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论文与技术报告

# 宽带雷达中频回波长脉冲压缩采样重构中的分段重叠处理及其机理分析

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摘要：

宽带雷达中频回波在频域上稀疏。根据压缩感知理论，可对其进行压缩采样并从压缩采样结果中以很高的概率重构出原信号。中频回波压缩采样的重构需要的矩阵尺寸由中频回波的长度决定。在长脉冲情况下，重构所需的矩阵尺寸大，占用内存资源过多，处理速度慢。针对此问题，论文将分段重叠处理引入重构过程。论文首先详细给出了引入分段重叠处理之后的重构方法，接着通过严格数学推导，证明了频谱泄漏与局部时域序列的关系具有如下特点：远离谱峰的谱值受时域序列两端的影响要强于靠近谱峰的谱值，利用该特点说明了分段重叠处理抑制误差的机理。实测数据实验表明了分段重叠处理在重构质量上优于分段不重叠处理，在对存储资源的要求上远低于不分段处理。

关键词： 宽带雷达； 中频回波； 压缩采样； 重构； 分段重叠

# Stagewise Overlap Processing and Mechanism Analysis in Reconstruction for Compressive Sampling of Intermediate Frequency Echo with Long Duration in Broadband RadarFrequency Echo with Long Duration in Broadband Radar

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Abstract:

Intermediate frequency (IF) echo of broadband radar is sparse in frequency domain. According to compressed sensing theory, compressive sampling can be applied to the IF echo and original signal can be reconstructed from compressive sample with high probability. In the reconstruction of compressive sample for IF echo, the dimensions of the needed matrix are determined by the length of the echo. In case the IF echo is with long duration, the dimensions of the matrix are large, much more memory resources are occupied and the processing speed is slow. In order to solve this problem, stagewise overlap processing is introduced into the reconstruction. Firstly, reconstruction method with stagewise overlap processing is described detailedly,. Then through strictly mathematical deduction, it is proved that the connection between spectrum leakage and local time domain sequence is with a characteristic. The characteristic is that the influence by the two ends of time sequence on the value of spectrum which is close to the spectrum peak is larger than it on the value of spectrum which is away from the spectrum peak. Utilzing the characteristic, the mechanism of restraining error for stagewise overlap processing is illustrated. Experiment with real data indicates that the stagewise overlap processing has better reconstruction quality than reconstruction method with stagewise but no overlap and the stagewise overlap processing need less memory resources than holistic reconstruction method which deals with the pulse as a whole.

Keywords: Broadband Radar Intermediate Frequency Echo Compressive Sampling Reconstruction Stagewise Overlap

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