Improve the performance for a Resource Allocation in OFDMA Using Genetic Based Approach

Deepika Singh
M Tech Scholar
TIT&Science Bhopal, India
E-mail- singhdeepika79@gmail.com

Mrs. Pratibha Devi Umesh
Department of EC
TIT&Science Bhopal, India
E-mail- pratibhat702@gmail.com

ABSTRACT
Resource allocation in wireless mesh network is very critical task. For the allocation of resource such as channel used various scheduling technique such as centralized and distributed. In centralized technique the allocations of channel resource share in single window process. For the improvement of the performance various authors used various optimization technique such as DCF game theory and other heuristic function. In this paper used genetic algorithm for the selection of resource such as cannel in wireless mesh network. By the genetic algorithm the selections of channel is very fair and improved the channel capacity and decrease the value of degree of interference. The proposed system of channel selection simulate in MATLAB 7.14.0 software. This software is well known simulation software for the analysis of communication network

The experimental result of simulation shows that better in case of channel capacity and degree of interference. The proposed selection technique compare with game theory selection process.

Keywords: - Wireless Mesh Networks (WMN), MANET, MIMO, GA, OFDM.

INTRODUCTION

Wireless Mesh Networks (WMNs) have become the focus of much research since they allow for increased coverage while retaining the attractive features of low cost and easy deployment. WMNs have been identified as key technology to enhance and complement existing network installations as well as provide access where traditional technology is not available or too costly in install [1]. A WMN is made up of mesh routers (MRs), which have limited or no mobility, and mesh clients (MCs) which are often fully mobile. The mesh routers form the backbone of the network allowing the clients to have access to the network through the backbone. We propose an algorithm for fair scheduling in WMNs with multiple gateways. We also propose another algorithm for scheduling which places more emphasis on throughput while retaining a basic level of throughput called mixed-bias. This technique biases against characteristics of the network which are detrimental to performance, fairness, or both. Many protocols currently implemented for WMNs have evolved from traditional single-hop wireless local area networks (WLAN) and mobile ad-hoc networks (MANET) [2]. However, both of these networks have characteristics which make them very different from WMNs. While WLANs have relatively static topologies, MANETs on the other hand are fully mobile. Therefore, using protocols designed solely for either of these networks alone does not take advantage of some of the most advantageous features of WMNs. Resource allocation and resource utilization is important factor in wireless mesh network. In wireless mesh network faced a problem of traffic congestion and delay rate. Such type of event generated due to sharing of channel and limited number of channel. For the reduction of traffic congestion and delay various authors used optimization technique. In consequence of optimization technique one author are used game theory techniques. Game theory technique search number of available channel using Deapth search technique and increase the rate of delay. Now in this dissertation used genetic algorithm for the selection of channel. Genetic algorithm is dynamic population based searching technique used for the process of resource optimization. The process of optimization finally gives the optimal list of channel for allocation. A wireless mesh network (WMN) is a network of wireless communicating devices organized in a mesh topology [2]. WMNs are reliable, cost-effective and easy to deploy. These properties make them a promising technology for broadband Internet access. Typical WMN deployments are built using IEEE 802.11 a/b/g technology, with each mesh node equipped with multiple radio interfaces. Section II discusses about description of algorithms. Section III discusses about the proposed methodology. Section IV discusses comparative result analysis. Finally, concluded in section V.

II DESCRIPTION OF ALGORITHMS

GENETIC ALGORITHM

Genetic algorithms are search algorithms based on the mechanics of natural selection and natural genetics. They combine survival of the fittest among string structures with a structured yet randomized information exchange to form a search algorithm with some innovative flair of human search. These algorithms are started with a set of random solution called initial population. Each member of this population is called a chromosome. Each chromosome of this problem which consists of the string genes. The number of genes and their values in each chromosome depends on the population specification. In the algorithm, the number of genes of each

chromosome is equal to the number of the nodes in the DGA and the gene values demonstrate the scheduling priority of the related task to the node, where the higher priority means that task must executed early. Set of chromosomes in each iteration of GA is called a generation, which are evaluated by their fitness functions. The new generation i.e., the offspring's are created by applying some operators on the current generation. These are called crossover which selects two chromosomes of the current population, combines them and generates a new child (off-spring), and mutation which changes randomly some gene values of chromosomes and creates a new offspring.

ORTHOGONAL FREQUENCY DIVISION MULTIPLEXING

The OFDM (orthogonal frequency division multiplexing) system is one of the MC (multi-carrier) systems which divides one high speed data stream into several low speed data stream in parallel and transmits them by many sub-carriers at the same time. So the symbol duration of each low speed data stream is lengthened. Modulation and demodulation of OFDM system can be made in the FFT (fast Fourier transform) processor so that the transceiver of OFDM can be effectively implemented in the digital domain. It also has an advantage that can avoid the interference among subcarriers by inserting the guard interval longer than delay spread of channel. OFDM is a digital modulation scheme in which a wideband signal is split into a number of narrowband signals. Because the symbol duration of a narrowband signal will be larger than that of a wideband signal, the amount of time dispersion caused by multipath delay spread is reduced. OFDM is a special case of multicarrier modulation (MCM) in which multiple user symbols are transmitted in parallel using different subcarriers with overlapping frequency bands that are mutually orthogonal. The overlapping multicarrier technique implements the same number of channels as conventional FDM, but with a much reduced bandwidth requirement.

MIMO

Multiple-input multiple-output (MIMO) technology, through the use of multiple antennas at the transmitter and receiver sides, has been an area of intense research for its promise of increased spectral efficiency and reliability. Through the application of multiplexing and diversity techniques, MIMO technology exploits the spatial components of the wireless channel to provide capacity gain and increased link robustness. Multiple-input multiple-output (MIMO) systems that utilize multiple antennas at transmitters and receivers can considerably increase link capacity as well as link reliability compared to conventional single-input single-output (SISO) systems. The advantages originate from the multiple spatial channels, which are provided by the multiple antennas together with the scattering environment surrounding the transmitters and the receivers. A general block diagram of MIMO systems is illustrated in below Figure, where MIMO encoder and MIMO decoder accommodate various MIMO coding/decoding schemes, such as singular value decomposition (SVD) and orthogonal space-time block coding (OSTBC). By applying different coding/decoding schemes, the self-interfering MIMO channel can be converted into a set of parallel sub-channels, over which separate data streams are transmitted.

CHANNEL ASSIGNMENT TECHNIQUE

Channel Assignment (CA) in a multi-radio WMN environment consists of assigning channels to the radio interfaces in order to achieve efficient channel utilization and minimize interference. In this section, we describe different schemes that can be used to assign channels in a wireless mesh network. These schemes are generally classified as: Static, Dynamic and Hybrid Channel Assignment.

WMNs have emerged as a promising candidate for extending the coverage of WiFi islands and providing exile high-bandwidth wireless backhaul for converged net-works. The wireless backbone, consisting of wireless mesh routers equipped with one or more radio interfaces, highly affects the capacity of the mesh network. This has a significant impact on the overall performance of the system, thus generating extensive research in order to tackle the specific challenges of the WMN. Current state-of-the-art mesh networks, which use o˙-the-shelf 802.11-based network cards, are typically configured to operate on a single channel using a single radio. This conjuration adversely affects the capacity of the mesh due to interference from adjacent nodes in the network. Various schemes have been proposed to address this capacity problem, such as modified medium access control (MAC) protocols adapted to WMNs, the use of channel switching on a single radio, and directional antennas. While directional antennas and modified MAC protocols make the practical deployment of such solutions infeasible on a wide scale, the main issue in using multiple channels with a single radio is that dynamic channel switching requires tight time synchronization between the nodes.

III PROPOSED METHODOLOGY

Using genetic selection approach, we can improve the efficiency of channel allocation in mesh network. In mesh network the total physical channel allocated as set of population for the processing of selection of resource.

- Let n is the no. of MR (j1, j2, and j3… jn).
- Let M is the no. of resource (r1,r2,……., rm)
- Compute the selection parameter indicator value.
- For each resource obtain the information like channel, computing capacity and current load of mesh network.
- For each MR obtain the MR size and the time needed to complete to complete the MR.
- Create grid matrix for the process and apply selection process.
- Generate the initial population of MR and apply the genetic selection mechanism to select the optimal MR from population. The selection of MR is done using fitness function evaluation.

F (xi) = …. ……..(I)

Where f (xi) is the fitness of individual xi and F (xi) is the total pheromone of that individual MR selected. Here in the process of genetic algorithm crossover phase are not required. For the process of mutation we fixed the value of variable probability p=0.07. And finally gets the optimized set of MR for allocation.

- Calculate local pheromone and set process priority order for completion of MR. If selected MR priority is high, then execute the MR.
- Again select population and repeat the process until all MR are processed.

The key idea of selection operator is to give preference to better individuals by allowing them to the pass on their genes to the next generation and prohibited the entrance of worst fit individuals into next generation; here we are using genetic approach to only select the channel for solution of mesh network.

Figure 1: Proposed model.

IV EXPERIMENTAL RESULT ANALYSIS

In this section discuss the comparative result analysis of previous algorithm with our proposed method used. To evaluate the performance of proposed method of wireless mesh network we have use MATLAB software 7.14.0 for experimental task. In this chapter we will describe the MATLAB simulation of the proposed wireless mesh network method. We will give the detail of simulation tool, input methods and formats, simulation steps, feature extraction method and finally get result images.

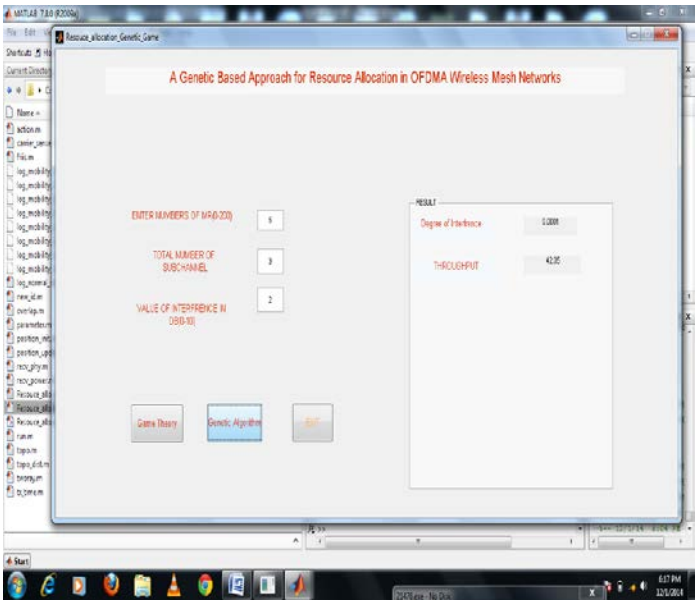

Figure 2: Shows that the window for Wireless Mesh Networks in OFDMA using GENETIC ALGORITHM for the maximum allocation of nodes is 20.

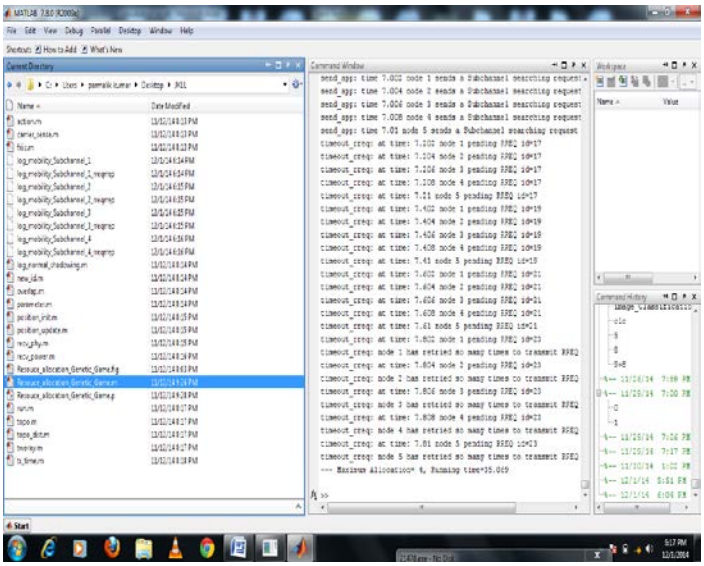

Figure 3: Shows that the window for Time request procedure and Running time value for Wireless Mesh Networks in OFDMA with maximum number of allocated node is 10 for Game theory.

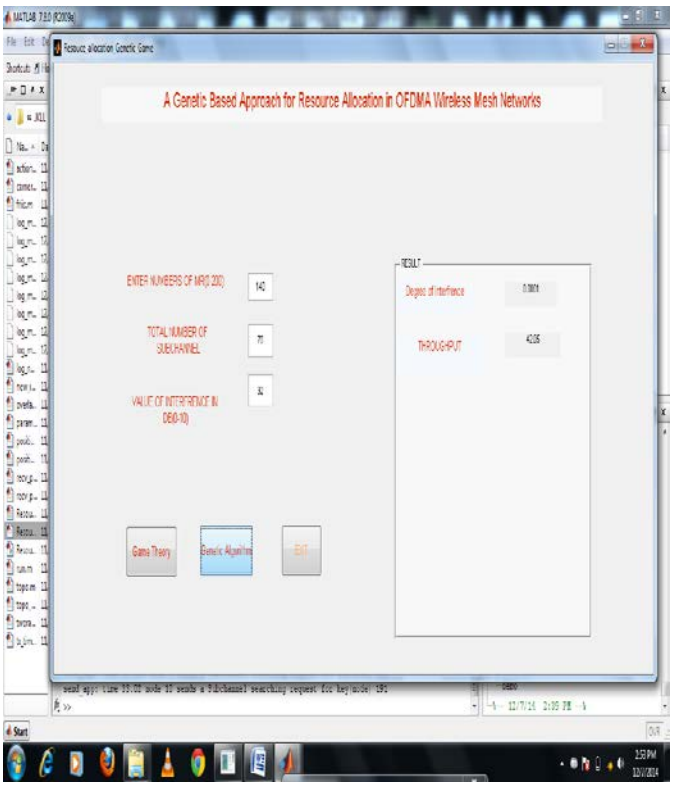

Figure 4: Shows that the window for Wireless Mesh Networks in OFDMA using GENETIC ALGORITHM.

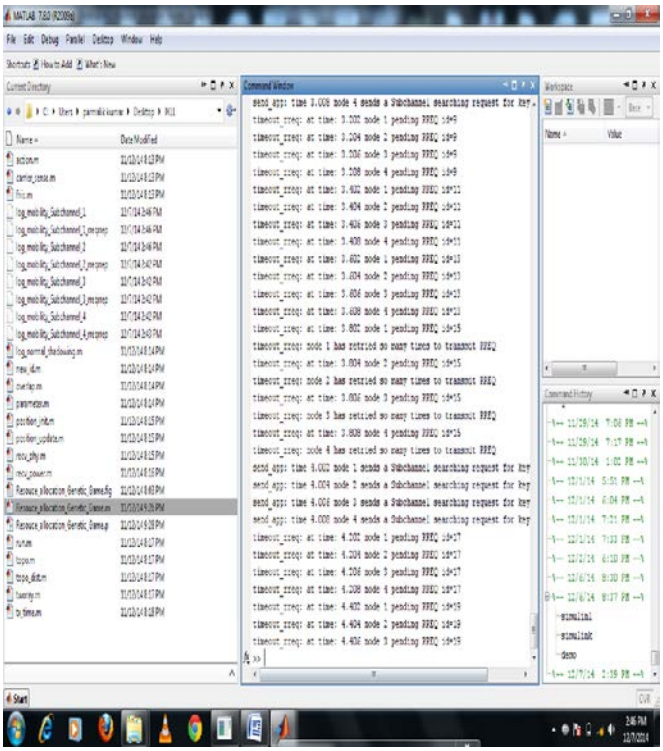

Figure 5: Shows that the window for Time request procedure and Running time value for Wireless Mesh Networks in OFDMA with maximum number of allocated node is 140 for Game Theory.

Method Name	Number of MR	Number of sub Channel	Value of Interference	Degree of Interferenc e	Throughput	Elapsed Time
Game Theory	10	5	4	0.001	40.05	27.55
	20	10	8	0.002	38.05	35.06
	30	15	12	0.004	32.04	29.45
	40	20	16	0.008	29.07	32.76
Genetic Algorithm	10	5	4	0.0001	42.05	18.93
	20	10	8	0.0002	39.05	38.04
	30	15	12	0.0005	34.04	31.08
	40	20	16	0.0007	33.06	33.26

Table 1: Comparative performance evaluation on the basis of maximum number of different nodes with using Game Theory and Genetic Algorithm.

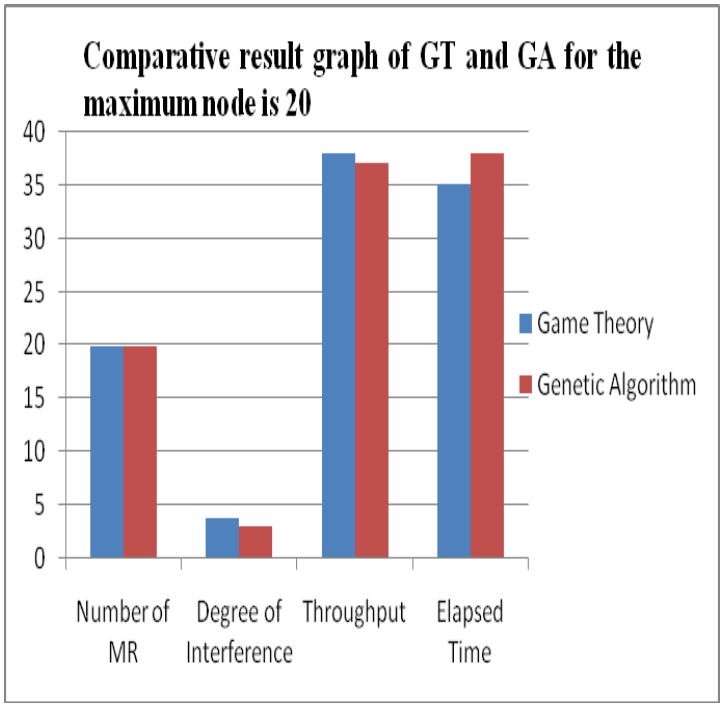

Figure 6: Shows that the comparative result graph for performance evaluation for the maximum number of node is 20 with using Game Theory and Genetic Algorithm, find the Degree of interference, Throughput and Elapsed Time.

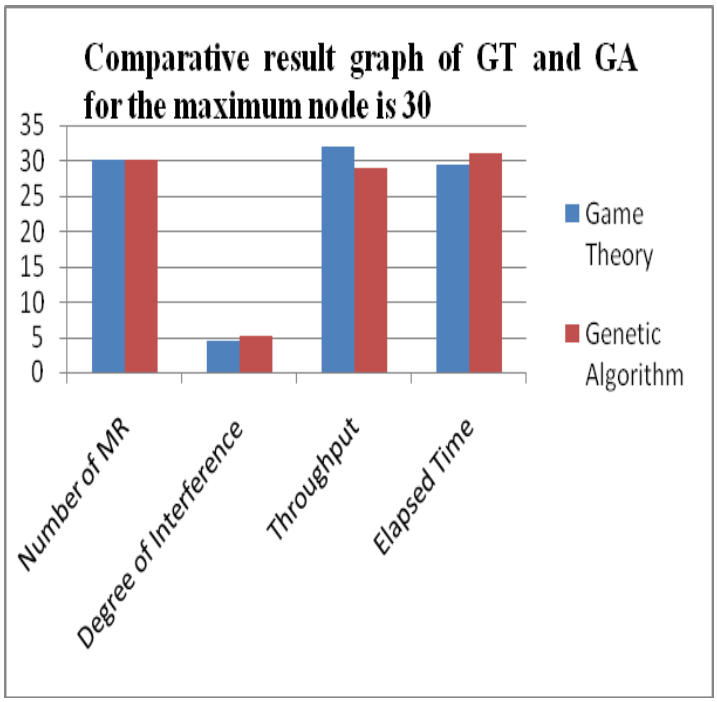

Figure 7: Shows that the comparative result graph for performance evaluation for the maximum number of node is 30 with using Game Theory and Genetic Algorithm, find the Degree of interference, Throughput and Elapsed Time.

V CONCLUSION AND FUTURE WORK

In this paper modified the process of channel selection in wireless mesh network. The process of channel selection in wireless mesh network is very difficult due to limited number of resource and maximum number of user traffic. For the improvement of channel selection used genetic algorithm. Genetic algorithm is dynamic population based searching technique. The dynamic population searching technique propose a selection process of channel. The selection process of genetic algorithm used fitness function for the selection of channel. The modified channel selection process is very efficient in case of traffic congestion and delay rate of mesh network. The increasing the size of mesh network the process of genetic channel selection process faced a problem of normal selection of channel. In case of vast network used Meta heuristic function for selection of channel in mesh network.

REFERENCES:-

[1] SaharHoteit, Stefano Secci, Rami Langar, Guy Pujolle "A Nucleolus-Based Approach for Resource Allocation in OFDMA Wireless Mesh Networks" TRANSACTIONS ON MOBILE COMPUTING, IEEE VOL. 12, 2013. Pp 2145-2154.

[2] Yao-Win Hong, Wan-Jen Huang, Fu-Hsuan Chiu, and C.-C. Jay Kuo "Cooperative Communications in Resource-Constrained Wireless Networks" SIGNAL PROCESSING MAGAZINE IEEE 2007. Pp 47-57.

[3] Mohamed Salem, Abdulkareem Adinoyi, Mahmudur Rahman, Halim Yanikomeroglu, David Falconer, Young-Doo Kim, Eungsun Kim, Yoon-ChaeCheong"An Overview of Radio Resource Management in Relay-Enhanced OFDMA-Based Networks" COMMUNICATIONS SURVEYS & TUTORIALS, IEEE VOL. 12, 2010. Pp 422-438.

[4] Ho Ting Cheng and Weihua Zhuang, University of Waterloo "Joint Power-Frequency-Time
Resource Allocation inClustered Wireless Mesh Networks" IEEE 2008. Pp 45-52.

[5] Mohammad Fathi, Hassan Taheri, MehriMehrjoo "Cross-Layer Joint Rate Control and Scheduling forOFDMA Wireless Mesh Networks" IEEE 2009. Pp 1-9.

[6] Ho Ting Cheng, Weihua Zhuang "Novel Packet-Level Resource Allocation withEffective QoS Provisioning for Wireless Mesh Networks" IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS IEEE vol 8 2009. Pp 694-700.

[7] F. Kaabi, S. Ghannay, and F. Filali "Channel Allocation and Routing in Wireless Mesh Networks:A survey and qualitative comparison between schemes" International journal of wireless & mobile networks vol 2, 2009. Pp 132-150.

[8] Aria Nosratinia, Todd E. Hunter "Cooperative Communication inWireless Networks" IEEE Communications Magazine IEEE 2004. Pp 74-80.

[9] SaharHoteit, Stefano Secci, Rami Langar, Guy Pujolle "Strategic Subchannel Resource Allocationfor Cooperative OFDMA Wireless Mesh Networks" IEEE 2006. Pp 1-5.

[10] I. Ahmed, A. Mohamed, T. Fouly, and Y. Hu, "On the Fairness ofFrequency Domain Resource Allocation in Wireless Mesh Networks- A Survey," Proc. IEEE GCC Conf. and Exhibition, Feb. 2011.

[11] F. Brah, A. Zaidi, J. Louveaux, and L. Vandendorpe, "On theLambert-W Function for Constrained Resource Allocation inCooperative Networks," EURASIP J. Wireless Comm. and Networking, 2011, pp. 1-13.

[12] D. Saha, A. Dutta, D. Grunwald, and D. Sicker, "Channel Assignment in Virtual Cut-Through Switching Based WirelessMesh Networks," Proc. 11th Int'l Conf. Distributed Computing andNetworking (ICDCN), Jan. 2010.

[13] F. Martignon, S. Paris, I. Filippini, and A. Capone, "Efficient Bandwidth Allocation in Wireless Community Networks," Proc. Wireless Days Conf., Oct. 2011.

[14] Y. Park and E.-S. Jung, "Resource-aware routing algorithms for multi hop cellular networks," International

Conference on Multimedia and Ubiquitous Engineering, 2007.,Pp. 1164-1167.

[15] S. Sadr, A. Anpalagan, and K. Raahemifar, "Radio resource allocation algorithms for the downlink of multiuser OFDM communication systems," IEEE Commun. Surveys Tutorials, 2009, pp. 92 – 106.

[16] C. Isheden , G. P.PFettweis "Energy-efficient link adaptation with transmitter CSI" in Proc. IEEE WCNC, 2011, Pp 1381–1386.

[17] M. Guowang, N. Himayat, G. Y. Li, "Energy-efficient link adaptation in frequency-selective channels" IEEE Trans. Commun. vol. 58, no. 2, 2010, Pp 545–554.

[18] R. S. Prabhu , B. Daneshrad "Performance analysis of energy-efficient power allocation for MIMO-MRC systems" IEEE Trans. Commun., vol. 60, no. 8, 2012, Pp 2048–2053.

[19] C. Isheden, Z. Chong, E. Jorswieck, and G. Fettweis"Framework for link-level energy efficiency optimization with informed transmitter" IEEE Trans.Wireless Commun., vol. 11, no. 8, 2012, Pp 2946–2957.

[20] C. Isheden , G. Fettweis "Energy-efficient link adaptation on a Rayleigh fading channel with receiver CSI" in Proc. IEEE ICC, 2011, Pp 1–5.

[21] K. Quan, L. Shu-Hung, Y. Xiangbin "Adaptive modulation and joint temporal spatial power allocation for OSTBC MIMO systems with imperfect CSI" IEEE Trans. Commun., vol. 60, no. 7, 2012, Pp 1914–1924.

[22] M. Torabi, J. F. Frigon, B. Sanso "Performance analysis of adaptive modulation in multiuser selection diversity systems with OSTBC over time-varying channels" IEEE Signal Process. Lett., vol. 19, no. 4, 2012, Pp 211–214.