CHAPTER I
INTRODUCTION

1.1 Background

Underground detection is one of the engineering research. Underground detection has a huge range of applications, from planetary exploration to buried mines detection cable repair, cable maintenance, pipe repair, pipe maintenance, etc. [2]. One of the underground detection is Ground Penetrating Radar (GPR), which was developed as a non-destructive structure of the earth.

There are many subsystems in the block diagram of GPR that include an antenna, amplifier, signal processing, display, etc. The function of the antenna is to transmit electromagnetic waves to the ground and the antenna receives electromagnetic waves after the electromagnetic waves detect the target. When the antenna receives the electromagnetic waves as a signal, the signal to the amplifier is displayed, and then the signal goes to the signal processing to convert the sinusoidal signal to the image, and the last one is displayed in a display.

Many people are not-expert to use GPR, so they are difficult to extract the information from the signal output in an amplifier to be displayed on the display. Signal processing is one of the important things in the block diagram that makes the signal into an image displayed on the display. In order to be useful in a practical context, a clear image must be displayed to the GPR's signal processing. To make the signal clear and easy to understand, a new method of signal processing must be clearly displayed on a display. What needs to be done to produce a good signal seen on the display is noise reduction, pulse shaping, clutter reduction, frequency filtering, etc.

This undergraduate thesis is to overview to make the signal clearly and improve the resolution. Comparing several methods of pulse shaping is one way to increase the resolution of the image that appears on the display. When trying several pulse formation methods, there is definitely one method that produces the best image. In Indonesia, some have developed credit formation at GPR. That is why in this undergraduate thesis we will develop the formation of pulses at GPR to display output signals that increase resolution so that the image on the screen is good to be observed.

In this research [3] established that the main frequency and the geometric middle of the frequency band were similar to the mean frequency objectively measured

using the power spectrum rather than the amplitude range used in some of the published literature. This paper has shown that the standard deviation from the mean frequency is not, as the literature suggests, the half-bandwidth of the frequency spectrum of the Ricker wavelet. The results of this paper show that the central frequency can be approximated by the mean frequency, evaluated using the power spectrum rather than the amplitude spectrum as used in certain parts of the published literature, and observed that the standard deviation of the mean frequency is not, as suggested in the literature, the half-bandwidth of the frequency spectrum, and evaluated either the power spectrum or the amplitude of the Ricker wavelet spectrum.

In this research [4] describes a comparative study of many kind of waveform. Very low cut-off frequency is a challenging issue for prospective hardware design if hardware has a very high upper cut-off frequency like a vector network analyzer (VNA). Time domain pulse shaping provides multiple advantageous features such as target range detection, soil measurement of electrical parameters, improvement of spatial resolution, etc. in a geo-radar application. The result is that Ricker wavelet provides a good solution to fulfill the desired signal shape. The operating frequency range should be such that the electrical parameter remains almost equal or constant.

This research [5] establishes a dynamic parametric pulse model (CVVP), with an extension into the complex plane of the actual valued pulse signal. Analysis signal calculated using a Ricker wavelet for measurement. A modulation angle parameter specific to the complex illustration provides extra flexibility and it can be used to model the fundamental pulses, thus elevating the conventional pulse shapes constraint in real-time correlation techniques to fixed pulse shapes. The imaginary part of the complex signal is measured with the Hilbert transformation as the real signals are actually evaluated. The main benefits of this principle are synthetic data and tested in the ultra-wideband pulse radar. Results from the complex pulse parameter estimation may be used to create a corresponding receptor architecture filter.

This research [6] deals with the analysis of seismic data that is very useful in defining the spectrum of the signal as a linear combination. This research formulated rational criteria for approximating functions and demonstrated that Ricker's family of waves is the simplest family of functions which can explain the empirical efficiency. In particular, signal propagation across many layers is discussed, and the Ricker wavelet reveals that it is the most simple, trivial-free solution to the related problem of data processing, provided that the approximation families properties

mentioned are fulfilled. In many cases, using Ricker Wavelets helps everyone to add fewer parameters to estimate the same seismic signals with the exactness given, for a line with empirical results.

This paper [7] proposes a concrete thickness measuring model using GPR, which obtains GPR data and then is used to measure the thickness of the surface. Modeling the GPR method using VNA in the operation of experiments. The concept model uses surface information for a reflective calculation to measure the relative permittivity of concrete using monocycle pulses as a raw data multiplication. The results of the experiments indicate that the measuring model can estimate the concrete thickness with great results.

1.2 Formulation of Problem

Good results of detection involve the right signal. The right signal is a signal that can show the target on a B-scan because the signal can have an effect on the detection performance. Detection may be impaired by noise distortion e.g. in heterogeneous dirt, gravel.

1.3 Objectives and Benefits

The objective of this undergraduate thesis is to compare some methods for shaping pulses so that the target can be clearly identified. In addition to the objectives, this thesis has the benefit of knowing which methods are appropriate for the configuration of good pulses in GPR.

1.4 Limitation of Problem

The limitation of problem from this thesis are:

1. Using VNA Experiment
2. Signal processing using A-Scan and B-Scan
3. Comparing between Monocycle pulse, Gaussian pulse, and Ricker wavelet.

1.5 Research Methods

The method used in the process of completing this thesis are:

1. Study of Literature

   Study the meaning and work principle of GPR

2. Experiment Preparation

   Before data collection, several tools must be prepared, including a sandbox for targeting and targets in the form of conductive objects.

3. Collecting Data

   Collecting data using VNA through vivaldi antenna which is bistatic.

4. Simulation

   After collecting the signal from the VNA, the signal is processed from the Real Imagineer form to the A-scan and B-scan form using a laptop

5. Analyze the Data

   After system realization must analyze that the data obtained in the simulation will be the same as expected.

6. Make the Conclusion

   After all the method have been done, the last is to make the conclusion from the simulation and analysis.