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Author: Ms. Wen Yu
Beijing Institute of Tracking and Telecommunication Technology (BITTT), China

Mr. Siwei Zhao
China
Mr. Zhongwei Liu
China

# STUDY ON A NEW MODIFIED-FS IMAGING ALGORITHM AND JAMMING CHARACTERISTICS FOR FMCW SAR

**Abstract**

In the field of airborne earth observation, there is a rising interest in small, low-cost, high-resolution imaging sensors. The combination of compact frequency-modulated continuous wave (FMCW) technology and synthetic aperture radar (SAR) paves a way for the development of the lightweight, cost-effective, high-resolution airborne imaging radar, which is suitable for small platforms such as unmanned aerial vehicles in military and civil use. Compared with the traditional pulsed SAR, the continuous radar motion during the transmission of a sweep and the reception of the corresponding echo will induce serious Doppler frequency shift as a reconstructed image distortion effect. That means, in FMCW SAR, the so-called stop-and-go approximation for pulsed SAR is no longer valid because of the relatively long sweeps which the FMCW SAR transmits. Moreover, the presence of nonlinearities in the transmitted signal highly deteriorates the range resolution and image quality because of the pair-echo effect. A novel modified frequency scaling (MFS) algorithm is proposed in this paper to compensate this Doppler frequency shift and simultaneously correct the range frequency non-linearity in order to complete the FMCW SAR imaging process. Based on the original FS algorithm which is designed for the strip-map and side-looking mode pulsed SAR, the advanced MFS gets a more satisfactory result by introducing a new phase term in range-Doppler domain and estimating the nonlinearities using the time-shift characteristic of the Fourier transform. Through simulation experiments, the MFS algorithm is proved to achieve a much higher resolution than the original FS method without extra computation load. As for military use, the technology of FMCW SAR jamming should always be considered. Regarding of the complexity and difficulty of FMCW SAR jamming, the lowest noise blanketing jamming needed for effective interference is derived from the analysis of the FMCW SAR signal detection performance, resulting in some significant conclusions. Furthermore, the expression of the interception factor confirms the anti-jamming superiority of the FMCW SAR over the conventional pulsed SAR in terms of the duty cycle. Preliminary jamming results are obtained by carrying out several simulation experiments, which is an innovative exploration, laying the foundation of validity and practicability of FMCWSAR technology.