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Cooperative Interference Prediction for Enhanced Link Adaptation in the 3GPP LTE Uplink

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Abstract:

The interference situation in the uplink of cellular networks, such as the 3GPP UTRAN Long Term Evolution (LTE), is usually highly volatile since from one transmission time interval to the other different users might be scheduled in nearby cells, thus often causing completely different levels of interference. This unstable behavior of the interference generally has a negative impact on the performance of fast link adaptation schemes since there is always an inherent delay between the time when the link adaptation is performed and the actual data transmission. In order to partially mitigate this problem, we propose in this paper a novel approach for predicting the interference situation during the actual data transmission already in advance, so that the link adaptation process can be considerably improved. This is accomplished by exchanging scheduling information between a set of cooperating base stations combined with multi-cell channel estimation. The performance of the proposed scheme is evaluated by means of extensive system-level simulations and we show that significant performance gains may be realized this way.

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I. Introduction

The 3GPP UTRAN Long Term Evolution (LTE) represents the next major generation of cellular networks, offering peak data rates exceeding 300 Mbps in the downlink and 75 Mbps in the uplink combined with a very short radio access network round-trip time of less than 10 ms [1]-[3]. Key technologies that have been introduced into the standard for accomplishing this unprecedented performance include orthogonal frequency division multiple access (OFDMA) in the downlink and single-carrier frequency division multiple access (SC-FDMA) in the uplink, various open- and closed-loop multiple-input multiple-output transmission schemes, frequency-selective scheduling as well as adaptive modulation and coding based on a very short transmission time interval (TTI) of only 1 ms [1]-[5].

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