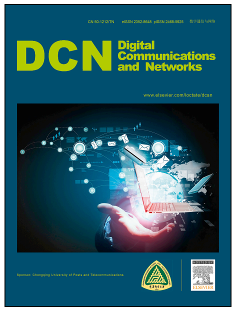
Accepted Manuscript



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PII: S2352-8648(16)30161-4

DOI: 10.1016/j.dcan.2017.07.006

Reference: DCAN 92

To appear in: *Digital Communications and Networks*

Received Date: 1 January 2017

Revised Date: 14 April 2017

Accepted Date: 11 July 2017

Channel Estimation and Channel Tracking for Massive MIMO System in Correlated Block Fading Channel

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Abstract

This paper presents a method of channel estimation and tracking for massive MIMO wireless cellular system in a correlated block-fading channel. In order to conserve resources, the proposed algorithm requires the uplink pilot only once at the start of communication. By utilizing the temporal correlation between consecutive resource blocks (RBs) and the error correction capability of turbo codes, the channel matrix in subsequent RBs is estimated at the base station (BS) itself using uplink data of current RB and the estimated channel matrix of previous RB. The proposed method is applicable to more general settings in terms of the number of BS antennas, users, and coherent channel usage compared to existing blind estimation methods. Simulation results show that the proposed algorithm gives better performance for a moderate RB size, a high order of QAM scheme, and a smaller ratio of the number of BS antennas and mobile terminals. For a reasonably larger number of active users compared to existing results, the proposed scheme displays a lower symbol error probability than the conventional pilot-based estimation approach.

KEYWORDS:

Massive MIMO, Channel Estimation, Resource Block, Turbo coding, Mobile terminal.

1. Introduction

Massive multiple input multiple output (massive MIMO) is a promising candidate for 5th generation wireless mobile communication systems [1, 2, 3]. Challenges like constraint on antenna spacing, channel estimation, and limited coherence block-size still need a better resolution before this technology comes into deploy-able form. massive MIMO systems in literature, are considered to be used with linear processors such as match filtering (MF) and zero forcing (ZF) for decoding and precoding the multiple data streams for different users. Instantaneous channel state information (ICSI) is the prime requirement for aforementioned linear processors. Moreover, the accuracy of ICSI is a key factor for performance in high SNR or high spectral efficiency regime [4]. However, the ICSI changes with time and frequency thus, the communication takes place in blocks of a finite duration and frequency band in which the ICSI is almost constant. These blocks are termed as resource blocks (RBs). Along with transmission of data, the ICSI has to be estimated in each RB. To bring the ICSI overheads within feasible limits, the proposed massive MIMO cellular system in literature works in time division duplex (TDD) mode. The conventionally proposed system uses pilot based estimation (PBE) to estimate ICSI where it is estimated by base station (BS) using the pilot signal transmitted from mobile terminals (MTs). The estimated ICSI is then used for decoding the uplink data and precoding the downlink data [3, 5].

Albeit being feasible, the pilot-based estimation (PBE) has a severe impact on system performance due to following factors: [6] First, a fraction of RB is consumed by pilot train which significantly lowers the spectral efficiency in the scenarios of smaller coherence time. Second, the pilots need to be reused across the cells during training phase which creates an interference called pilot contamination. The research on pilot-free massive MIMO system is already in progress. A subspace projection-based blind pilot decontamination approach reported by Muller et al. [7] utilizes the bulk decomposition of singular values of channel matrix under certain conditions on the system parameters. However, the