信号处理 2011, 27(11) 1680-1686 DOI: ISSN: 1003-0530 CN: 11-2406/TN

算法研究

结合子孔径NCS算法和运动补偿的机载UWB SAR实时处理

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摘要：

低频机载UWB SAR实现高分辨成像需要大积累角和长孔径，实时成像面临大数据量和大运算量的挑战；此外，较长的孔径时间内载机运动比较复杂，增加了实时运动补偿的难度。本文讨论了机载UWB SAR实时成像的子孔径NCS算法，分析了其降低数据量和提高成像精度的改进措施；然后讨论了基于运动测量数据的实时运动补偿方案，利用实时PRI调整补偿前向运动误差，并在实时成像流程中嵌入视线运动误差补偿环节。在上述分析的基础上，提出了结合子孔径NCS算法和运动补偿的机载UWB SAR实时处理流程。最后，给出了实际飞行实验中机载UWB SAR的实时处理结果，证明本文所提流程可以满足机载UWB SAR处理实时性以及处理精度的要求。

关键词： 机载UWB SAR 子孔径NCS算法 实时PRI调整 方位空变运动补偿

Real-time Processing of Airborne UWB SAR based on Sub-aperture NCS algorithm with integrated Motion Compensation

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Abstract:

Airborne UWB SAR which works in low frequency has large integration angle and long aperture, so the real-time imaging suffers from large amount of data and heavy computational load. Besides, the influence of the motion errors becomes complex and severe due to the long aperture time. All these increase the difficulties of real-time image formation and motion compensation. In this paper, the sub-aperture NCS algorithm is discussed and the modifications in order to reduce the data volume and improve the imaging precision are analyzed. Then the real-time motion compensation strategy based on motion sensor measurements is present. By means of real-time PRI adjustment the variation of the forward velocity is corrected and the across-track motion error will be compensated in the real-time imaging flow. According to the former analysis, a real-time processing flow for airborne UWB SAR on the basis of sub-aperture NCS algorithm with integrated motion compensation is present. At the end of the paper, the real-time processing result of an airborne UWB SAR during a real flight test is present, which validates that the real-time processing flow can meet the demand of real-time and precision of airborne UWB SAR.

Keywords: Airborne UWB SAR sub-aperture NCS algorithm real-time PRI adjustment azimuth space variant motion error compensation

收稿日期 2011-05-31 修回日期 2011-09-17 网络版发布日期 2011-11-25

DOI:

基金项目:

通讯作者:

作者简介:

作者Email:

参考文献：

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