

### 基于脉内波束指向的单相位中心多波束星载SAR系统接收端DBF处理

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## Digital Beamforming for Single Phase Center Multi-beam Spaceborne SAR Based on Intrapulse Beamsteering

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摘要

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**摘要** 该文将单相位中心多波束(SPCMB)星载SAR系统与脉内波束指向相结合,有效地解决了传统SPCMB-SAR系统方位模糊较大的问题。该文推导了接收端方位向、距离向及2维联合数字波束形成(DBF)的处理方法,并归纳出先方位向DBF后距离向DBF,先距离向DBF后方位向DBF,以及2维DBF 3种处理流程。同时分析了该系统的主要系统参数,对比了3种处理流程的数据率和计算复杂度。仿真验证了3种处理方法的有效性,并通过模糊度分析证明采用该系统能降低方位模糊和距离模糊,有效实现高分辨率宽测绘带成像。

**关键词:** 合成孔径雷达 单相位中心多波束 脉内波束指向 数字波束形成 模糊分析

**Abstract:** This paper studies single phase center multi-beam spaceborne SAR based on intrapulse beamsteering by combining spaceborne Single Phase Center Multi-Beam (SPCMB-SAR) and intrapulse beamsteering in order to reduce large azimuth ambiguity. The principle of digital beamforming for receiving signal process is explored, including azimuth DBF, elevation DBF and two-dimensional DBF. Three kinds of DBF processing methods are proposed, including azimuth DBF first and elevation DBF later, elevation DBF first and azimuth DBF later, and two-dimensional DBF. The primary system parameters are analyzed. Data rate and calculation complexity of the three methods are compared. Simulation results show that all methods are effective. Ambiguity analysis confirms that the SPCMB-SAR system proposed in this paper can reduce range ambiguity and azimuth ambiguity and realize high resolution wide swath SAR imaging effectively.

**Keywords:** SAR Single Phase Center Multi-Beam (SPCMB) Intrapulse beamsteering Digital beamforming Ambiguity analysis

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