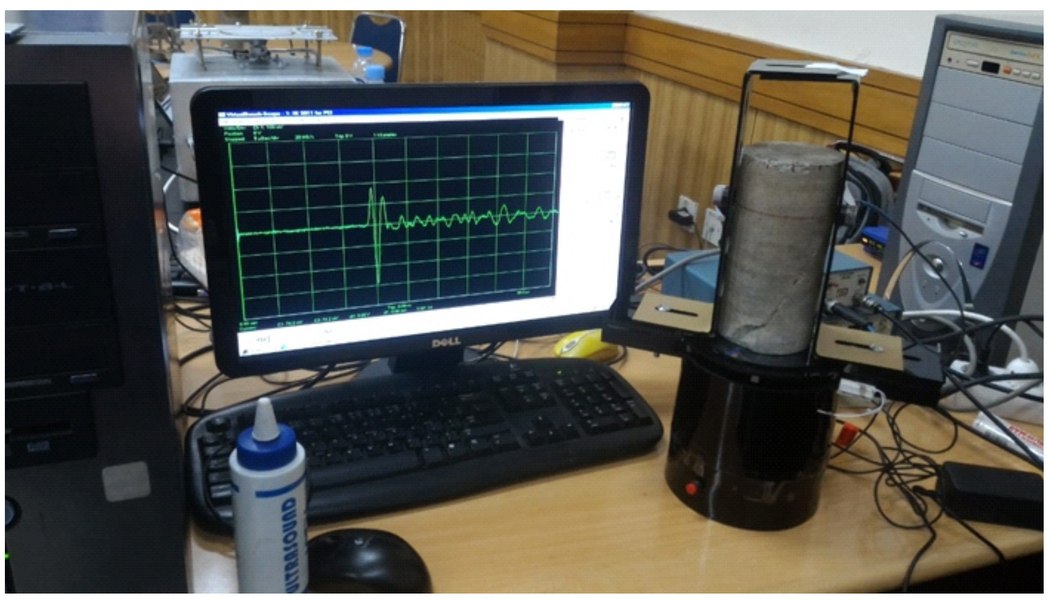
DC Motor

Robotic

Robot Magnetic Instument



Integrated System Measurements



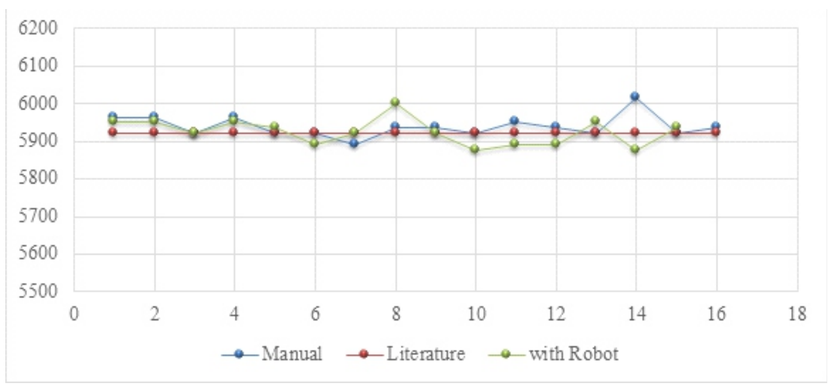
Integrated system measurement with robot magnetic instrument

Result

Data is presented in a comparison of three variables at once, the P wave velocity from conventional, robotic, and references/literature. Data is presented in a graphical form. S wave velocity data can not be presented due to the tranducers condition being irrelevant for measurement.

Literature	Manual	Robotic	%Error Manual	%Error Robotic
5920	5960,784	5953,003	0,688924	0,557477
5920	5960,784	5953,003	0,688924	0,557477
5920	5922,078	5922,078	0,0351	0,0351
5920	5960,784	5953,003	0,688924	0,557477
5920	5922,078	5937,5	0,0351	0,295608
5920	5922,078	5891,473	0,0351	0,481877
5920	5891,473	5922,078	0,481877	0,0351
5920	5937,5	6000	0,295608	1,351351
5920	5937,5	5922,078	0,295608	0,0351
5920	5922,078	5876,289	0,0351	0,738367
5920	5953,003	5891,473	0,557477	0,481877
5920	5937,5	5891,473	0,295608	0,481877
5920	5922,078	5953,003	0,0351	0,557477
5920	6015,831	5876,289	1,618769	0,738367
5920	5922,078	5937,5	0,0351	0,295608
5920	5937,5	5953,003	0,295608	0,557477

Comparison



Comparison graph of P wave velocity from cross measurement data.

Conclusion

The qualitative analysis of ultrasonic tomography for core samples are achieved through several measurements using conventional method and robot magnetic instrument. Data quality improvement by modifying conventional method of ultrasound tomography with technology can be achieved through robotic application. Our findings of core laboratory measurements show that Robot RTDs-U100 improved measurement error from 0,32% with manual measurement to 0,12% after using Robot RTDs-U100. With this robotic rotation, the position of sensors is more precise, uniform and it takes less time. The ultrasonic tomography using robotics equipment proves to be helpful in obtaining better measurements when compared in terms of conventional measurements.