

频带合成超高分辨率机载SAR系统的相位误差校正

张梅^{*①②} 刘畅^① 王岩飞^{①*}

^①(中国科学院电子学研究所 北京 100190)

^②(中国科学院研究生院 北京 100039)

Channel Error Correction for Ultra-high Resolution Airborne SAR System with Synthetic Bandwidth

Zhang Mei^{①②} Liu Chang^① Wang Yan-fei^{①*}

^①(Institute of Electronics, Chinese Academy of Sciences, Beijing 100190, China)

^②(Graduate University of the Chinese Academy of Sciences, Beijing 100039, China)

摘要

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摘要 频带合成技术是实现机载合成孔径雷达距离向超高分辨率的有效途径,然而在实际频带合成系统中,相位误差破坏了信号间的相干性,导致直接合成的结果严重恶化。该文在详细研究相位误差对频带合成影响的基础上,提出一种直接从回波中提取相位误差的方法改进的多项式相位变换方法(PPT),其用分数阶傅里叶变换(FRFT)取代傅里叶变换(FT)作为PPT的变换核,降低了差分变换的阶数,减少了信噪比的损失,同时循环次数得以减半。理论推导和实际数据验证了该方法的有效性,最终实现了优于0.05 m的距离向分辨率。

关键词: 合成孔径雷达 距离向高分辨率 频带合成 通道误差 分数阶傅里叶变换-多项式相位变换(FRFT-PPT)方法

Abstract: Synthetic bandwidth technique provides an effective way to achieve the ultra high range resolution of airborne SAR. But in the real synthetic bandwidth system, the correlation is badly distorted by the phase error. If it is directly synthesized, the result will be seriously deteriorated. In this paper, based on the detailed research of the phase error, an improved Polynomial-Phase Transform (PPT) method is proposed to estimate the phase error from the echo directly. The Fourier Transform (FT) is replaced by the FRactional Fourier Transform (FRFT) in the new method, which can decrease the number of PT to reduce the SNR loss, and the circle amount is half. Theoretical analysis and the raw data prove the proposed approach is effective. Finally, the range resolution down to 0.05 m is obtained.

Keywords: SAR Ultra high range resolution Synthetic bandwidth Channel error FRactional Fourier Transform-Polynomial-Phase Transform (FRFT-PPT) method

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通讯作者: 张梅 Email: zhangmei2011@gmail.com

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