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Guest editorial: special issue on high mobility wirelesscommunications

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Abstract

The high-speed railway and high-way networks are now expanding at a phenomenal speed in China and in many other parts of the world. The related broadband wireless communication over high-speed trains and highway vehicles is a very challenging task due to hostile transmission channel conditions. The demand for such services is growing rapidly, following the proliferation of laptop/tablet computers and smart phones. This motivates the research on wireless communications in the high mobility environments.

This special issue aims at putting together the new achievements and developments in this field. There are 11 papers in this special issue, which have been organized into three thematic groups. The first group of4 papers deals with the rapidly time-varying channelmeasurement, modeling and estimation. The second group of 3 papers addresses the Doppler effects andsignal detection. The last group of 4 papers contributesto the relays, networking coding, and the fast handover schemes for high mobility scenarios.

Key words: high mobility; wireless communications; high speed trains (HSTs)

Among the four papers dealing with rapidly time- varying channel modeling and estimation, two papers are concerned with channel measurement and modeling, namely, “High-speed railway channel measurements and characterizations: a review” (Tao ZHOU, et al.), and“Propagation characteristics of the wideband high-speed railway channel in viaduct scenario at 2.35 GHz” (Yunling GUO, et al.). The former provides an overview

of the recent channel measurement campaigns in high- speed railways (HSRs), along with some specificmeasurement and modeling results. The later presents a channel measurement and modeling in a railway viaductscenario between Zhengzhou and Xi’an, a passenger dedicated line, with a bandwidth of 50 MHz at 2.35 GHz. The third paper, “Antenna calibration using channel prediction for time-varying channels” (Yamin SONG, et al.), proposes an antenna calibration method for rapidly time-varying channels. It is shown that the proposed method can well compensate the performance loss and significantly improve the antenna calibration performance for time-varying channels. The fourth paper, “Modified clustered comb pilot-aided fast time- varying channel estimation for OFDM system” (Xin LI, et al.), proposes a modified clustered comb pilot-aided structure with improved channel estimation performance,where the time varying channel is approximated by a basis expansion model (BEM). Based on complex- exponential BEM (CE-BEM) model, a suboptimal-pilot structure is also proposed.

Concerning the three papers related to the topic of Doppler effects and signal detection, the first paper, “Doppler frequency offsets estimation and diversity reception scheme of high-speed railway with multiple antennas on separated carriage” (Yaoqing YANG, et al.),presents a joint Doppler frequency offset (DFO) estimation and channel estimation algorithm, together with a theoretical Crammer Rao bound (CRB), based on Ricean channel model, to exploit the cooperative multi- antenna diversity gains. In the paper “Signal detection through circular convolution reconstruction for OFDM system in fast varying channel” (Hai ZUO, et al.), a signal detection algorithm is devised for the orthogonal

frequency division multiplexing (OFDM) system in the presence of fast time-varying channel which is represented by a piece-wise linear variant model with normalized Doppler frequency of less than 0.2. It is shown that the proposed method can not only track the channel variation, but also promise better performance gain in the OFDM symbol detection. The final paper of this group, “Achievable secrecy rate of bit-interleaved coded modulation schemes” (Weichen XIANG, et al.), studies the impact of various modulation mapping strategies and signal constellation shapes on the secrecy rates achievable with bit-interleaved coded modulation (BICM) schemes. It is concluded that proper design of signal mapping can significantly enhance the achievablesecrecy rate in BICM schemes.

The four remaining papers deal with topics related to the relays, networking coding, and the fast handoverschemes for high mobility wireless communications. The paper “asymptotic analysis of multi-branch amplify-and-forward two-way relaying in Nakagami-*m* fading with arbitrary fading parameter” (Jing YANG, et al.) investigates the asymptotic performance for multi- branch dual-hop two-way amplify-and-forward (AF) relaying networks in independently but not necessarily identically distributed Nakagami-*m* fading channels witharbitrary parameter $m \geq 0.5$. Utilizing the obtained result, asymptotic outage probability expression is derived, from which the diversity order and coding gain are analyzed. By considering jointly the wireless relay and network coding, the paper “Optimal power allocation for complex field network coding scheme with the *K*-th best relay selection” (Xi CAI, et al.) proposes a complex field network coding (CFNC) scheme and an optimal power allocation algorithm,

where the *K*-th best relay is selected to forward the multiplexed signal to the destination. The subsequent paper “Network coding with diversity and outdated channel state information” (Tong CHEN, et al.) applies network coding with diversity (NCD) and outdated channel state information (CSI) to achieve a form of selection diversity, and extend NCD to cooperative multiple access channels. To handle the serious high mobility management problem, the last paper, “Position- assisted fast handover schemes for LTE-advanced network under high mobility scenarios” (Ming FEI, et al.), proposes two position-assisted fast handover schemes (*A* and *B*) for LTE-A system under very high mobility scenarios. System level simulation shows that, Scheme *A* could reduce inter-site handover delay byabout 50 ms, while Scheme *B* could cut down nearly 50% of all handovers when the time to trigger (TTT) is0 ms. Besides, as TTT gets larger, Scheme B has much better success rate.

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