بسم الله الرحمن الرحيم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

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MONA MAGHRABY

AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

Electronics Engineering and Electrical Communications

Cognitive Radio Enhancement using Massive MIMO System

A Thesis submitted in partial fulfillment of the requirements of the degree of

Master of Science in Electrical Engineering

(Electronics Engineering and Electrical Communications)

By

Moustafa Mohamed Moustafa ElSayed

Bachelor of Science in Electrical Engineering

(Electronics Engineering and Electrical Communications)

Faculty of Engineering, Ain Shams University, 2014

Supervised by

Prof. Dr. Salwa Hussein El-Ramly

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Cairo – (2020)

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STATEMENT

This thesis is submitted as a partial fulfilment 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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Date: May 9, 2020

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THESIS SUMMARY

It became obvious that the current available technologies and techniques used in different communication systems would not be sufficient to withstand the huge expansion of the needed data rates in the next few years. This increased the need to devise new technologies that can increase the data rates while using the same available resources.

Two of the most promising technologies are Cognitive Radio (CR) systems & Massive MIMO (Multiple-Input-Multiple-Output). The former one solves the scarcity in the available spectrum by sharing it among different users and making use of the unused spectrum to increases the utilization of the available spectrum. The latter one provides great opportunities in the area of increasing the available date rates and decreasing interference between the users by using precoding.

The current researches have presented the idea of integrating different state-of-the-art technologies to improve the system performance.

This thesis studies the enhancement that could be achieved by using massive MIMO in CR systems. Two different precoder designs for massive MIMO systems are proposed to be used in both the Underlay and Overlay CR scenarios. The proposed designs are used with low computational time algorithms to maximize the sum rate achieved by the system while decreasing the computational complexity of the system. The performance of the proposed precoders is studied using both uncorrelated and correlated channel models.

Keywords: massive MIMO, underlay cognitive radio, antenna selection, overlay cognitive radio, precoding.

Dedicated to my family