Performance Evaluation of Space-Time Block Coding (STBC) in MIMO Systems

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Abstract:

Space-time wireless technology that uses multiple antennas along with appropriate signaling and receiver techniques offers a powerful tool for improving wireless performance. More advanced MIMO techniques are planned for future mobile networks in wireless Local Area Network (LANs) and Wide Area Network (WANs). The Space Time Coding has evolved as a most vibrant research area in wireless communications. Recently, Space-Time Block Coding (STBC) has been trying to incorporate in the coming generation of mobile communication standard, which aims to deliver true multimedia capability. This paper presents the Space-Time Block Codes (STBC) for wireless networks that use multiple numbers of antennas at both transmitter and receiver. The simulations have been done in MATLAB using three scenarios ,first scenario of the Alamouti Scheme of STBC for two transmitter and one receive antenna ,the second scenario of the Alamouti for two transmitter and two receiver antenna ,the third scenario of the four transmitter and M receiver antenna. Our simulation result gives better performance when the symbol error rate is decrease and the number of antennas is increase at the receiver.

Research Objective:

The objective of this research is to design space-time block codes, such as complex orthogonal space-time block codes with rate above 3/4 from complex orthogonal designs for PSK modulation (2,4,8,16 and 32), lattice based space-time block codes, and unitary differential space-time block codes for four transmit antennas and 1,2,3and 4 received antenna .

Research plan:

- ➢ Section one contains abrief introduction of research topic.
- ➢ In section two, explain the related works the STBC for wireless networks that uses multiple numbers of antennas at both transmitter and receiver.
- ➢ In section three, explain the simulation model.
- ➢ In section four, discuss the simulation results for orthogonal STBC for the Alamouti case (two transmit antenna and one receive antenna and two transmit antenna and two receive antenna) and the other cases of the N transmit antenna and M receive antenna by using QAM and PSK modulation and analyses the result of the simulation code..
- ➢ Section five, conclusion and suggestions for different research topics for future work are proposed.

Curriculum Vitae

Adel GaafarAbdElrahim Mohamed Salih

PERSONAL DETAILS

Surname	Adel GaafarAbdElrahim Mohamed Salih				
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Address	241 Hay Elmittar., Port Sudan, Sudan				
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Mobile	+249912287541			**Email**	adelgaafar2010@gmail.com
Date of birth	Day 7	Mo 9	Yr 1973	**Place of birth**	Port Sudan, Sudan

EDUCATION

School/College/University/Other	Degree obtained	Dates (from-to)
Electrical Engineering Department , Faculty of Engineering, Ain Shams University, Cairo, Egypt..	Ph.D. in Electrical Engineering	2007-2011
Electrical Engineering Department , Faculty of Engineering, Khartoum University, Khartoum, Sudan.	M.Sc. in Electrical Engineering	2002-2005
Electrical Engineering Department, Faculty of Engineering, Khartoum University, Khartoum, Sudan.	B.Sc. in Electrical Engineering	1993-1998

EMPLOYMENT HISTORY

Employer	Position	Dates (from-to)
Faculty of Engineering, Red Sea University, Port Sudan. Sudan.	Faculty Dean	2014-present
Faculty of Engineering, Red Sea University, Port Sudan. Sudan.	Vice Dean	2012-2014
Electronics and Communications Engineering Department, Faculty of	Head of the Electrical Engineering Departement	2005-2007

Engineering, Red Sea University, Port Sudan. Sudan.		
Electronics and Communications Engineering Department, Faculty of Engineering, Red Sea University, Port Sudan. Sudan.	Assistant Professor	2011-Present
Electronics and Communications Engineering Department, Faculty of Engineering, Red Sea University, Port Sudan. Sudan.	Academic Advisor	2011 - Present
Electronics and Communications Engineering Department, Faculty of Engineering, Red Sea University, Port Sudan. Sudan.	Head of the Electrical Engineering Departement	2005-2007
Electronics and Communications Engineering Department, Faculty of Engineering, Red Sea University, Port Sudan. Sudan.	Lecturer, Academic Advisor	2005-2007
Electronics and Communications Engineering Department, Faculty of Engineering, Ain Shams University, Cairo. EGYPT.	Research Assistant	2007-2011
Electronics and Communications Engineering Department, Faculty of Engineering, Red Sea University, Port Sudan. Sudan.	Research Assistant	1999-2005

MEMBERSHIP OF PROFESSIONAL ASSOCIATIONS

Professional body Level of membership	Year of Award
IEEE	2011-Now
Sudan Engineering Council.	2000-Now
Sudan Engineering Society.	2000-Now

FIELDS OF INTEREST

- Telecommunication Networks.

- Mobile systems.

- AdHoc networks

- Sensor Networks.

- Digital Image Processing.

- Cognitive Radio Networks.

- Network Security.

- Switching and teletraffic engineering

- Design of Digital Electronics Circuits.

TEACHING COURSES (Undergraduate level):

- Data Communication.
- Telecommunication Networks.
- Fiber Optics
- Communication Systems.
- Digital Signal Processing.
- Analog Communication.
- Digital communication.
- Microprocessors Systems.
- Computer Architecture.
- Antenna and Radio propagation
- Information Theory.
- Mobile Communication.
- Digital Design.
- Signals and Systems.
- Assembly Language.

Graduation Project Supervision:

- Network Protocols Implementation And Applications.
- Wireless LAN: Protocols, Planning, and Implementation.
- OPNET Network Simulator.
- Performance Enhancement of Mobile Multimedia IP Calls.
- Handover Techniques In Heterogeneous Mobile Networks.
- Multi-Hop Routing Protocols In Sensor Networks.
- Cognitive Radio Networks.

Computer Experiences and Skills

- Operating System: Linux, and windows

- Programming Languages: MatlaB, NS-2, PASCAL, C, C++, Visual BASIC, PHP

- Prewritten software: Word-processing, spread sheets, etc.

- Web Site Management and Design.

- Many Open Source Software Applications.

Languages
- Arabic, Mother Language.

- English.

University Activities
- **Chair** of First International conference in Engineering and applied science (ICEAS2017)

- Designed and supervised the implementation of the Red Sea University Information Network Upgrading 2012-present.

- Member, degree structure and curriculum committee for the B.sc & M.Sc. course on Telecommunication and Information system 2012-present.

- Member, University Planning Committee.2012-present.

- Member of the Committee evaluation and accreditation management to upgrade and characterize the courses in Faculty of Engineering from 2013 to present.

- Member, the academic committee to re-evaluate of academic assessment regulation, Faculty of Engineering 2005-2007

- Member, Faculty of Engineering examination committee, representing electrical engineering department 2005-2007.

- Member of the Committee install communications and solar power plants at the Faculty of Engineering – Red Sea University in 2013.

- External Examiner To: Port Sudan College for Engineering, Alahlia Port Sudan College.

- Lecturer: Alahliya Port Sudan College, Port Sudan 2000 - present.

- Member of the Board of professors at the University of the Red Sea from 01/05/2005 to present.

- Member of the Board of the Faculty of Engineering from 01/05/2005 to present.

- Member of many other technical committee 2011-present.

PUBLICATIONS :

1. Adel Gaafar, Hussein A. Elsayed, Salwa H. Elramly, and Magdy M. Ibrahim, "An Energy Aware Routing Protocol for Mixed Static and Mobile Nodes in Wireless Sensor Networks", SpringSim'11,14th Communications and Networking Symposium (CNS'11), April 4 - 9, 2011, Boston, MA, USA.

2. Adel GaafarA.Elrahim, Hussein A. Elsayed, Salwa H. Elramly, and MagdyM.Ibrahim, "An Energy Efficient Routing Protocol Approach for Wireless Sensor Networks", In IEEE Proceedings of the 8th International Conference on Computer as a Tool (EuroCon and ConfTele), April. 2011, Lisbon, Portugal.

3. Adel GaafarA.Elrahim, "Energy Aware Routing Protocol for Low Energy Sensor Networks", In IEEE Proceedings International Conference on Computing, Electrical and Electronic Engineering (ICCEEE 2013).

4. Adel Gaafar, Hussein A. Elsayed, Salwa H. Elramly, and MagdyM.Ibrahim, "Performance Evaluation of Energy Efficient Routing Protocols for Wireless Sensor Networks" International Conference on Signals, Systems and Automation ICSSA-2011, January 24-25, 2011 Vallabh Vidyanagar, India.

5. Adel Gaafar, Hussein A. Elsayed, Salwa H. Elramly, and MagdyM.Ibrahim, "Energy Efficient Congestion Control Operation in WSNs" In IEEE Proceedings of 2011 International Conference on Computer Engineering & Systems ICCES'2011, pp 41-46, Nov.30 - Dec.1, 2011, Cairo, Egypt.

6. Adel Gaafar, Hussein A. Elsayed, Salwa H. Elramly, and Magdy M. Ibrahim, "An Energy Aware WSN Geographic Routing Protocol", Universal Journal of Computer Science and Engineering Technology, pp 105-111, Nov. 2010.

7. Adel GaafarA.Elrahim, Hussein A. Elsayed, Salwa H. Elramly, and MagdyM.Ibrahim, "A new Routing Protocol for Mobility in Wireless Sensor Networks", Cyber Journals: Multidisciplinary Journals in Science and Technology, Journal of Selected Areas in Telecommunications (JSAT), February Edition, 2011.

8. Adel GaafarA.Elrahim, "A survey of Gognitive Radio Networks", INTERNATIONAL JOURNAL OF COMPUTER SCIENCE AND TELECOMMUNICATIONS (IJCST), November Edition, 2014.

9. Adel GaafarA.Elrahim, "Performance Comparison of Two On-demand Routing Protocols for WSNs", Red sea University Journal, 2013.

10. Adel GaafarA.Elrahim, Hussein, "EAGRP: Energy Aware Geographic Routing Protocol for Wireless Sensor Networks", International Journal of Computer Science and Telecommunications (IJCST),ISSN 2047-3338, 2014.

11. Adel GaafarA.Elrahim, "Energy Efficient Congestion Control Operationin WSNs", International Journal of Enhanced Research in Science Technology &Engineering(IJERSTE), ISSN: 2319-7463, 2014.

12. Adel GaafarA.Elrahim, "A survey for Cognitive Radio Networks", International Journal of Computer Science and Telecommunications (IJCST),ISSN 2047-3338, 2014.

13. Adel GaafarA.Elrahim, "Geographical and Energy Aware Routing Protocol for Wireless Sensor Networks", International Journal of Enhanced Research in Science Technology &Engineering(IJERSTE), ISSN: 2319-7463, 2014.

14. . Adel GaafarA.Elrahim, "Geographical and Energy Aware Routing Protocol for Wireless Sensor Networks", International Journal of Enhanced Research in Science Technology &Engineering(IJERSTE), ISSN: 2319-7463, 2014.

15. Adel GaafarA.Elrahim, "Geographical and Energy Aware Routing Protocol for Wireless Sensor Networks", International Journal of Enhanced Research in Science Technology &Engineering(IJERSTE), ISSN: 2319-7463, 2014.

16. Adel GaafarA.Elrahim, Zeinabkamal "Evaluation of Reactive and Proactive Routing Protocols for MANET", International Journal in IT and Engineering, Impact Factor- 4.747 (IJITE), ISSN: 2321-1776, 2015.

17. Adel GaafarA.Elrahim, Nada Mohammed, "Energy Detector Forms" , Red sea university Journal of Basic and Applied Science), ISSN: ISSN: 1858 -7690, 2016.

18. Adel GaafarA.Elrahim, Zeinabkamal, "Performance Evaluation Comparison of RIP, IGRP, EIGRP,and OSPF routing protocols in UMTS" , Red sea university Journal of Basic and Applied Science), ISSN: ISSN: 1858 -7690, 2016.

19. Adel GaafarA.Elrahim, Nada Mohammed, "New Optimization Method for cooperative spectrum sensing based improved double threshold energy detection" , Red sea university Journal of Basic and Applied Science), ISSN: 1858 -7690, 2017.

20. Adel GaafarA.Elrahim, Zeinabkamal, "Design of heterogeneous networks UMTS/MANET " , Red sea university Journal of Basic and Applied Science, ISSN: 1858 -7690, 2017.

21. Adel GaafarA.Elrahim, RashaEltayeb, "Cognitive Improved AODV Routing Protocol for Cognitive Radio Adhoc Network", International Journal of Innovative Studies in Sciences and Engineering Technology (IJISSET), 2017.