



شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم



MONA MAGHRABY



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التوثيق الإلكتروني والميكروفيلم



شبكة المعلومات الجامعية التوثيق الإلكتروني والميكروفيلم



MONA MAGHRABY



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التوثيق الإلكتروني والميكروفيلم

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

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MONA MAGHRABY



Ain Shams University
Faculty of Engineering
Electronics and Communications Engineering Department

Advanced Aeronautical Communication for Air Traffic Management

A Thesis

Submitted in partial fulfillment for the requirements for the degree of Doctor of
Philosophy in Communications Engineering
(Electronics and Communications Engineering)

By

Emad Abd-Elaty Mohamed Korim

B.Sc. in Electrical Engineering, Communication and Computer Engineering
Dept., Higher Institute of Engineering at Elshorouk, El-Shorouk Academy,
2006

M.Sc. in Electrical Engineering, Electronics and Communications Engineering
Dept. Minoufiya University, 2014

Supervised by

Prof. Abdelhalim Abdelnaby Zekry

Electronics and Communications Engineering Dept., Faculty of Engineering
Ain Shams University

Prof. Salah Sayed Ibrahim Elagooz

Head of Communication and Computer Engineering Dept., Higher Institute of
Engineering at Elshorouk, El-Shorouk Academy

Cairo 2020



Ain Shams University
Faculty of Engineering
Electronics and Communications Engineering Department

“Advanced Aeronautical Communication for Air Traffic Management”

Name: Emad Abd-Elaty Mohamed Korim

Degree: Doctor of Philosophy in Communications Engineering

Judgment Committee

Name and Affiliation

Signature

Prof. Ahmed E. El-Mahdy

Dean of the Faculty of Information Engineering and
Technology - German University – Cairo.

.....

Prof. Ismail Mohamed Hafez

Electronics and Communications Engineering Dept.
Faculty of Engineering - Ain Shams University.

.....

Prof. Abdelhalim Abdelnaby Zekry

Electronics and Communications Engineering Dept.
Faculty of Engineering - Ain Shams University.

.....

Prof. Salah Sayed Ibrahim Elagooz

Head of Communication and Computer Engineering
Dept., Higher Institute of Engineering at Elshorouk,
El-Shorouk Academy

.....

Date: / /



Ain Shams University
Faculty of Engineering
Electronics and Communications Engineering Department

Statement

This dissertation is submitted as a partial fulfillment of the degree of Doctor of Philosophy in Electrical Engineering (Electronics and Communications 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.

Name : Emad Abd-Elaty Mohamed Korim

Signature :

Date : / /



Ain Shams University
Faculty of Engineering
Electronics and Communications Engineering Department

Curriculum Vitae

Name of the researcher: Emad Abd-Elaty Mohamed Korim

Date of Birth: 25 – 9 – 1984

Place of Birth: Qena

Nationality: Egyptian

Education: B.Sc. in Electronics and Communication Engineering,
Higher Institute of Engineering at Elshorouk, EL
Shorouk Academy-2006

M.Sc. in Electrical Engineering, Electronics and
Communications Engineering Dept. Minoufiya
University, 2014

Experience: Instructor at Communication and Computer
Engineering Dept., Higher Institute of Engineering, EL
Shorouk Academy from 2006 until 2014

Teaching Assistant at Communication and Computer
Engineering Dept., Higher Institute of Engineering, EL
Shorouk Academy from 2014 until 2020

Signature:

Date ... /... /...

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List of Publications

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3. **E. Abd-Elaty**, A. Zekry, S. El-Agooz and A. M. Helaly, "Nested Code Division Multiple Access for DME Interference Mitigation in LDACSI Aeronautical Communication System", International Journal of Communication Systems, Wiley. (Under Review).
4. **E. Abd-Elaty**, A. Zekry, S. El-Agooz and A. M. Helaly, "Underlay Spectrum Sharing for LDACSI Aeronautical Communication System", Wireless Personal Communications, Springer. (Under Review)

Abstract

Air to ground communications have been transferred from the congested very high frequency band to occupy the guard bands between adjacent distance measurement equipment (DME) navigation channels within the L-Band. However, the inlayed channels, called L-Band digital aeronautical communications channels (LDACS), experience severe interference with the coexisting DME channels. In this thesis, a DME interference detection and mitigation technique is proposed to improve the performance of the L-Band digital aeronautical communications system in the presence of DME interference. The proposed detection technique is performed by using an adaptive threshold to achieve the best trade-off between the signal detection and false alarm. The proposed interference mitigation technique relies on a code division multiple access. In this thesis, the closed form expression for the probability of detection, false alarm, and the detection error rate are derived. The results show that the proposed technique provides improvement in the probability of detection and the detection error rate compared to the previous work. Moreover, the results shows that the proposed technique provides lower bit error rate and less complexity compared to the previous work.

The previous work depends on both DME interference detection and mitigation techniques. In this thesis, a DME interference

mitigation technique is proposed to improve the performance of the LDACS without requiring the detection process. The proposed technique depends on the underlay spectrum sharing for LDACS signal. The underlay concept is performed using spread spectrum technique. The spread LDACS signal is friendly coexist on the top of DME interference signal. Moreover, the results shows that the proposed underlay spectrum sharing technique provides lower bit error rate and less complexity compared to the previous work.

This thesis is also provided cognitive radio network (CRN) to conquer the interference between the DME signal and the onboard LDACS receiver. In the LDACS-CRN, an adaptive threshold spectrum sensing DME energy detector is proposed to provide the best trade-off between miss detection and false alarm. The joint effect of hybrid spectrum sharing with frame structures is proposed to provides higher ergodic throughput than the interweave spectrum sharing for all frame structures. Joint effect of hybrid spectrum sharing with parallel/modified frame structures is proposed to provide a trade-off between high LDACS throughput and low data loss. Besides, ergodic throughput maximization using genetic algorithm for hybrid spectrum sharing with different frame structures is proposed. Besides, ergodic throughput maximization for hybrid spectrum sharing under constraints of the average LDACS transmitted power and tolerable interference power on the DME signal is performed. Moreover, results show that the proposed LDACS-Type I (LDACSI)-CR system performance provides lower bit error rate and less complexity compared to the previous work.

Table of Contents

Acknowledgements	v
List of Publications	vi
Abstract	vii
Table of Contents	ix
List of Abbreviations	xiii
List of Figures	xix
List of Tables	xxv
List of Symbols	xxvi

Chapter 1 Introduction and Literature Review

1.1 Introduction	1
1.2 Problem Statement	3
1.3 Literature review.....	5
1.4 Thesis Contributions.....	10
1.5 Thesis Organization.....	11

Chapter 2 Radio Navigation and Communication Systems

2.1 Introduction.....	13
2.2 Automatic Direction Finder (ADF).....	15
2.2.1 ADF principle of Operation	15
2.2.2 ADF Aircraft Equipment	17
2.3 VHF Omni-directional Range (VOR).....	20
2.3.1 VOR principle of operation	22
2.3.2 VOR Aircraft Equipment	24

2.4 Instrument Landing System (ILS)	26
2.4.1 ILS principle of operation	26
2.4.2 ILS Ground Station	26
2.4.3 ILS Aircraft Equipment	30
2.5 Distance Measuring Equipment (DME).....	31
2.5.1 DME principle of operation	31
2.5.2 DME Frequency Usage and Channelization.....	31
2.5.3 DME Modes of Operation.....	36
2.5.4 DME Ground Equipment.....	37
2.5.5 DME Aircraft Equipment.....	40
2.6 VHF Aeronautical communication.....	42
2.7 L-band Digital Aeronautical Communication System (LDACS)...	43
2.7.1 LDACSI Forward Link Transceiver.....	46
2.7.2 LDACSI Reverse Link Transceiver	50
2.7.3 LDACSI Frame Structure	51

Chapter 3 Proposed Spread Spectrum DME Interference Mitigation in LDACSI

3.1 Introduction.....	54
3.2 Proposed LDACSI Wavelet-Based for DME Interference Mitigation.....	56
3.2.1 Overview.....	56
3.2.2 Proposed LDACSI System Model.....	58
3.2.3 Simulation Results.....	60
3.3 Proposed Nested CDMA for DME Interference Mitigation in LDACSI system.....	64
3.3.1 Overview.....	64
3.3.2 DME Scenario and Interference Problem.....	67

3.3.3	Proposed LDACSI System Model.....	70
3.3.3.1	Proposed Nested CDMA Up-converter.....	71
3.3.3.2	Proposed DME Mitigation Technique.....	74
3.3.4	DME Detection and LDACSI Throughput.....	77
3.3.4.1	Conventional Fixed DME Energy Detector.....	77
3.3.4.2	Proposed Adaptive DME Energy Detector.....	81
3.3.4.3	LDACSI Frame Structure and Throughput.....	83
3.3.5	Complexity Analysis.....	84
3.3.6	Simulation Results.....	85
3.4	Proposed Underlay Spectrum Sharing for Aeronautical Communication.....	94
3.4.1	Overview	94
3.4.2	Proposed LDACSI underlay Spectrum Sharing System.....	95
3.4.2.1	Proposed LDACI Underlay Transmitter.....	96
3.4.2.2	Proposed LDACSI Underlay Receiver.....	98
3.4.3	Complexity Analysis.....	101
3.4.4	Simulation Results.....	102

Chapter 4 Proposed Cognitive Radio for Utilizing the Primary DME for aeronautical Communication

4.1	Introduction	108
4.2	Cognitive Radio cycle.....	113
4.2.1	Spectrum Sensing.....	114
4.2.2	Spectrum Decision.....	116
4.2.3	Spectrum Sharing.....	116
4.2.4	Spectrum Mobility.....	118
4.3	Proposed LDACSI Cognitive Radio Network.....	118
4.4	DME Spectrum sensing Model.....	121

4.4.1	Classical DME Energy Detector.....	121
4.4.2	Proposed DME Energy Detector.....	124
4.5	LDACSI-CR Frame Structure and Spectrum Sharing.....	127
4.5.1	LDACSI-CR Frame Structure.....	127
4.5.2	LDACSI-CR Spectrum Sharing.....	129
4.6	Proposed joint Hybrid spectrum sharing with Frame structures...	130
4.7	Proposed LDACSI-CR Channel Capacity.....	131
4.7.1	LDACI-CR throughput and Data Loss.....	131
4.7.1.1	Throughput-Data Loss for interweave Spectrum Sharing with Different frame Structures.....	133
4.7.1.2	Throughput and Data Loss for hybrid Spectrum Sharing with Different frame Structures.....	135
4.7.2	Proposed LDACI-CR Ergodic Throughput.....	136
4.7.2.1	System and Transmission Model.....	136
4.7.2.2	Optimization Problem Formulation.....	138
4.7.2.3	Proposed Genetic optimization Algorithm.....	140
4.8	Complexity Analysis.....	141
4.9	Simulation Results.....	143
4.9.1	Simulation Results for DME Energy Detector.....	143
4.9.2	Simulation Results for LDACSI Throughput and Data Loss.....	149
4.9.3	Simulation Results for LDACSI Ergodic Throughput.....	155
Chapter 5 Conclusions and Future Work		
5.1	Conclusions	164
5.2	Suggestion Future Work	167
References		168