Antenna Target Recognition with Terahertz Radar based on RCS Characteristics

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***Abstract*—Regarding the problem of antenna target recognition in terahertz (THz) band, in this paper, it proposed a target recognition process based on Radar Cross Section (RCS) characteristics. Besides, it established an antenna target recognition simulation for four kinds of typical antenna with 140G narrowband radar, which verified the effectiveness of the above method.**

I. INTRODUCTION

There is a promising application in airborne Video Synthetic Aperture Radar (ViSAR) for terahertz (THz) radar. Additionally, research on target scattering characteristics and recognition of ground antenna can make great contribution to airborne ViSAR in THz band. Compared to microwave radar, THz radar is more beneficial for target recognition for its short wavelength, wide bandwidth and high resolution [1]. Furthemore, target scattering characteristics in THz band are much more abundant. In addition, RCS characteristics of the targets are significant for target recognition due to its stability and reliability [2].

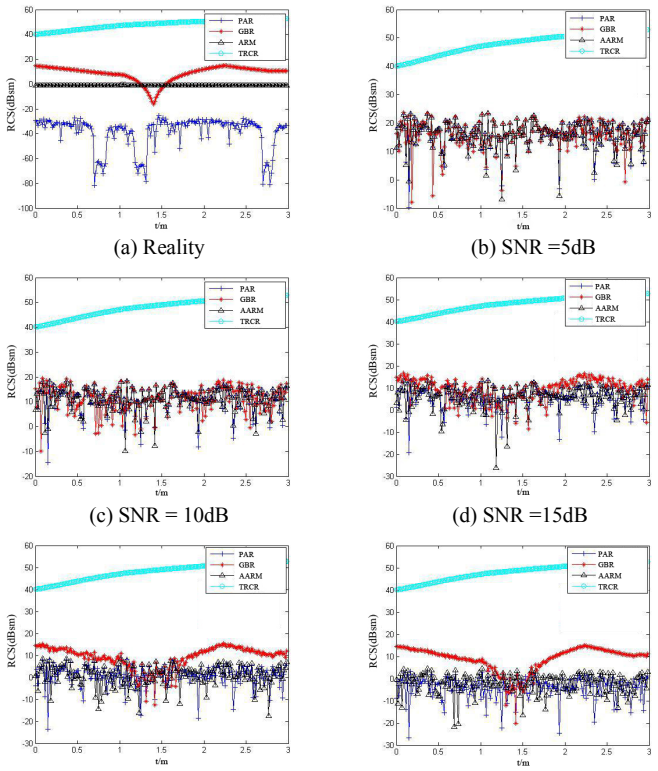
In THz band, the problem of ultra-electrically-large demands high-frequency approximation approaches to computing target electromagnetic scattering characteristics. The usual approaches contain Geometrical Optics (GO), Physical Optics (PO), Equivalent Electromagnetic Currents (EEC), Shooting and Bouncing Ray (SBR), etc. However, there is not an application in computing target scattering characteristics in THz band for antenna target recognition.

This paper adopted SBR to compute the antenna target scattering characteristics. Then, the antenna RCS characteristics were extracted to design the Nearest Neighbor Classifier (NNC) [3]. Eventually, it proposed the general process of antenna target recognition with terahertz radar based on RCS characteristics. Ultimately, simulation on antenna target recognition was established for Parabola antenna (PAR), Ground-Based radar antenna (GBR), Anti Anti-Radiation Missile antenna (AARM) and Triangle Corner Reflector (TRCR) with 140G narrowband radar, which verified the effectiveness of the method.

II. RESULTS

Fig 1 shows the RCS estimation results respectively in reality, SNR=5dB, 10dB, 15dB, 20dB and 25dB. Reference to RCS in reality, when the SNR is less than 15 dB, RCS estimation is incredible for loud noise. RCS tends to be steady in 20 dB. When SNR comes to 25 dB, RCS becomes more accurate and reliable.

Table 1 obtains the recognition result based on RCS characteristics. Target recognition is low in 15dB except for the TRCR. In 20dB, only the recognition rate of AARM is low. At last, all target recognition has a high level of reliability in 25dB. In conclusion, the proposed approach is effective.



(a) Reality (b) SNR =5dB

(c) SNR = 10dB (d) SNR =15dB

(e) SNR = 20dB (f) SNR =25dB

Fig. 1. RCS sequence of the four typical antenna (reality, SNR=5dB, 10dB, 15dB, 20dB and 25dB)

Table. 1. Recognition Result based on RCS

Target \ SNR	5dB	10dB	15dB	20dB	25dB
	Correction Number / Total Number				
PAR	0.474	0.736	0.582	0.750	0.816
GBR	0.236	0.198	0.652	0.814	1
AARM	0.098	0.022	0.012	0.066	0.788
TRCR	1	1	1	1	1

III. SUMMARY

In conclusion, we proposed an antenna target recognition process based on RCS in THz band, which shows promising potential on airborne ViSAR. Besides, simulation on antenna target recognition was established for PAR, GBR, AARM and TRCR with 140G narrowband radar, and the results verified the effectiveness of the method.

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