Heaven's Light is Our Guide

Department of Electronics & Telecommunication Engineering
Rajshahi University of Engineering & Technology

Your Thesis Title

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January, 2024

Acknowledgement

Write your acknowledgments here.

January, 2024 Mr. Xyz

RUET, Rajshahi-6204, Bangladesh

Declaration

I hereby declare that this submission is my work and to the best of my knowledge and belief, it contains no material previously published or written by another person, nor material which to a substantial extent has been accepted for the award of any other degree or diploma at Department of Electronics & Telecommunication Engineering, Rajshahi University of Engineering & Technology, or any other educational institution, except where due acknowledgment is made in the thesis. Any contribution made to the research by colleagues, with whom I have worked at Rajshahi University of Engineering & Technologyor elsewhere, during my candidature, is fully acknowledged. I also declare that the intellectual content of this thesis is the product of my work, except to the extent that assistance from others is acknowledged.

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Certificate

*This is to certify that the thesis paper entitled "**Your Thesis Title**" has been carried out by **Mr. Xyz** under the supervision of **Mr. PQR**, Assistant Professor, Department of Electronics & Telecommunication Engineering, Rajshahi University of Engineering & Technology.*

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Abstract

Please restrict the abstract to greater than 350 words and less than or equal to 500 words. It should be one paragraph, you can use more than one paragraph but it's not preferred. The abstract should explain the purpose and conclusions of the contribution. This should include the purpose of the research, the methods and principal results, the major points of discussion, and conclusions.

*CRITICAL: Do Not Use Symbols, Special Characters, or Math in Abstract.

Contents

List of Figures

List of Tables

List of Abbreviations

AWGN	Additive white Gaussian noise
BS	Base Station
CDF	Cumulative Distribution Function
CGR	Channel Gain Ratio
CSI	Channel State Information
C-MIMO	Co-located Multiple Input Multiple Output
D-MIMO	Distributed Multiple Input Multiple Output
ISI	Inter Symbol Interference
ESMC	Ergodic Secrecy Multicast Capacity
MIMO	Multiple-Input Multiple-Output
MISO	Multiple-Input Single-Output
MISOME	Multiple-Input Single-Output Multiple-Eavesdropper
MMSE	Minimum Mean Square Error
MRC	Maximal Ratio Combining
MU-MIMO	Multiuser Multiple-Input Multiple-Output
PDF	Probability Density Function
PNSMC	Probability of Nonzero Secrecy Multicast Capacity
SC	Selection Combining
SISO	Single-Input Single-Output
SIMO	Single-Input Multiple-Output
SIMOME	Single-Input Multiple-Output Multiple-Eavesdropper
SISOME	Single-Input Single-Output Multiple-Eavesdropper
SIMOSE	Single-Input Multiple-Output Single-Eavesdropper
SNR	Signal-to-Noise Ratio
SOPM	Secure Outage Probability for Multicasting
SDPC	Secret Dirty-Paper Coding
ZF	Zero Forcing
AWGN	Additive white Gaussian noise
BS	Base Station
CDF	Cumulative Distribution Function

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List of Symbols

$\mathbf{h}$	channel co- efficient vectors
$\mathbf{g}^T$	Transpose of matrix g
$f_\gamma(\gamma)$	Probability Density Function
$F_\gamma(\gamma)$	Cumulative Distribution Function
$\Gamma(\cdot)$	Gamma function
$\mathbb{E}(\cdot)$	Expectation operator
$\mathrm{Tr}(\mathbf{A})$	Trace of matrix $\mathbf{A}$
$I_v(.)$	Bessel Function.
$\mathrm{G}_{p,q}^{m,n}[.]$	Meiger's G-function
$\mathrm{rank}(\mathbf{A})$	Rank of matrix $\mathbf{A}$
$\sum_{u=1}^{N_1} h_u$	Sum of elements $(h_1,\ldots,h_{N_1})$
$\prod_{i=1}^{N} b_i$	Product of elements $(b_1,\ldots,b_N)$
$\|\mathbf{A}\|_F$	Frobenius norm of a matrix A
$(a)^+$	$\max(a,0)$
$\mathbb{C}$	Set of complex numbers
$\mathbb{C}^{M\times N}$	Set of $M\times N$ complex numbers
$H(X)$	The entropy of X
$H(X\|Y)$	The conditional entropy of X conditioned on Y
$I(X;Y)$	The mutual information between X and Y
$I(X;Y\|S)$	The conditional mutual information between X and Y conditioned on S
$\widetilde{\mathcal{N}}(0,N_e)$	The Additive White Gaussian Noise (AWGN) samples alongside noise power N_e
$C_s^{(\mathrm{Full})}$	Secrecy capacity with full CSI at the transmitter
$C_s^{(\mathrm{M})}$	Secrecy capacity with only main channel CSI at the transmitter
$C_s^{(\mathrm{lim})}$	Asymptotic secrecy capacity
$Pr(C_s>0)$	The probability of non-zero secrecy capacity

List of Publications

1. **A. S. M. Badrudduza**, Sheikh Habibul Islam, Milton Kumar Kundu, Imran Shafique Ansari, "Secrecy Performance of $\alpha - \kappa - \mu$ Shadowed Fading Channel" in *ICT Express*, vol. 9, no. 2, pp. 177-181, April 2023.

2. **A. S. M. Badrudduza**, S. M. S. Shahriyer, M. K. Kundu and S. Shabab, "Enhancement of Secrecy Multicast Capacity over $\kappa - \mu$ Shadowed Fading Channel," in *2019 IEEE International Conference on Telecommunications and Photonics (ICTP)*, pp. 1-4, 2019.

3. ...

4. ...

Chapter 1

Introduction

Before starting to write the chapter, Write a few lines for the introduction of this chapter here first.

1.1 Literature Review

1.2 Motivation

1.3 Objectives

The formulation of underwater.....

1.

2.

3.

1.4 Thesis Outline

Chapter 2

Background and Preliminaries

Explain all the keywords of your thesis title elaborately with necessary theories, figures, and equations.

Chapter 3

Methodolgy

Briefly explain the working procedure with the necessary flow charts, block diagrams, and definitions and significance of the performance metrics.

Chapter 4

RIS-Aided Hybrid RF-UWOC Network

In this chapter, propose and describe your work along with the results and analysis. Add a comparison table showing the performance improvement as compared to the existing works.

4.1 Sample Figure

The proposed system model in Fig. 4.1 depicts .....

Figure 4.1: System model.

4.2 Sample Equation

$$Z_2 = \int_0^{\infty} (1+\gamma)^{-1} \mathrm{G}_{2,3}^{1,2}\left[K_{\mathscr{E}_{S_2}}\gamma \middle| \begin{matrix} 1-\Psi_{i_{\mathscr{E}_S}}, 1 \\ \mu_{\mathscr{E}_S}+k, 0, -\Psi_{i_{\mathscr{E}_S}} \end{matrix}\right] \mathrm{G}_{2,3}^{1,2}\left[K_{R_2}\gamma \middle| \begin{matrix} 1-\Psi_{i_R}, 1 \\ \mu_R+k, 0, -\Psi_{i_R} \end{matrix}\right] d\gamma$$

$$=????$$

$$=??? \tag{4.1}$$

Here, (4.1) represents.....

4.3 Sample Table

In this section, the Table 4.1.....

Table 4.1: Comparison with existing works.

Existing Work	Proposed Work

Underwater optical communication link ...  Contributions: 1. 2. 3.	Underwater optical communication ....  Contributions: 1. 2.

4.4 Sample References

In [1], the authors .... Following [2, 8.11.134] .....

4.5 Learn LaTeX

Click Here to learn LaTeX

or go to

`https://www.youtube.com/watch?v=Kxl1WS7SG7A&t=10s`

Chapter 5

Conclusions

5.1 Conclusions

Summarize your key findings here.

5.2 Directions of Future Research

Write one/two future scopes.

Appendix A

Proofs of Chapter 3

A.1 Proof of Dual-hop SNRs (Scenario I)

A.1.1 $\mathscr{S} \rightarrow \mathscr{K} \rightarrow \mathscr{M}$ link

Appendix B

Proofs of Chapter 3

B.1 Proof of Dual-hop SNRs (Scenario I)

B.1.1 $\mathscr{S} \rightarrow \mathscr{K} \rightarrow \mathscr{M}$ link

Bibliography

[1] A. Badrudduza, M. Ibrahim, S. R. Islam, M. S. Hossen, M. K. Kundu, I. S. Ansari, and H. Yu, "Security at the physical layer over GG fading and mEGG turbulence induced RF-UOWC mixed system," *IEEE Access*, vol. 9, pp. 18 123–18 136, 2021.

[2] S. Wolfram, *The MATHEMATICA® book, version 4*. Cambridge university press, 1999.