

防御电子技术

基于MMSE估计的全极化雷达自适应脉冲压缩

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摘要:

针对同时极化测量体制雷达发射波形自相关和互相关特性相互制约的矛盾, 提出了一种基于最小均方误差估计的全极化雷达自适应脉冲压缩方法, 其核心思想是通过初始化滤波器得到各距离单元散射系数的先验信息, 并结合对应极化通道的回波信号, 根据贝叶斯原理估计得到每个距离单元的自适应滤波器, 在分离各极化通道回波信号的同时实现脉冲压缩。通过设置典型的仿真场景, 从检测概率和目标极化散射矩阵估计的均方误差两个方面分析了自适应脉冲压缩算法的性能。仿真结果表明, 该算法能有效地抑制邻近距离单元的干扰和不同极化通道之间的互扰, 比标准匹配滤波器更好地实现全极化雷达脉冲压缩。

关键词: 自适应脉冲压缩 同时极化测量 最小均方误差估计 极化散射矩阵

Adaptive pulse compression for fully polarimetric radar based on MMSE estimation

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Abstract:

An adaptive pulse compression method based on minimal mean square error (MMSE) estimation is presented to eliminate the conflict between the auto-correlation and cross-correlation of waveforms for fully polarimetric radars. The core concept of this method is to estimate the adaptive filter for a given range cell in a Bayesian sense through combining the echoes of corresponding polarization channel and employing the initial filter estimates of the surrounding range cells as a priori knowledge. This method can jointly separate received return signals from other polarization channels and implements pulse compression concurrently. The performances of this proposed method, including the mean-square error of the polarization scattering matrix and the detection probability, are analyzed over several stressing simulation scenarios. Simulation results show that the proposed method can effectively eliminate the interferences from adjacent range cells and different polarization channels, and is superior to standard matched filter for the pulse compression of fully polarimetric radars.

Keywords: adaptive pulse compression instantaneous polarization measurement minimal mean square error (MMSE) estimation polarization scattering matrix

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