Compressed channel estimation for massive MIMO-OFDM systems over doubly selective channels

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PHYSICAL COMMUNICATION
Volume: 36
Article Number: UNSP 100771
DOI: 10.1016/j.phycom.2019.100771
Published: OCT 2019
Document Type: Article
View Journal Impact

Abstract

Doubly selective (DS) channel estimation for the downlink massive multiple-input-multiple-output orthogonal frequency division multiplexing (MIMO-OFDM) systems is a challenging problem, due to the requirements on high pilots overhead and prohibitive complexity. In this paper, by exploiting the highly correlated spatial structure of the obtained array response vectors and sparsity of the multipath signal components of the massive MIMO-OFDM channels, a modified spatial basis expansion model (modified-SBEM) is introduced. Thus, using complex exponential (CE-) modified-SBEM (i.e., modified CE-SBEM) can improve the resolution of the angles of departures (AoDs) information to represent the downlink with far fewer parameter dimensions, since the AoDs are much slower than path gains. Subsequently, we jointly design the effective pilot power and pilot placement for sparse channel estimation by means of an extended model. Our design is based on the block-coherence and sub-coherence simultaneous minimization of the measurement matrix associated with the massive MIMO-OFDM system pilot subcarriers. Furthermore, we leverage the sparse nature of the massive MIMO-OFDM system to formulate the quantized AoDs estimation into a block-sparse signal recovery problem, where the measurement matrix is designed based on the estimated virtual AoD. Thus, a new algorithm namely, generalized quasi-block simultaneous orthogonal matching pursuit (gQBSO), is introduced to solve the problem by providing sparse signal reconstruction solution. Simulation results demonstrate that the proposed scheme can effectively estimate the DS channel for massive MIMOOFDM systems compared with other existing algorithms. For example, at SNR = 20 dB for K = 4 users, Doppler shift = 0.093 with N-T = 32 antenna size, the adaptive-QBSO algorithm with G-SBEM and the proposed gQBSO with modified-SBEM can realize approximately 75.44% and 85.14% of the NMSE achieved by the oracle estimator with modified-SBEM.

Keywords

Author Keywords: Spatial basis expansion model (SBEM); Communication channels; Compressed sensing (CS); Channel estimation; Doubly selective (DS) channel; Sparse matrices; OFDM; Massive MIMO; Pilot design
KeyWords Plus: SYMBOL DESIGN; TRANSMISSIONS; EQUALIZATION; CAPACITY

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Funding

Funding Agency (Show details)	Grant Number
School of Electrical and Electronic Engineering, Universiti Sains Malaysia, Malaysia	
Ministry of Education, Malaysia	FRGS 203/PELECT/6071373

View funding text

Publisher

ELSEVIER, RADARWEG 29, 1043 NX AMSTERDAM, NETHERLANDS

Journal Information

Impact Factor: Journal Citation Reports

Categories / Classification

Research Areas: Engineering; Telecommunications
Web of Science Categories: Engineering, Electrical & Electronic; Telecommunications

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