算法研究

# UWB密集多径下基于检测概率差值最大的TOA估计方法

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摘要：

密集多径信道下，较为实际的超宽带测距系统一般采用基于TOA信息的能量检测器（energy detector, ED）接收机。TOA的估计精度决定着测距精度。在ED中多采用阈值比较的方法来估计TOA，阈值的设计对TOA估计的精度有着非常重要的影响。本文将最大概率检测（maximum probability of detection, MPD）算法应用于基于ED的TOA估计器中，并对样本检测概率计算方法进行改进，在搜索阈值的基础上计算出每次正确检测到直达路径（direct path, DP）的概率，提出一种阈值确定和DP检测新准则，即把相邻两个DP检测概率差值最大时对应的路径作为DP，则该次搜索所对应的阈值即为最佳阈值。文中给出了这种准则的理论分析及TOA估计算法流程。最后通过仿真比较考察了不同信噪比下不同TOA估计方法的估计误差。仿真结果表明了该算法相比于传统的TOA估计方法具有更高的精度，论证了该算法的有效性。

关键词： 超宽带；密集多径；阈值；检测概率差值最大

# A Novel Probability-of-Detection-Difference Maximum-Based TOA Estimation Method in UWB Dense Multipath Channels

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Abstract:

Under dense multipath channels, a practical UWB ranging system usually adopts TOA-based energy detection receiver. The accuracy of TOA estimation determines the accuracy of ranging. Threshold comparison is used a lot in ED and the designing of threshold affects the accuracy of TOA estimation greatly. In this paper, we apply the maximum probability of detection method to the energy-based TOA estimators. By improving the method of calculating the probability of detection, a new criteria to determine the threshold value and detect the DP is proposed. The algorithm calculates the probability of detection of DP during searching the optimal threshold. The DP is determined when the difference of the DP detection probability reaches maximum. And then the optimal threshold is also acquired. The paper analyzes theoretically and presents the novel procedure of the proposed TOA estimation method. In the Simulation, we compare our method with other methods. Simulation results show that our method outperforms others and verify the effectiveness of our method.

Keywords: Ultra Wide Band   dense multipath channels   threshold   Maximum probability-of-detection-difference

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