Analysis and Evaluation of Increasing the Throughput of Processors by Eliminating the Lobe's Disorder

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ABSTRACT:
In modern radars, the design is such that radar vulnerability to noise disturbance is significantly reduced. This dramatic decrease is due to the fact that radars are always trying to increase their capability against the heavy clutter they receive from the ground. Radars use antenna sidelobes to reduce clutter. By reducing the antenna sidelobes, the vulnerability of the radar to the heavy clutches of the sidelobes is reduced, which also reduces the vulnerability to sidelobe disturbance. In this article, we try to examine the reduction of clutter causing the reduction of vulnerability to disorder.

KEYWORDS: Radar, Electronic Warfare, Electronic Attack, Electronic Protect, Electronic Support.

1. INTRODUCTION

Since the end of World War II there have been many advances in the areas of science, genetic algorithms [1], hardware [2], software [3], phase lock loops [4], distributed production resources [5], Neural networks [6,7], cryptography and watermarking[8] Electronic warfare [9], and photonic crystal [10] were performed
With the advancement of technology and increasing the operational power of processors, the elimination of sidelobe disorder was used. In this method, reducing the area and width of the sidelobe is one of the most effective methods to deal with sidelobe disorder. In the following, we will examine the reduction of clutter, which reduces the vulnerability to the disorder.

2. REDUCING THE CLUSTER REDUCES THE VULNERABILITY TO THE DISORDER

A normal reduction for the sidelobes in this case is to reduce the gain of the sidelobes by 12dB compared to the main lobe. As you can see in Fig. 1, in this case the equal distance between the power of the radar return signal and the interfering signal is doubled,in this case the radar range is doubled in the presence of the interruptor.

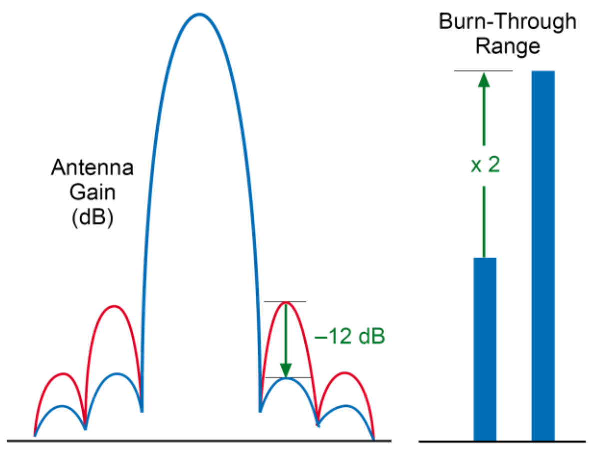

Fig. 1. Reduction of sidelobe gain by 12dB.

Elimination of the sidelobe is a combination that depends on the distance of the anti-electronic disturbance. In this technique, when the amplitude of the signal received in the guard antenna beam (directional antenna with wide beam and low direction) from the

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signal amplitude received by the main antenna beam (directional antenna with narrow beam, and high direction that send and receive the signal Is responsible for) more, this signal is removed at the receiver output. Because naturally the amplitude of the received signals in the main antenna should be greater than the amplitude of the received signals in the guard antenna. The blocking system therefore removes the false target injected into the sidelobe of the radar antenna. The display of disruptive sparks is also lost during the search, as the disruptor swipes the radar sidelobes.

It should be noted that the antenna guard has little direction and its efficiency is more than the strongest sidelobe. See Fig. 2 for a better understanding. The radar logic in operating the blocking system must be sufficiently intelligent to be able to eliminate disturbance from long distances to the sidelobes but to detect signal bounces from distant targets.

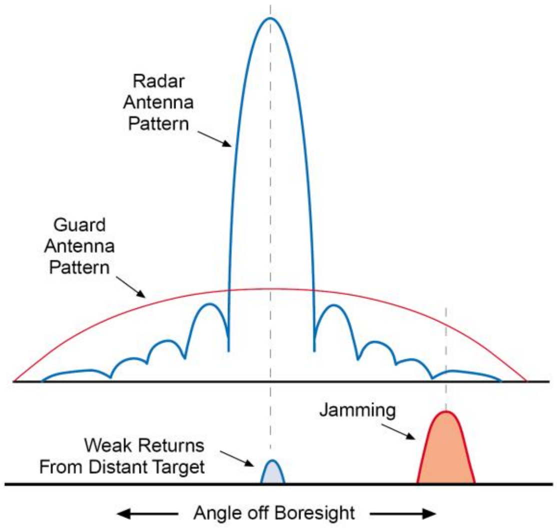

Fig. 2. Sidelobe blanker eliminates false returns injected into radar sidelobe. But the system must be intelligent enough to keep and detect poor returns from distant targets, but to eliminate disturbances from long distances on the sidelobe that do not pose an acute problem.

With the advancement of technology and increasing the operational power of processors, the elimination of sidelobe disorder was used. In this method, reducing the area and width of the v is one of the most effective methods to deal with sidelobe disorder. This reduction in width in the sidelobe occurs in the direction in which the disruptor is located. In this case, a gap is created in the sidelobe of the radar receiver antenna to receive the interfering signal. The basic concept of this technique for a simple disruptor is shown in Fig. 3.

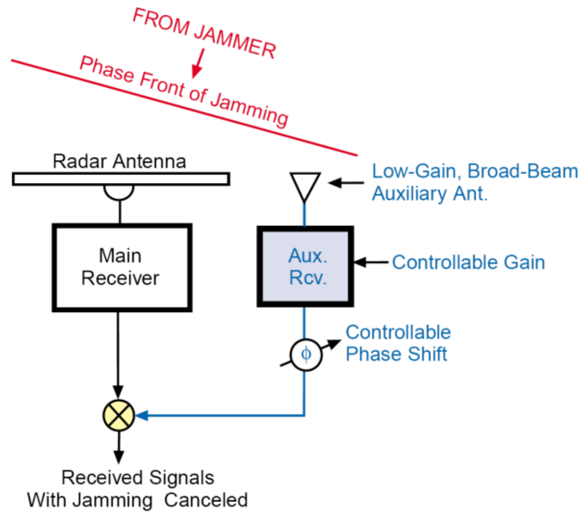

Fig. 3. Sidelobe disorder removal technique. The gain and shift of the secondary receiver phase are adjusted to eliminate disturbance at the receiver output after assembly.

The radar antenna is synchronized with the all-round secondary antenna, which has low gain and wide beam width, both antennas have the same angular width, but the side antennas of the main antenna are less so that it can be better oriented. The signal received by the secondary antenna is routed to another receiver that has controllable gain and phase shift. The output of this receiver joins the output of the main receiver.

By matching the secondary receiver gain, the difference in the gain of the two antennas will be compensated for in the direction of the interfering (normally, the signal strength received in the secondary antenna is less than the signal strength received in the main antenna. It is important to note that the pattern level the secondary antenna is higher than the strongest sidelobe of the main antenna, the interruptor sends a lot of power to the sidelobe's in which case the signal power received in the secondary antenna increases and equals the main antenna and may even exceed it. The disruptor sends its power to the sidelobe of the radar antenna, so that the inherent power difference between the two antennas is eliminated in the direction in which the disruptor is located. By adjusting the phase shift of the secondary receiver, the disturbance signal at the output of this receiver is 180 degrees different from the disturbance signal at the output of the main receiver. Therefore, when the output of the two receivers is combined, the disturbance will be eliminated. In this way, the effect of creating a notch in the pattern of receiving the radar receiver antenna in the direction of the interruptor, leads to the elimination of the disturbance signal.

The gaps created in this process can be widened in the direction of several disruptors. This technique is the basis of EP[1] techniques called CSLC[2]. A separate secondary antenna and receiver must be provided for each desired slot. To ensure the result of the work, we must consider the number of secondary antennas to be 1.5 to 2 times the number of possible interruptors so that we can neutralize the disturbances in different directions. The secondary antenna must cover the entire field of view of the radar antenna. And they must be positioned so that their phase center is another substitute, also replacing the phase center of the radar antenna.
A quick and adaptable algorithm is to adjust the amplitude and phase of each secondary receiver to the location of the slots and the receiving direction of the interrupts.

Phase rotation and signal combination may occur in the RF, IF, or digital processor segment. Although digital processing is somewhat time consuming due to time consuming, it is the best and most flexible method.

3. HOW TO REMOVE THE DISORDER ON THE SIDELOBE

Amplitude difference ΔA is caused by the difference in the gain of the secondary antenna and the main antenna in the direction of the interfering.

Phase difference $\Delta\varphi$ is caused by a difference in the distance between the disruptor and the center of the phase.

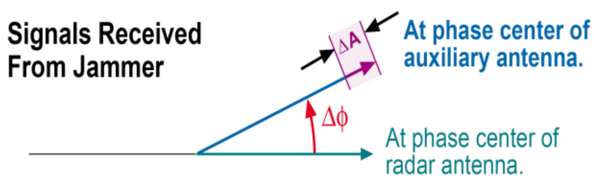

Fig. 4. Phase difference and amplitude difference.

4. DOMAIN SETTING

By setting the secondary gain, the amplitude difference is eliminated.

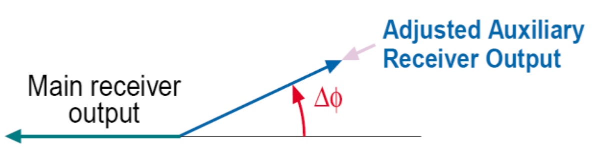

Fig.5. Elimination of domain difference by setting the secondary beneficiary. Of course, it is assumed that the interferor is inside the first lobe of the radar antenna. Therefore, the interfering phase at the antenna output will be reversed.

5. PHASE ADJUSTMENT

It will be removed by setting the phase shift at the output of the secondary receiver.

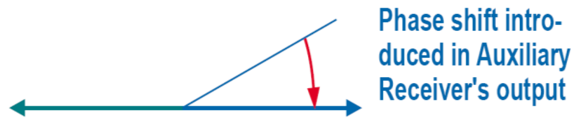

Fig. 6. Elimination, by adjusting the phase shift at the output of the secondary receiver.

As a result, the disturbance signal at the secondary receiver output has an equal amplitude and a phase difference of 180 degrees with respect to the disturbance signal phase at the output of the main receiver. Therefore, by combining the two outputs, the interfering signal is removed. However, a gap is created in the direction of the radar antenna sidelobe pattern in the direction of the interference.

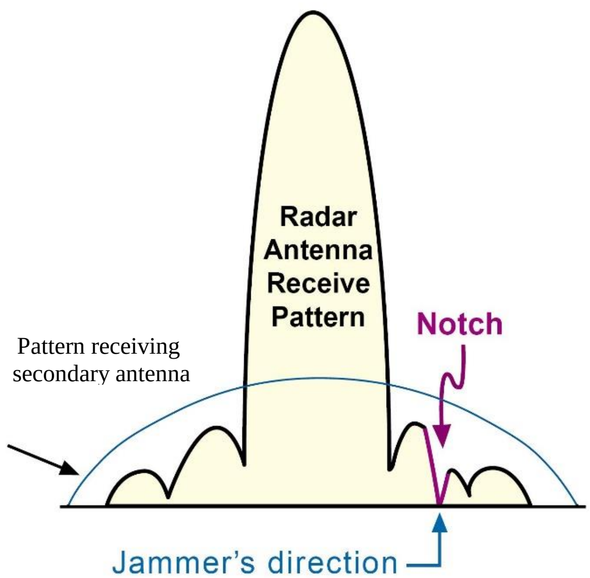

Fig. 7. Creating a gap in the direction of the radar antenna sidelobe pattern in the direction of the interfering.

6. ELIMINATION OF THE MAIN LOBE DISORDER

The disturbance received through the main lobe of the radar antenna can be eliminated with the adaptive GMTI slit technique. This technique, sometimes called "ABF[3]", creates a single slit in the main lobe of the pattern receiver in the disruptive direction. This is done by combining the matching phase of the relative phases of the monopulse antenna outputs in the right and left halves. As you can see in Fig. 8, when this compound

[1] Electronic Protect
[2] Coherent Sidelobe Cancellation
[3] Adaptive Beam Forming

occurs, the radiation received from the disruptor will be removed.

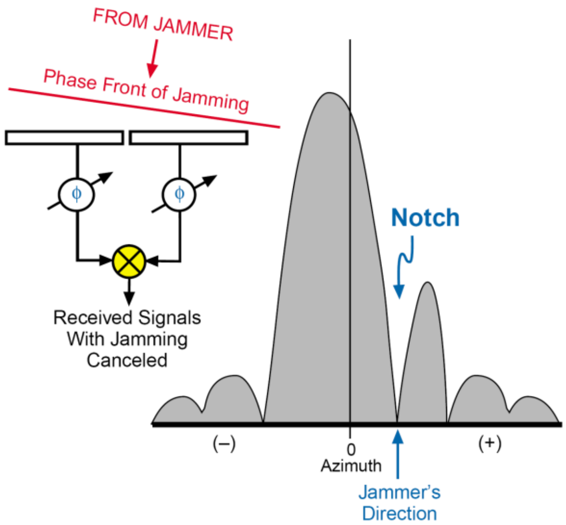

Fig. 8. The main concept of eliminating the main lobe disorder. The relative phase of the radiation received from the right and left halves of the monopulse radar antenna is shifted so that there is a phase difference of 180 degrees for the radiation received in the disruptive direction.

As in the case of sidelobe removal, phase rotation processes and signal combinations are commonly performed in the digital radar processor section.

7. CONCLUSION

In this article, the increase of the operational capacity of the processors to eliminate the sub-lobe disorder was investigated. This method is one of the most effective methods to deal with the sub-lobe disorder by reducing the area and width of the sub-lobe. This reduction in width in the sublobe occurs in the direction in which the disruptor is located. In this case, a gap is created in the sub-lobe of the radar receiver antenna in order to receive the interfering signal.

REFERENCES

[1] Hashemi SM, Barati S, Talati S, Noori H. A genetic algorithm approach to optimal placement of switching and protective equipment on a distribution network. J Eng Appl Sci 2016; 11: 1395-1400.

[2] O. Sharifi-Tehrani and S. Talati, "PPU Adaptive LMS Algorithm, a Hardware-Efficient Approach; a Review on", Majlesi Journal of Mechatronic Systems, vol. 6, no. 1, Jun. 2017.

[3] Hashemi, Seyed & Abyari, M. & Barati, Shahrokh & Tahmasebi, Sanaz & Talati, S.. (2016). A proposed method to controller parameter soft tuning as accommodation FTC after unknown input observer FDI. Journal of Engineering and Applied Sciences. 11. 2818-2829.

[4] S. Talati, A. Rahmati, and H. Heidari, "Investigating the Effect of Voltage Controlled Oscillator Delay on the Stability of Phase Lock Loops", MJTD, vol. 8, no. 2, pp. 57-61, May 2019.

[5] Saeed. Talati, Behzad. Ebadi, Houman. Akbarzade "Determining pf the fault location in distribution systems in presence of distributed generation resources using the original post phasors"QUID 2017, pp. 1806-1812, Special Issue No.1- ISSN: 1692-343X, Medellín-Colombia. April 2017.

[6] Saeed Talati, Mohamadreza HasaniAhangar, "Analysis, Simulation and Optimization of LVQ Neural Network Algorithm and Comparison with SOM", MJTD, vol. 10, no. 1, Jan. 2020.

[7] Talati, S., & Hassani Ahangar, M. R. (2020). Combining Principal Component Analysis Methods and Self-Organized and Vector Learning Neural Networks for Radar Data. Majlesi Journal of Telecommunication Devices, 9(2), 65-69.

[8] Saeed Talati, Pouriya Etezadifar, "Providing an Optimal Way to Increase the Security of Data Transfer Using Watermarking in Digital Audio Signals", MJTD, vol. 10, no. 1, Feb. 2020.

[9] Hassani Ahangar, M. R., Talati, S., Rahmati, A., & Heidari, H. (2020). The Use of Electronic Warfare and Information Signaling in Network-based Warfare. Majlesi Journal of Telecommunication Devices, 9(2), 93-97.

[10] Talati, S., & amjadi, alireza. (2020). Design and simulation of a novel photonic crystal fiber with a low dispersion coefficient in the terahertz band. Majlesi Journal of Mechatronic Systems, 9(2).

[11] Talati, S., akbari sani, M., Hassani Ahangar, M. (2020). Identifying Radar Targets using the GMDH Deep Neural Network. *Radar,* 8(1), 65-74.

[12] Talati, S., hasani ahangar, M. (2021). 'Radar data processing using a combination of principal component analysis methods and self-organizing and digitized neural networks of the learning vector', *Electronic and Cyber Defense*.

[13] Aslinezhad, M., Mahmoudi, O., & Talati, S. (2020). Blind Detection of Channel Parameters Using Combination of the Gaussian Elimination and Interleaving. Majlesi Journal of Mechatronic Systems, 9(4), 59-67.

[14] Talati, S., & Amjadi, A. (2020). Design and Simulation of a Novel Photonic Crystal Fiber with a Low Dispersion Coefficient in the Terahertz Band. Majlesi Journal of Mechatronic Systems, 9(2), 23-28.

[15] Talati, S., & Alavi, S. M. (2020). Radar Systems Deception using Cross-eye Technique. Majlesi Journal of Mechatronic Systems, 9(3), 19-21.

[16] O. Sharifi-Tehrani, M. F. Sabahi, and M. R. Danee, "GNSS Jamming Detection of UAV Ground Control Station Using Random Matrix Theory," ICT Express, vol. In Press, 2020.
[17] O. Sharifi-Tehrani, "Novel hardware-efficient design of LMS-based adaptive FIR filter utilizing Finite State Machine and Block-RAM," Przeglad Elektrotechniczny, vol. 87, no. 7, pp. 240-244, 2011.
[18] O. Sharifi-Tehrani, "Hardware Design of Image Channel Denoiser for FPGA Embedded Systems," Przegląd Elektrotechniczny, vol. 88, no. 3b, pp. 165-167, 2012.
[19] O. Sharifi-Tehrani, A. Sadeghi, and S. M. J. Razavi, "Design and Simulation of IFF/ATC Antenna for Unmanned Aerial Vehicle," Majlesi Journal of Mechatronic Systems, vol. 6, no. 1, pp. 1-4, 2017.
[20] O. Sharifi-Tehrani, M. F. Sabahi, and M. R. Danee, "Low-Complexity Framework for GNSS Jamming and Spoofing Detection on Moving Platforms," IET Radar, Sonar & Navigation, vol. 14, no. 12, pp. 2027-2038, 2020.
[21] O. S. Tehrani, M. Ashourian, and P. Moallem, "An FPGA-based implementation of fixed-point standard-LMS algorithm with low resource utilization and fast convergence," International Review on Computers and Software, vol. 5, no. 4, pp. 436-444, 2010.
[22] O. Sharifi-Tehrani, "Design, Simulation and Fabrication of Microstrip Hairpin and Interdigital BPF for 2.25 GHz Unlicensed Band," Majlesi Journal of Telecommunication Devices, vol. 6, no. 4, 2017.