بسم الله الرحمن الرحيم

MONA MAGHRABY

شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

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جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

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MONA MAGHRABY

INTERFERENCE MITIGATION AND OPTIMAL FAIR RESOURCE ALLOCATION USING ANGULAR DIVERSITY TECHNIQUES IN VLC SYSTEMS

By

Mona Elsayed Hosney Ibrahim

A Thesis Submitted to the
Faculty of Engineering at Cairo University in
Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Electronics and Communications Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Under the Supervision of

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Title of Thesis:

Interference Mitigation and optimal Fair Resource Allocation using Angular Diversity Techniques in VLC systems

Key Words:

VLC, Angular Diversity, Resource Allocation, CCI.

Summary:

The high increase of data demands requires searching for a new techniques of data transmission. Visible Light Communication (VLC) is one of the solutions that can be used in the nearest future because of its great advantages. However; it suffers from some challenges. One of these challenges is Limited LED bandwidth. This can be solved either by making frequency reuse to be one or fair resource allocation among distributed users. In this thesis, these two points have been discussed and simulated using diversity techniques i.e.; Angular Diversity Receiver (ADR), and Angular Diversity Transmitter (ADT). The first part is making frequency reuse and solve Co-channel interference (CCI) problem which acceptable Bit-error rate at different scenarios. The second part is on making resource allocation optimization using two search algorithms (exhaustive and heuristic search algorithm) that maximize the minimum Signal to Interference Noise Ratio(SINR). Both algorithms achieve superior performance. However heuristic algorithm achieves very low complexity comparing others.

Disclaimer

I hereby declare that this thesis is my original work and that no part of it has been submitted for a degree qualification at any other university or institute.
I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

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Mona Hosney

Table of Contents

List of Figures

List of Tables

NOMENCLATURE

A	Total number of distinct sets
$\mathbf{A}_{alloc}$	Allocation matrix between each LED f of ADT's j
A_d	Photo-detector effective area
a	Allocation element of the allocation matrix
$\bar{\mathbf{a}}$	Binary allocation vector
A_d	Photo-detector active area
A_l	Set of possible combinations of received LED indices
A_l*	A selected set of LEDs indices
$\mathbf{A}_{opt}$	Optimum Allocation matrix
c	Speed of light
C_l	Correlation Coefficient
D^j	Desired LED j
d_{ij}	Distance from the LED j to the PD i
d_{jk}	Distance from LED j to the center of reflecting element k
d_{ik}	Distance from center of reflecting element k to the PD i
F	Total number of LEDs per ADT
$\mathbf{H}(t)$	Channel response matrix
$h_{ij}(t)$	Sum of LOS and NLOS channel gain between LED j and PD i
h_{ij}^{los}	LOS channel response from the transmitted LED j to PD i
h_{ij}^{Nlos}	NLOS channel response from the transmitted LED j to PD i
h_{ijf}^{los}	LOS channel response from the transmitted LED f of ADT j to PD i
h_{ijf}^{Nlos}	NLOS channel response from the transmitted LED f of ADT j to PD i
I_j	Indicator o number of LOS received signals
K	Total number of reflected elements
L	Number of possible non-repeated sets
L_x, L_y, L_z	Length, width, and height of the room, respectively
m	Order of Lambertian emission
M	Total number of single PD
N	Total number of ADTs
$\mathbf{N}(t)$	AWGN matrix
$n_i(t)$	AWGN added to PD i
$\hat{n}_i$	Normal vector with the PD
N_{los}	Number of LOS signals
N_r	Total number of ADR's PDs
N_t	Total number of LEDs
$P_j(t)$	OOK pilot training modulated sequence vector
$P_q(t)$	Pilot training bit
P_s	Source optical power
P_t	Transmitted Optical Power

q	Length of pilot signal
Q	Total number of all LEDs for all ADTs
R	Photo-detector responsivity
r	ADR / ADT circle radius
$R(\phi)$	Lambertian radiant intensity
$\hat{\mathbf{S}}_l$	Estimated pilot pattern
$\hat{S}_{lmn}$	Elements of matrix $\hat{S}_l$
$\mathbf{S_i(t)}$	Received Pilot signal
SINR	Signal to interference noise ratio
S_{mn}	Elements of matrix S
T_s	Sampling period
$\mathbf{X}(t)$	Optical intensity-modulated signal matrix for all LEDs
$x_j(t)$	Optical intensity-modulated signal for LED j
X_r,y_r,z_r	Coordinates of the center of the PD body
$X^{\wedge}_{ML}$	Recovered transmitted signal
$X^{PD}_i,y^{PD}_i,z^{PD}_i$	Coordinates of ADR PDs
x_i,y_i,z_i	Coordinates of Single PD
$\mathbf{Y}(t)$	Generated photo-current for all PDs
$y_i(t)$	Generated photo-current for PD i
α_{jk}	The angle of incidence at reflecting element k with respect to LED j
α_{fjk}	The angle of incidence at reflecting element k with respect to LED f of ADT j
β_{ik}	Irradiance angle at reflecting element k with respect to PD i
γ_i	The azimuth of single PD i
γ^j_f	The azimuth of LED f for ADT j
γ_{PD}	PD azimuth angle
γ_R	Whole receiver horizontal orientations angle
ΔA	Reflection element area
δ_i	Elevation of single PD
δ^i_{PD}	The total elevation angle of the ADR
δ^j_f	Elevation of LED f for ADT j
δ_r	ADR tilting angle
δ_{tilt}	ADR's PDs tilting angle
$\epsilon(H)$	Sum of square error for channel estimation
θ_{ij}	The incident angle at PD i with respect to LED transmitter j
θ_{ijf}	The incident angle at PD i with respect to LED transmitter f of ADT j
θ_{ik}	The incident angle at PD i with respect to reflecting element k
ρ	Reflection Coefficient
σ_n^2	Noise variance
σ^2_{sh}	Shot noise
σ^2_{th}	Thermal noise
Φ	Angle of emission
$\phi_{1/2}$	Semi half-angle
Φ_{ij}	The angle of irradiance at the LED transmitter j to PD i