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一种基于高阶修正双曲线距离方程的中轨道SAR二维频谱

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A Two-dimensional Spectrum for MEO SAR Based on High-order Modified Hyperbolic Range Equation

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摘要 中轨道合成孔径雷达(MEO SAR)轨道高度高，合成孔径时间长，直线运动轨迹模型下的双曲线距离方程不再适用。针对这一问题，该文提出了一种适用于MEO SAR的高阶修正双曲线距离方程，该距离方程通过引入一线性项和一四次项对双曲线距离方程进行修正，使得其能对MEO SAR真实斜距历程进行四阶精确逼近。在此基础上，采用驻相点近似的方法推导该距离方程下2维频谱的闭合解析解，并结合级数反演法对频谱精度进行分析，发现采用驻相点近似方法得到的频谱精度严格精确到四次相位项，能满足MEO SAR精确成像的要求，为了便于成像算法的设计，该文对2维频谱各部分的空变性进行了分析。最后，仿真结果表明：该文距离方程和频谱精度较高，能实现MEO SAR全孔径精确成像。

关键词： 合成孔径雷达 中轨道 距离方程 级数反演 2维频谱

Abstract： Because of the long integration time of Medium Earth Orbit SAR (MEO SAR), the hyperbolic range equation based on linear trajectory module is not suit for MEO SAR. Considering this issue, a high-order modified hyperbolic range equation is proposed. Incorporating with an additional linear component and quartic component, quartic Taylor series expansion of it has exactly the same value as which of the actual range history of MEO SAR. Then, the two-dimensional spectrum based on high-order modified hyperbolic range is analytically derived by using an approximate azimuth stationary point, based on method of series reversion the accuracy of the two-dimensional spectrum is analyzed which is exactly equal to quartic phase term. Simulation results show that the proposed range equation and the two-dimensional spectrum are accurate which can give fine resolution imagery with the entire aperture.

Keywords： SAR Medium Earth Orbit (MEO) Range equation Series reversion Two-dimensional spectrum

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