

短文与研究通讯

空间谱估计中非同步采样误差补偿方法研究

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摘要:

高分辨空间谱估计算法要求对多路信号进行同步采样, 非同步采样会导致空间谱估计的偏差。本文提出了一种对非同步采样进行补偿的方法——前后向对称采样法。该方法设置阵元采集顺序为非顺序采样, 利用前、后向对称采样数据之和计算空间谱。当交替采样延时精确的时候, 由于对称性, 相加后信号的阵列误差矩阵是一个实数矩阵, 对方向向量的相位没有影响, 因此可以得到方位角的无偏估计。理论分析与仿真结果表明: 当交替采样延时精确时, 该方法可以消除非同步采样对空间谱的影响, 与重新建模法补偿性能相近; 当交替采样延时不精确时, 该方法比重新建模法的补偿效果好, 而且前后向对称采样法算法简单, 且无需已知交替采样延迟时间。因此, 前后向对称采样法是对空间谱估计中非同步采样误差的一种有效补偿方法。

关键词: 空间谱; 非同步采样; 前后向对称采样; 补偿

A forward and back symmetrical sampling method to compensate asynchronous sampling error

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Abstract:

High-resolution spatial spectrum estimation algorithm required that multi-channel signals were sampled synchronously. If multi-channel signals were sampled asynchronously, non-synchronous sampling error would introduce deviation of spatial spectrum estimation. In order to compensate the non-synchronous sampling error, this paper proposed a new compensation method——forward and back symmetrical sampling method. This method used the reconstructed array signals which were added data of forward and back sampled data to compute the spatial spectrum. When the alternate sampling delay was accurate, because of symmetry, the added array error matrix was a real matrix which had no influence on the phase of the direction vector. In consequence, unbiased estimation of spatial spectrum can be realized. Theoretical analyses and simulation results showed that this method can eliminate the influence of non-synchronous sampling error when the alternate sampling delay was accurate, and its performance was similar to the remodeling method; When the alternate sampling delay was not accurate, its performance was better than the remodeling method. The new method has the advantages of lower complexity and it is not necessary to know sampling delay time. Therefore, the forward and back symmetrical sampling method is an effective compensation method for non-synchronous sampling error of spatial spectrum estimation.

Keywords: spatial spectrum asynchronous sampling forward and back symmetrical sampling compensation

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