AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
Electronics Engineering and Electrical Communications

Joint Channel and Phase Noise Estimation in OFDM Systems

A Thesis submitted in partial fulfillment of the requirements of
Master of Science in Electrical Engineering
(Electronics Engineering and Electrical Communications)

by

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Bachelor of Science in Electrical Engineering
(Electronics Engineering and Electrical Communications)
Faculty of Engineering, Ain Shams University, 2011

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Cairo, 2017

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Statement

This thesis is submitted as a partial fulfillment of Master of Science in Electrical Engineering, Faculty of Engineering, Ain shams University. The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

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Thesis Summary

Orthogonal Frequency Division Multiplexing (OFDM) systems are highly used in modern standards such as LTE, WiMax and DVB because of their practical and simple hardware implementation as well as their robustness against frequency selective channels and inter-symbol interference(ISI).

However, OFDM systems are very sensitive to phase noise and doubly-selective channels that cause inter-carrier interference (ICI) to the received signal. The resulting ICI can cause severe performance degradation for OFDM systems.

This thesis is concerned with the mitigation of both doubly selective channels and phase noise effects in OFDM systems. The effects of both doubly selective channels and phase noise in OFDM systems are studied and an algorithm is proposed to mitigate both effects by applying an iterative decision-directed feedback method where the most significant ICI components are estimated. Moreover, the error propagation that occurs from one iteration to the next is reduced by using the estimated doubly selective channels and by reducing the residual phase noise.

The thesis starts with an overview on the OFDM technique where an introduction to its main idea is provided as well as its main advantages and disadvantages.

Then, a detailed study is provided for the effects of both phase noise and doubly selective channels as well as a literature review for the recent proposed algorithms for mitigating them.

Finally, an algorithm is proposed to mitigate these effects and simulation results are presented to show the performance versus the perfect decision directed feedback case for different system and design parameters. The simulation results have shown that the proposed algorithm achieves a significant performance close to the perfect decision directed feedback case for different practical standards channel models as well as different modulation orders.

Key words: Doubly selective channels, Inter-Carrier Interference (ICI), Orthogonal Frequency Division Multiplexing (OFDM), phase noise, iterative decision-directed feedback.

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