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双基角时变下的空间目标BISAR自聚焦算法

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BISAR Autofocusing Algorithm of Space Targets in Presence of Bistatic Angle Changes

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摘要 以空间目标为研究对象,针对双基地逆合成孔径雷达(BISAR)成像中双基角变化及同步误差导致的二维ISAR像散焦问题,提出了基于粒子群优化(PSO)的非参数自聚焦算法。算法首先将回波中平动和转动及同步误差等因素导致的相位变化统一建模,其次将二维图像对比度最大作为优化目标,利用PSO算法对所有高次项相位进行整体优化估计,然后对高阶相位项进行补偿,最后基于补偿后剩余的一阶线性相位项进行方位压缩得到目标的二维ISAR像。算法可解决参数相位误差估计法中因模型误差导致的聚焦精度下降问题,同时也降低了BISAR自聚焦算法的复杂度。通过与参数法自聚焦算法的性能进行对比仿真实验,验证了算法的有效性。

关键词： 空间目标 双基地逆合成孔径雷达 自聚焦 粒子群优化 对比度最大

Abstract： To absolve the defocusing problem caused by bistatic angle change and synchronization error in bistatic inverse synthetic aperture radar (BISAR) for space targets, a non-parameter autofocusing algorithm based on particle swarm optimization (PSO) is put forward. Phase variation caused by translational motion, rotation and various other factors is modeled as a whole, and based on the optimization aim of maximizing the image contrast, all the second and higher order phase items are estimated using the PSO. Then, image autofocusing is completed using the estimated phase error. Finally, the first order phase item which is left over after phase compensation is used for ISAR imaging. Defocusing caused by model error in the parameter autofocusing algorithm is solved and the complexity of BISAR autofocusing is decreased. The validity of this algorithm is proved by a comparison with the parameter autofocusing algorithm through simulation experiment.

Keywords： space target bistatic inverse synthetic aperture radar autofocusing particle swarm optimization contrast maximization

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