

论文

## 基于正交训练序列的MIMO系统联合最大似然时频同步和信道估计

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摘要

该文推导了多输入多输出(MIMO)系统中的符号定时、频偏和信道参数的联合最大似然(ML)估计。针对联合ML估计没有闭合的表达式、数值计算复杂度高的问题,该文提出了一种基于重复结构的正交训练序列的简化估计算法。该估计算法形式简单、复杂度低,且仍为最大似然估计。最后仿真分析了最大似然参数估计的均方误差与接收信噪比和天线数目的关系,并与Cramer-Rao界作了比较,表明了该算法的有效性。

关键词 [MIMO系统](#) [联合ML估计](#) [定时同步](#) [载波频偏估计](#) [信道估计](#)

分类号 [TN92](#)

### Joint ML Time-Frequency Synchronization and Channel Estimation for MIMO Systems Using Orthogonal Training Sequences

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Abstract

This paper addresses the issue of joint Maximum-Likelihood (ML) time-frequency synchronization and channel estimation for Multiple-Input Multiple-Output (MIMO) systems. The resulting joint ML estimation requires solving a maximization problem with no closed-form solution. Since numerical calculation of the estimation is computationally hard, a computationally efficient closed-form ML solution is proposed using two repetitions of orthogonal training sequences. With theoretical analysis and simulations, the mean-square errors of the ML estimates versus the average SNR and the number of antennas are investigated, and then the performance of the proposed estimator is compared with the Cramer-Rao Bound (CRB). The results prove the effectiveness of proposed estimator.

Key words [MIMO systems](#) [Joint ML estimation](#) [Time synchronization](#) [Carrier Frequency Offset \(CFO\) estimation](#) [Channel estimation](#)

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