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Comparison of Wall Clutter Mitigation Methods in TWRI

Youngjoon Lim^{*}, Dooneon Yang, Sangwook Nam

Institute of New Media & Communication, Seoul National University, Seoul, Korea

yjim@ac1.snu.ac.kr, doohuyn@ac1.snu.ac.kr, snam@snu.ac.kr

I. Introduction

In through-the-wall radar imaging(TWRI), wall clutter mitigation is one of critical issues. Wall clutter often dominates the target signals, so targets are obscured in its image. In the past few years, various techniques for wall clutter mitigation using background removal, average trace subtraction, singular value decomposition are investigated [1]. In this paper, we quantify performance of the techniques using target-to-clutter ratio(TCR).

II. Wall Clutter Mitigation Techniques

(a) Background Removal(BR) Method

In ideal case, received radar signal is composed of wall clutter signal and target signal. If we know the exact wall reflection response without targets, target signal can be extracted by subtracting wall reflection response from received radar signal.

(b) Average Trace Subtraction(ATS) Method

Ideally, wall clutter response does not vary with respect to antenna locations. By applying proper spatial filtering in direction of data acquisition, wall clutter can effectively be removed. This can be achieved by subtracting from each trace the average one.

(c) Singular Value Decomposition(SVD) Method

The most significant terms of the singular spectrum of received signal matrix are dominated by the wall clutter. Using singular value decomposition, received signal can be decomposed into several orthogonal images. Wall clutter signal can be removed by deleting the first dominant orthogonal image.

III. Simulation

In order to compare TCR to quantify the performance of images, synthetic data are obtained using open FDTD solver source GPRmax2.0.

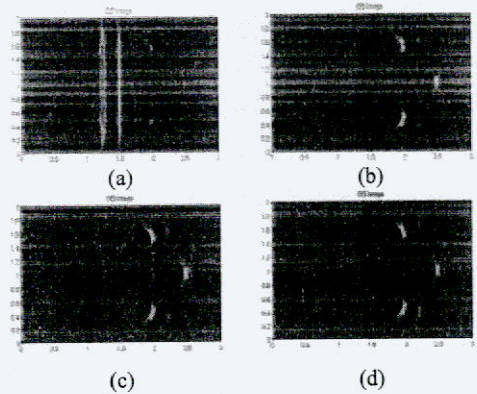


Fig. 1. Delayed-Sum(DS) image after each technique :

(a) Raw data (b) BR (c)ATS (d) SVD

Table 1. TCR measurement result

Techniques	TCR [dB]
Raw data	6.64
BR	56.80
ATS	54.60
SVD	56.31

Fig.1and Fig.2 shows delayed-sum image after each technique and TCR results respectively. By applying each technique, TCR has been increased at least 47.96 dB.

IV. Conclusion

In TWRI simulation, wall clutter mitigation techniques are compared. TCR has enormously been increased after applying the techniques.

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References

- [1] Raffaele Solimene and Antonio Cuccaro, "Front Wall Clutter Rejection Methods in TWI", IEEE Geosci. Remote Sens. Lett, vol. 11, no. 6, pp. 1158-1162, JUNE 2013