SIMULINK MODEL FOR   MONOPULSE RADAR TARGET DISCRIMINATION

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Abstract - *Target discrimination for radar systems plays a major role in air safety, naval and in defense applications. The ability of the radar to distinguish between the separate echoes is known as target discrimination. The true target is discriminated from the clutter.*

In this work, the Simulink model is built for target discrimination concept. It will provide the information about the how signals will be processed. Target discrimination is applied by collecting data as the cluster. The proposed work depends on the frequency domain analysis. The collected data will be converted to frequency domain and then the discriminate between the true target and false target is done by intra-pulse processing. Typically false target encountered are chaff and corner reflector. This implementation will include Simulink, Signal processing blocks and MATLAB.

Key Words: *Target discrimination, Simulink, chaff, Mono-pulse radar, True target.*

1. INTRODUCTION

Modern radar systems are used in multiple function operations such as detection, discrimination and tracking etc. Mono-pulse radar compares the single received pulse against itself for multiple of operations. Target discrimination plays a major role in radar systems. The different echoes distinguishing capacity of the radar is known as target discrimination. First, the radar antenna illuminates the target with an electromagnetic signal, which will be reflected by the target and it will be picked by the receiving antenna. The received signal is called as echo signal. In mono-pulse radar system the beam is split into parts and then send the two resulting signal with slightly different directions out of the antenna.

The received signals are amplified separately and then they are compared with each other for the further requirements.

The counter measures found as a false target are chaff and corner reflector. Chaff will distract the radar guided missiles from their targets. The reflected signal from the corner reflector will be strong. So it is difficult for the radar to distinguish the true target and clutter.

The target discrimination and classification scheme has been presented in [1]. It is applied to through-the-wall images. The probability theory method to discriminate between the targets has been presented in [2]. The variation of echoes with target aspect angle, noise level, the background hash will determine the reliability of discrimination. The use of Polari-metric radar data to study the target detection algorithms is presented in [3]. The hypothesis testing framework for comparing and analyzing the transmission waveforms of an M-target ID is presented in [4]. The scheme of analyzing the frequency components of returned wave energy to distinguish between the target and clutter and by using the target energy characterization of being present in a narrow range, increasing in range over the time, or remaining substantially in range over time can be detected [5]. The natural frequencies of ultra-wideband for discriminating the radar by independent method is presented in [6].

In the proposed work, the pulse compressed signals are used for target discrimination. For every pulse repetition frequency the radar will discriminate the target based on received data. It is implemented by intra-pulse processing the every pulse and data is collected as cluster. Here frequency domain analysis method is used to analyze the data and find the difference between true target and false target. The previously proposed methods are difficult to implement and to discriminate the targets in practical scenario. The proposed work is simple way to analyze and implement

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Block diagram for target discrimination is shown in figure 2.1. The explanation of each block is as follows: First, the data is stored in repeating sequence stairs and then the sine wave with different frequencies are added to obtain the input. The input samples taken here are 512. These inputs are then passed to buffer whose output is taken as the input to FFT signal processing block. FFT performs the Fast Fourier Transform of the input samples. After converting to frequency domain it is passed to abs block. In abs block absolute value is founded means only positive values will be given as output from the block. Then output will be passed to peak finder block and embedded matlab function block.

In embedded matlab function block the code will be written in such a way that when all the inputs to the given block is less than threshold value then output will be '1' from the block else it will be '2'. These output value will be given to another embedded matlab function block.

In peak finder block the maximum values among all the input value is founded. In this block threshold value will be specified. This block will found the values greater than threshold. This will also display the index value and count of the maximum values.The count value will be the number of maximum values present in the data. In peak finder block,the number of maximum values to be finded can be specified. The output of peak finder block such as index and maximum value are displayed using display block.From peak finder block the index value is given to diff block. In diff block the difference of consecutive values is founded out and that output is displayed in display block. Again the output is passed to another diff block. Here again the difference of consecutive values from diff block output is founded. Then output value is displayed in display block. This output is given to embedded matlab function block2.

In embedded matlab function block2 the code will be written in such a way that When the output from diff block is in the range of '-2' to '2'. Then the output value will be '1' .when the output value is not within this ranges the output will be '2'. Then again this input is connected to another embedded matlab function block1. In this embedded matlab function block1, code is written in such a way that when the output from embedded function block2 is '1' then the output from embedded function block1 is will be '3'. That means the target is clutter.when the output from embedded matlab function block is '1'and output from embedded matlab function block2 is '2' then output from embedded matlab function block1 will be '1' else if the output from embedded matlab function block is '2' and output from embedded matlab function block2 is '2' then output from embedded matlab function block1 will be '2'. Figure 2.2 shows the Simulink model for monopulse radar target discrimination.
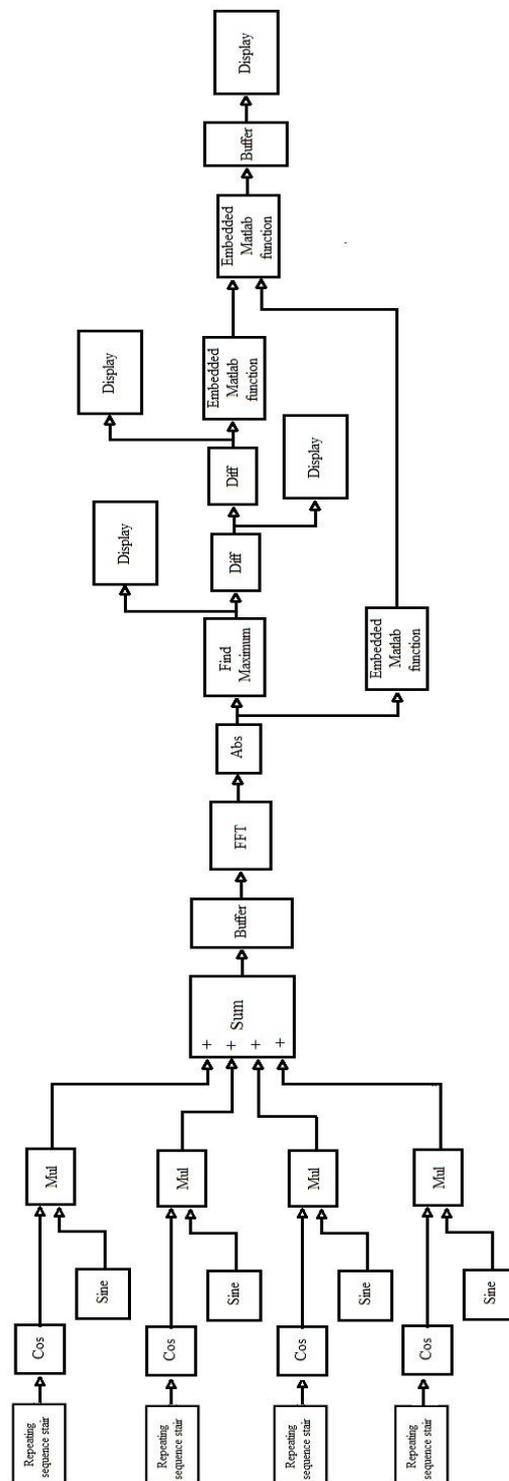

Figure 2.1 Block Diagram For Target Discrimination.

3. EXPERIENTAL RESULTS

The periodicity is checked here. If the output from FFT block is periodic then it is false target. If the output from FFT block is non-periodic then output is true target. In Simulink model the output is displayed as '1' if it is a true target, '2' if it is a false target and '3' for chaff.

Figure 3.1 shows the FFT block output for true target which are non-periodic.

Figure 3.1 FFT Block Output For True Target.

Figure 3.2 shows the final output of Simulink model for true target. Here in first frame the target will be chaff hence output is '3' and all other frames have true target hence output is '1'.

Figure 2.2 Simulink Model of Target Discrimination.

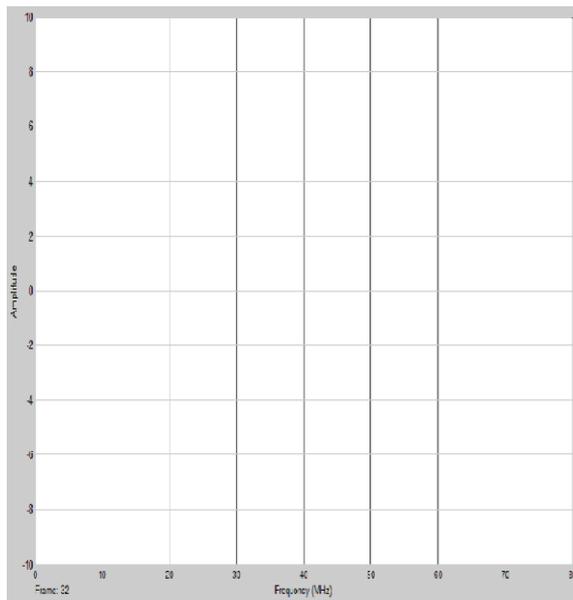Figure 3.2 True Target Output Of Simulink Model.

Figure 3.3 False Target Output of FFT Block.

Figure 3.4 shows the Simulink model output for false target. Here in first frame the target will be chaff hence output is '3' and all other frames have false target hence output is '2'.
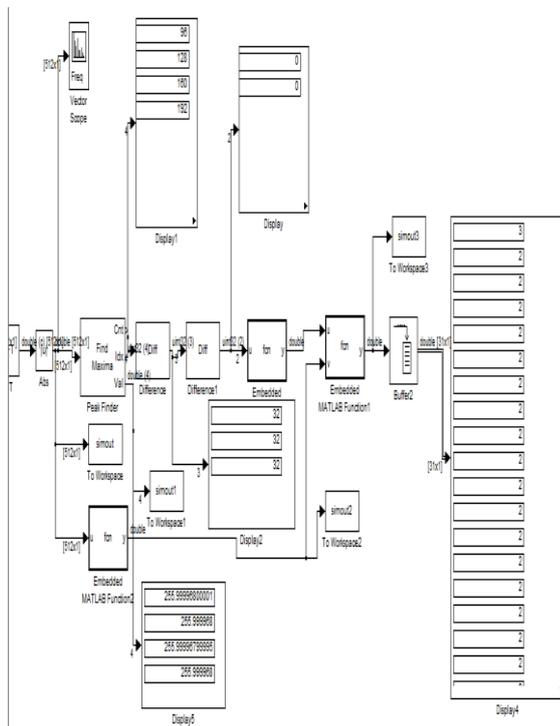

Figure 3.4 False Target Output Of Simulink Model.

4. CONCLUSIONS AND FUTURE WORK

It is important to known about the presence, absence, true and false target in the radar guided missiles. Here the frequency domain computation is used to known about the true and false target. The method implemented here is easy,

accurate and the maximum possible discrimination between the different targets is done. MATLAB and Simulink are used in the present work. In future the detection is extended to multiple targets.

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