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SAR极坐标格式成像算法对运动目标响应特性

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Response of PFA to Moving Target in SAR Imaging

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摘要

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摘要 运动目标的合成孔径雷达 (SAR) 成像特征是SAR地面运动目标指示 (SAR/GMTI) 系统进行运动目标检测、成像和重定位的基础。为此, 从信号二维解耦校正距离徙动角度推导和分析了极坐标格式算法 (PFA) 对运动目标的响应特性, 揭示了极坐标格式转换过程中的距离插值和方位插值对运动目标距离徙动的校正原理。理论分析表明: PFA在完成对静止目标成像的同时, 还能够自动校正所有运动目标的线性距离徙动, 且校正过程无需目标运动信息, 因此对于径向运动目标, 在忽略波前弯曲条件下PFA也能够对其进行完全聚焦。最后, 通过仿真数据处理对理论分析结果进行了验证, 表明PFA作为一种运动目标成像预处理方法具有很大的应用前景。

关键词: 合成孔径雷达 极坐标格式算法 SAR/GMTI 距离徙动校正 keystone变换

Abstract: The synthetic aperture radar (SAR) signatures of moving target are the basis of ground moving target detection, imaging and relocation. This article develops and analyses the response of polar format algorithm (PFA) to the moving target from the range migration correction point of view, and reveals the principle concerning how the range interpolation and azimuth interpolation correct the range migration for moving target in polar format transformation. The analytical results indicate that PFA not only produces focused image of stationary target, but also eliminates the effects of linear range migration for all the moving targets regardless of their unknown velocity. Therefore, the moving targets with only radial motion will also be well focused by PFA processing when the wavefront curvature can be neglected. Finally, the analytical results are verified via simulation data processing, which indicate that as an imaging pretreatment method, PFA has a wide application prospect.

Keywords: synthetic aperture radar polar format algorithm SAR/GMTI range migration correction keystone transform

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