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An Optimal Modelling Wavelet Application for Ground Water Detection-A Programmatic Approach

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***Abstract* :- This paper analyses the wavelet signal for ground water detection using D8 algorithm by performing flow direction, volumetric analysis. The GPR radar is considered with depth ranging up to 30-50 meters. The simulated signal is generated using simulink, and specifications of various parameters are Spectral Reflectance, di electric constant, hydraulic conductivity are recorded to calibrate the location, depth, direction, volume of ground water. The observed values, experimental values, estimated values are plotted in a graph for accurate measurements.**

INTRODUCTION

The hydro geologist will be using the application to save the time, cost, effort, and accurately identify the GIS position of ground water availability in the aquifer,
The latitude and longitude positions are taken into consideration for easy manipulation of GIS data on the Maps. The survey can be done easily using Drone or Digital image of satellite.
Signal processing is a discipline discipline in electrical electrical engineering engineering and in mathematics mathematics that deals with analysis analysis and processing processing of analog and digital digital signals signals , and deals with storing storing , filtering filtering , and other operations operations on signals. signals. These signals signals include include transmission transmission signals of sound or voice signals signals , image signals , and other signals e.t.c.
Out of all these signals , the field that deals with the type of signals for which the input is an image and the output is also an image is done in image processing. processing. As it name suggests, suggests, it deals with th processing on images.
It can be further divided into analog image processing and digital image processing Systems
A system is a defined defined by the type of input and output it deals with. Since we are dealing dealing with signals , so in our case , our system would be a mathematical mathematical model , a piece of code/software code/software , or a physical hysical device , or a black box whose input is a signal and it performs performs some processing processing on that
signal , and the output is a signal. signal. The input is known as excitation and the output is known as response.

In the above figure a system has been shown whose input and output both are signals signals but the input is an analog signal. And the output is an digital signal. It means our system is actually actually a conversion conversion system that converts analog signals to digital signals.

SAMPLING

Sampling Sampling as its name suggests suggests can be defined defined as take samples. samples. Take samples samples of a digital digital signal over x axis. Sampling is done on an independent variable. In case of this mathematical equation:
Sampling is done on the x variable. We can also say that the conversion of x axis (infinite values) to digital is done under sampling.
Sampling is further further divided into up sampling and down sampling. sampling. If the range of values on x-axis are less then we will increase increase the sample of values. This is known as up sampling and its vice versa is known as down sampling

QUANTIZATION

Quantization as its name suggest suggest can be defined defined as dividing dividing into quanta (partitions). (partitions). Quantization is done on dependent variable. It is opposite to sampling.
In case of this mathematical equation $y = \sin(x)$
Quantization is done on the Y variable. It is done on the y axis. The conversion onversion of y axis infinite infinite values to 1 , 0 , -1 (or any other level) is known as Quantization.

These are the two basics steps that are involved while converting an analog signal to a digital signal. The quantization of a signal has been shown in the figure below.

BOREHOLE GPR APPLICATIONS

 Locate tunnels, cavities, and solution voids
 Map beneath electrically conductive soils that limit surface deployed
GPR
 Detect underground storage tanks (USTs) under buildings
 Detect large, buried UXOs in areas where magnetometers cannot be
used
 Examine rock mass uniformity
 Locate leaks from USTs
 Examine foundations, piers and piles
 Locate conductive groundwater contamination
 Monitor grout injection
 Monitor environmental remediation such as air sparging
 Measure the physical properties of stratigraphy

pulseEKKO®

Low Frequency (12.5 to 200 MHz)
in the pictures below). The 50, 100 and 200 MHz antennas can also be deployed on a SmartCart or in the SmartTow configurations.

APPLICATIONS:

- Very deep geologic sounding applications such as determining bedrock structure

- Glacier and ice sheet depth
- If one looked at just the Line Scan in Figure 2, it would be very hard to discern all the targets, let alone know the orientation of them. Using the EKKO_Project™ software with the Interpretation module, certain features were added as numbered annotations on the Line Scan image in Figure 2. These features are also noted on the depth slice image in Figure 1. In particular, features #1, #2, #3 all occur in a very small area making it very difficult to see them as three individual targets.
- *Results & benefits*
- Some operators rely solely on Line Scan data to mark out targets. However, line scan data can be open to a lot of interpretation, especially in congested areas. In these situations operators should be collecting grids and then viewing all depth slices to ensure they are not missing any objects. By correlating the cross-section views with the depth slices, one can have far greater confidence in what they are observing and in marking out the targets on the floor.

TIPS: Estimating GPR Penetration
The very first question that someone usually asks about GPR is, "How deep can it see?". Although we hear this question daily, we still do not have a quick, straight-forward answer for it. The shortest answer is, "It depends". A better answer, but still not very specific is, "If you are working on fresh water, 1 to 40 meters, on the ground, 1 to 100 meters, on ice, even deeper".
The reason that we cannot answer this question simply is because the depth of penetration of GPR depends on many factors, including the GPR antenna frequency, the GPR transmitter power, the number of stacks, scattering losses in heterogeneous materials and the level of background radio frequency noise. However, the biggest factor is the electrical properties of the material being scanned, specifically the electrical conductivity of that material (Figure 1).
Most people have heard that clay soils are "bad" for GPR penetration. The underlying reason that clay-rich soils are not good for deep penetration with GPR is because clay has high electrical conductivity. Other common materials with high electrical conductivity are silty soils, sea water and, of course, metal. One of the first lessons that GPR operators learn is not to expect to see through metal.

The electrical conductivity of the material being scanned controls the attenuation of the signal. Lower electrical conductivity
(left) allows GPR signals to travel deeper into the medium than high electrical conductivity (right).

Estimating GPR Penetration in the Ground
Occasionally, we have a customer that has a measurement of the electrical conductivity of an area they are interested in scanning with GPR. This information is often from another geophysical survey conducted in the area, such as an electrical resistivity survey or an electromagnetic (EM) survey. With this information, the depth of penetration that would be achieved with GPR in meters can be estimated by the expression:

$$Depth(m) = 40/\boxed{\sigma}$$

where, σ is electrical conductivity expressed in millisiemens per meter (mS/m)

If the measurement is resistivity in ohm-meters, the formula becomes:

$$Depth\ (m) = \rho/\boxed{25}$$

where, ρ is resistivity expressed in ohm-meters (ohm-m)

Estimating GPR Penetration in Fresh Water
If you are interested in using GPR on fresh water, there is also a formula, related to the ones above, for estimating the depth of penetration when using GPR. It requires a property of water, commonly measured by hydrologists, called the total dissolved solids or TDS. If you have a measurement of TDS of the water you want to scan with GPR, use this expression to estimate the depth of GPR penetration in the water:

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$Depth\ (m) = 1850 / \boxed{\text{TDS}}$

where, TDS is measured in milligrams per liter (mg/l) or parts per million (ppm)

The table below summarizes these formulas using typical values for electrical conductivity and resistivity values for the various materials. Remember: the formulas provide a best-case estimate of the depth of penetration; additional factors, including antenna frequency, transmitter power and receiver sensitivity as mentioned above, also need to be considered. As well, rarely are GPR surveys conducted through a pure material; most often the subsurface is a heterogeneous mixture of different materials resulting in signal scattering which also reduces penetration.

Department of CSE, S.V. U.C.E, Tirupati-2 Email : subbarao_chdv@hotmail.com **Material**	**Electrical Conductivity (mS/m)**	**Electrical Resistivity (ohm-m)**	**Total Dissolved Solids (ppm)**	**Depth of Penetration (m)**
Air	0	0		∞
Ice, Snow,	0.1	10,000		400+
Granite, Marble	0.4	2500		100
Dry sand, Limestone	1	1000		40
Wet sand, gravel	2	500		20
Silt	20	50		2
Clay, concrete	50	20		1
Fresh water (low TDS)			45	40
Fresh water (high TDS)			3700	0.5
Sea water			40,000	0.01

Limitations:

Other disadvantages of currently available GPR systems include:

- Interpretation of radar-grams is generally non-intuitive to the novice.
- Considerable expertise is necessary to effectively design, conduct, and interpret GPR surveys.
- Relatively high energy consumption can be problematic for extensive field surveys.

It is possible to use the depth to a known object to determine a specific velocity and then calibrate the depth calculations.

Ground-penetrating radar uses a variety of technologies to generate the radar signal: these are impulse,[17] stepped frequency, frequency-modulated continuous-wave (FMCW), and noise. Systems on the market in 2009 also use Digital signal processing (DSP) to process the data during survey work rather than off-line.

A special kind of GPR uses unmodulated continuous-wave signals. This holographic subsurface radar differs from other GPR types in that it records plan-view subsurface holograms. Depth penetration of this kind of radar is rather small (20–30 cm), but lateral resolution is enough to discriminate different types of landmines in the soil, or cavities, defects, bugging devices, or other hidden objects in walls, floors, and structural elements.[18][19]

GPR is used on vehicles for close-in high-speed road survey and landmine detection as well as in stand-off mode.[*definition needed*]

In Pipe-Penetrating Radar (IPPR) and In Sewer GPR (ISGPR) are applications of GPR technologies applied in non-metallic-pipes where the signals are directed through pipe and conduit walls to detect pipe wall thickness and voids behind the pipe walls.[20][21][22]
In this paper, control of energy management system (EMS) for microgrid with photo voltaic (PV) based distribution generation (DG) system. The DG units along with energy storage devices play a vital role in optimizing the performance and efficiency in the distribution system network. Hill Climbing technique is used as MPPT (Maximum Power Point Tracking) algorithm to extract maximum power generated from PV source and supplemented by battery based energy storage system during cloudy conditions. The load arrangements are divided into two categories, Secured and Non secured loads. An Uninterrupted Power Supply (UPS) unit acts as interface between grid and secured loads and ensures continuous supply during stand alone condition. The proposed EMS control operates by sensing the load demands under both grid connected and stand alone modes and switches the loads and energy storage devices accordingly. The validity of the proposed EMS methodology is verified with the simulation results.

CONCLUSIONS :

This paper serves the purpose of surveying for bore well , to reduce time, money, effort, and pinpoint the sources of ground water in the aquifier, the bore well gap is also to be maintained of atleast 30-40m gap, and depth of not more

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than 50m.The Darcy's Law is applied, MD8, MDInfy algorithms are used for further investigations.

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