Breast Cancer Prediction by Machine Learning Algorithms - A Comparative Study of Naive Bayes, KNN and J48 in Weka Environment

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Abstract

Breast cancer is considered one of the most common cancers occurring in women. Each year, it affects 2.1 million women, causing cancer-related deaths. As per the estimation, breast cancer took the lives of 627,000 women in 2018 alone. The disease is mostly observed in the developed areas of the world, with current rates expanding in almost every region across the world. The role of predicting cancer is crucial for the further progress of data mining tools currently available. K-nearest neighbor, J48 algorithm, and Naïve Bayes are applied to predict cancer disease. For acquiring an extensive dataset, Naïve Bayes is very helpful and easy to design. K-nearest neighbor produces a dataset, separating it into distinct categories. It predicts new points in the classification. Grounded on the Decision Tree, J48 Classifier uses such facts from the datasets of training, which can be utilized to decide the minor subsection. To measure the precision of the cancer dataset, the Weka tool cab is applied. Its dataset encompasses nine kinds of cancer. A 70% train and 30% test data set split has been utilized to predict the cancer disease. The exactness of Naïve Bayes is 91.81%, whereas the identity of J48 and K-nearest neighbor is respectively 92.98% and 97.07%.

Keywords

Breast Cancer, K-nearest neighbor, j48 algorithm, Naïve Bayes

1. Introduction

1.1. Background

Early diagnosis is essential to enhance the results and survival rates of breast cancer. There are two strategies for early detection of breast cancer, including screening and early diagnosis. The settings with limited resources and poor health organizations where most women are detected in advanced stages must focus on the early detection programs grounded on the consciousness of early symptoms and quick recommendations for analysis and treatment. Screening comprises assessing women for identifying the risks of cancer before the appearance of symptoms. These screening tools include breast self-exam, clinical breast exam, and mammography. Since it requires significant investment, the decision to continue with the screening procedure should be made following fundamental breast health amenities that include efficient detection and appropriate treatment. Early diagnosis involves delivering apt access to cancer treatment by decreasing the barriers that come before enhancing access to proper diagnosis services. The purpose is to study the comparison of Naïve Bayes, KNN, and J48 classifier accuracy in predicting the proportion of breast cancer identification in the early phases [5, 12]. Cancer is a genetic disorder that happens due to the alterations to the genes and the sudden expansion of cells and division. Metastatic cancer is when the cancer cells spread to another place

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CHAPTER 9

Social, Professional, Ethical, and Security Issues Associated with IoMT and Smart Healthcare: Post-COVID-19 Pandemic Scenario

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ABSTRACT

The IoMT has gained high levels of notoriety in the modern world with advanced solutions being deployed in multiple treatment facilities along with care units. The methodology used in this research work is that existing scholarly articles with various case studies have been researched to bring out information about the topic. The secondary data researched will account for an inclination to the qualitative form of research, which will make the approach deal more in non-numerical data. This qualitative form of research will be backed by a further descriptive representation of the same in this research. The overall representation will thus blend the findings of various research works, bringing out a compilation of significant information about the topic. The information brought out in this research will be made subject to further critical analysis as a part of the preparation of this research work. The issues found in this research work is that the healthcare domain has been revamped to a great extent due to the introduction of such facilities

Internet of Medical Things in Smart Healthcare: Post-COVID-19 Pandemic Scenario.
Saravanan Krishnan, PhD and Aboobucker Ilmudeen, PhD (Eds.)

INTERNET OF MEDICAL THINGS IN SMART HEALTHCARE

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Introduction to Operations Research Methodologies

The domain of operational research involves various techniques applied for complex problem-solving and arriving at decisions. Operations research methodologies are applied by organizations to solve real-life problems, as they assist in managing all operations efficiently. Hence, operations research has emerged as a scientific method for problem-solving by engaging quantitative information for enhanced decision-making methodologies of operations research including probability, statistics, simulation and optimization. This study provides an introduction to the use of methods from operations research in scientific decision-making, design, analysis and management. It also includes a guide to using these approaches. The objective of this project was to produce a text that is both comprehensible and practical. An in-depth investigation into the mathematical models and the tried-and-true and cutting-edge approaches to problem-solving that lie at the foundation of today's software tools for quantitative research and deliberation has yielded insights that are both theoretically sound and practically applicable. While probability and statistics enable us to arrive at predictable solutions applicable in risk scenarios by applying mathematical algorithms, simulation allows the construction of models for solution testing before applying them. Optimization allows us to achieve optimum results within a given condition. Arriving at suitable solutions using operations research follows several steps by way of problem identification, construction of the mathematical model, deriving solutions from the model constructed, testing of the model, establishing control over solutions and finally arriving at the solution to implement them. The scope of this chapter will explore all such methodologies in detail and evaluate concepts that can be reliably applied in cases of smart edge computing.

1.1. Introduction

The use of quantitative techniques for the purpose of assisting analysts and decision-makers in the process of creating, assessing and improving the performance

Chapter written by Trishit BANERJEE and Arup DASGUPTA.

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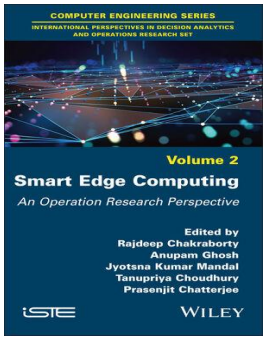

Smart Edge Computing: An Operation Research Perspective

Jyotsna Kumar Mandal, Prasenjit Chatterjee, Rajdeep Chakraborty, Tanupriya Choudhury, Anupam Ghosh

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Description

This book pioneers the synergy between state-of-the-art edge computing technologies and the power of operations research. It comprehensively explores real-world applications, demonstrating how various operations' research techniques enhance edge computing's efficiency, reliability and resource allocation. Innovative solutions for dynamic task scheduling, load balancing and data management, all tailored to the unique challenges of edge environments, are displayed.

Starting with operation research methodologies with foundations, applications and research challenges in edge computing and an overview of digital education, this book continues with an exploration of applications in the health sector using IoT, intelligent payment procedures and performance measurement of edge computing, using edge computing and operation research. Smart or AI-based applications are also explored further on and the book ends with insight into ultralightweight and security protocols with solutions for IoT using blockchain.

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ANALYZING THE DIGITAL NOTE PROGRESSION OF RAGAS WITHIN A *THAAT* USING FRACTAL GEOMETRY

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ABSTRACT*:*

Music is one of the oldest forms of art, something to experience and enjoy. In recent times we have seen a great interest of modern science interacting with this highly emotional and experiential phenomenon of music. Music is organized sound that is capable of conveying emotion; hence melody has to be ordered successions of musical notes and it is of interest to investigate if the successions depict a fractal nature. Successions are *fractal* if the incidence frequency F and the interval between successive notes i in a musical piece bear the relation: $F = c/i^{D}$ where D is the fractional dimension and c is a constant of proportionality. The present work compares four ragas within a *thaat* (a raga-group based on scale) using fractals. Two of the ragas are of restful nature and the remaining two restless. Our findings are very interesting. Fractal nature is found to be far more prominent in both the restless ragas! We propose to extend the work to other *thaats* also as well as compare ragas between *thaats*.

Key Words— Fractals, melody, musical notes, *thaat*, raga

1. INTRODUCTION

Music is a way of expressing nature's harmony, and fractals are the tools that describe this harmony. Naturally it is of interest to explore the application of fractals in music. One direction of research could be to investigate whether a musical succession of digital notes depicts a fractal nature or not. Another interest can be if we can mathematically characterize the difference between the musical component of ragas (with different moods) within a *thaat* or those with similar moods between the *thaats* or finally can we make fractal music (music generated algorithmically using fractals) interesting? In this paper we are interested in comparing ragas within a *thaat* using fractals while comparing ragas between *thaats* using fractals is reserved as a future work.

1.1 Fractal and Music

Fractals are geometric shapes with interesting properties that set them apart from normal Euclidean shapes. The first interesting property is that of self similar nature. Another property of fractal is a non integer dimension which is related to the concept of self similarity. The term fractal was coined by Benoit Mandelbrot in 1975 to describe shapes that are "self-similar" – that is, shapes that look the same at different magnifications and we refer to his classic treatise [1] for an insight.

Mandelbrot's fractal geometry has provided a new qualitative and quantitative approach for the understanding of the complex shapes of nature. The calculation of fractal dimension is an important way to classify objects that exhibit fractal characteristics.

The relative abundance or the incidence frequency F, of notes of different acoustic frequency f in a musical composition is not fractal [2]. Unplanned striking of the keys in a piano or a harmonium will not create music. Music is *organized sound that conveys emotion*; hence melody has to be ordered successions of musical notes. These successions are fractal if the incidence frequency F of the interval between successive notes i in a musical piece bear the relation

$F=c/i^D$ where D is the fractional dimension and C is a constant of proportionality [3].

or, ln(F)=ln(c)-Dln(i)=C-Dln(i) where C=ln(c), another constant. ……. (1).

Voss and Clark [4] determined that music exhibits $1/f$ - power spectra at low frequencies. This fact allows us to consider music as a time series and analyze the fractal dimension of a particular piece of music. Bigerelle and Lost [5] found the global *D* to be an invariant for different types of music. In another work [6], *D* in the music of Mozart and Bach was calculated. Hsu and Hsu [3] discussed the application of *D* to music in detail and for a work of Bach, found *D* to be 2.418.

1.2 Ragas and *Thaats*

A raga, in Indian classical music (both Hindustani and Cartatic), may be defined as a melodic structure with fixed notes and a set of rules that characterize a particular mood conveyed by performance. According to Vishnu Narayan Bhatkhande (1860-1930) one of the most influential musicologist in the field of Hindustani Classical Music in the twentieth century, each one of the traditional ragas is based on, or is a variation of ten basic *thaats*, or musical scales or frameworks. The ten *thaats* are Bilawal, Kalyan, Khamaj, Bhairav, Poorvi, Marwa, Kafi, Asavari, Bhairavi and Todi. If one were to pick a raga at random, it should be possible to find that it is based on one or the other of these *thaats* [7]. For instance, the four ragas Bhimpalashi (or Bhimpalashree), Pilu, Bageshree and Kafi studied here all belong to the Kafi *thaat*. Table 1 gives the distinguishing musical features of these ragas.

Table 1: Musical Feautures of four ragas of the Kafi *thaat*

Musical feature:-	Raga 1: Bageshree	Raga 2: Pilu	Raga 3: Kafi	Raga 4: Bhimpalashi
Thaat	Kafi	Kafi	Kafi	Kafi
Arohan (ascent)	S g M D n **S**	*N* S g R g, M P, d P, n D P, **S**	S R g M P D n **S**	*n* S g M P n **S**
Awarohan (Descent)	**S** n D, M P D g, M g R S	**S** n D P M g, *N* S	**S** n D P M g R S	**S** n D P M g R S
Pakad (note assembly giving a catch of the raga)	S *n D*, S M D n D, M g R S	N S g N S, *P d N* S	S S R R g g M M P	*n* S M, M g, P M, g, M g R S
Vadi-Samvadi Swars (Most important and second most important notes)	M, S	g, N	P, S	M, S
Jati (raga group according to number of distinct notes allowed in ascent and descent)	*Aurabh-Sampoorna (5 distinct notes allowed in ascent; 7 in descent)*	*Sampoorna-Sampoorna 7 distinct notes allowed in ascent; 7 in descent)*	*Sampoorna-Sampoorna (7 distinct notes allowed in ascent; 7 in descent)*	*Aurabh-Sampoorna (5 distinct notes allowed in ascent; 7 in descent)*
Nyas Swars (stay notes in the raga)	g M D	G P N	R g M P	g M P n
Prakriti (nature)	Restful	Restless	Restless	Restful
Time of rendition	9PM-12PM	12.00-3PM	Midnight	1PM-3PM

Notes 1: The raga Pilu discussed here is actually *Mishra Pilu* and uses two notes N and d which are not used in the other three ragas of the Kafi thaat. In fact, these two notes are not among the parent notes of the Kafi *thaat*, namely, S R g M P D and n. However, these additional notes do make this raga more coulourful and suitable for thumris, a lighter form of Hindustani classical music and it is the lighter form of Pilu that is more popular and hence being analyzed here.

2: Kafi is both a *thaat* and a raga within this *thaat*. Raga Kafi should not be confused with Kafi as a *thaat* which is a raga-group and not an individual raga.

Abbreviations: The letters S, R, G, M, P, D and N stand for Sa, *Sudh* Re, *Sudh* Ga, *Sudh* Ma, Pa, *Sudh* Dha and *Sudh* Ni respectively. The letters r, g, m, d, n represent *Komal* Re, *Komal* Ga, *Tibra* Ma, *Komal* Dha and *Komal* Ni respectively. Normal type indicates the

note belongs to middle octave; italics implies that the note belongs to the octave just lower than the middle octave while a bold type indicates it belongs to the octave just higher than the middle octave. Sa, the tonic in Indian music, is taken at C. Corresponding Western notation is also provided. (see table 2) The terms "*Sudh*", "*Komal*" and "*Tibra*" imply, respectively, natural, flat and sharp.

2. METHODOLOGY

We take four different ragas from Kafi *thaat* and calculate intervals *i* as the absolute values of differences in pitch of two successive notes. For each sequence of notes, a frequency distribution is found of the intervals. Accordingly four tables of ln *F* versus ln *i* are formed, one for each raga. Calculations are made only for those values of *F* and *i* for which both ln *F* and ln *i* are defined. The note sequences are taken from a standard text [7] and not from any audio recording. There are some obvious advantages and disadvantages for doing so. If we go for audio recordings, it is not always necessary that the same raga performed by different artists (or even the same artist on different occasions) will exhibit the same fractal nature. Even if we analyze a single recording of an artist, it is not easy to say which part of the fractal nature is attributable to the raga itself and which part to the style. In a structure analysis, the style of the artist does not interfere with our analysis whereby the fractal nature can be studied for its presence (with dimension) in the raga structure itself in a general sense. The technique is to assign the number 0 to C (where the tonic Sa or S is taken), 1 to the next note Db (Komal Re or r) and so on (table 2). On the disadvantage side, we miss information on note duration and pitch movements between the notes which we could get in audio recordings.

Table 2: Numbers representing pitch of notes [8]

C	Db	D	Eb	E	F	F#	G	Ab	A	Bb	B
S	*r*	*R*	*g*	*G*	*M*	*m*	*P*	*d*	*D*	*n*	*N*
(lower octave)											
-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1
S	r	R	g	G	M	m	P	d	D	n	N
(middle octave)											
0	1	2	3	4	5	6	7	8	9	10	11
S	**r**	**R**	**g**	**G**	**M**	**m**	**P**	**d**	**D**	**n**	**N**
(higher octave)											
12	13	14	15	16	17	18	19	20	21	22	23

3. EXPERIMENTAL RESULTS

Our experimental results are summarized in tables 3-6 and corresponding fig. 1-4 for the ragas Bageshree, Pilu, Kafi and Bhimpalashi respectively.

***Thaat*: Kafi** Raga: Bageshree

i	F	lni	lnF
0	10		2.30
1	41	0.00	3.71
2	67	0.69	4.20
3	11	1.10	2.40
4	32	1.39	3.47
5	15	1.61	2.71
6	3	1.79	1.10
7	1	1.95	0.00

Table 3: Fractal Analysis for Bageshree

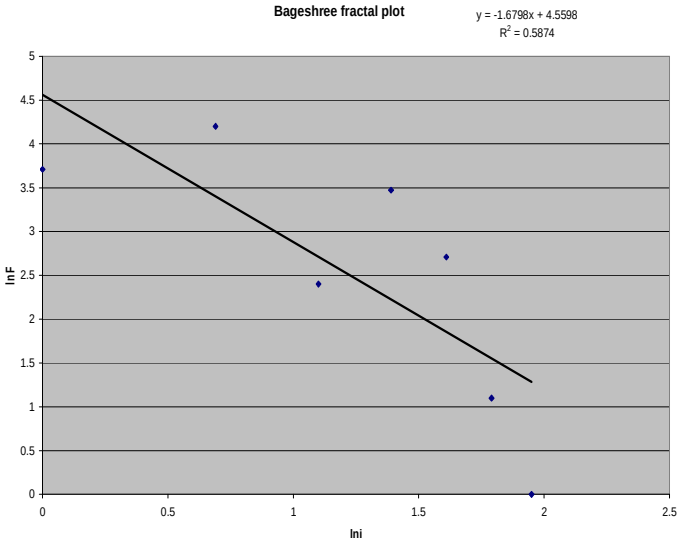

Fig. 1 Fractal Plot of Bageshree

i	F	lni	lnF
0	6		1.79
1	48	0.00	3.87
2	74	0.69	4.30
3	25	1.10	3.22
4	21	1.39	3.04
5	4	1.61	1.39
6	1	1.79	0.00
11	1	2.40	0.00

Table 4: Fractal Analysis for Pilu

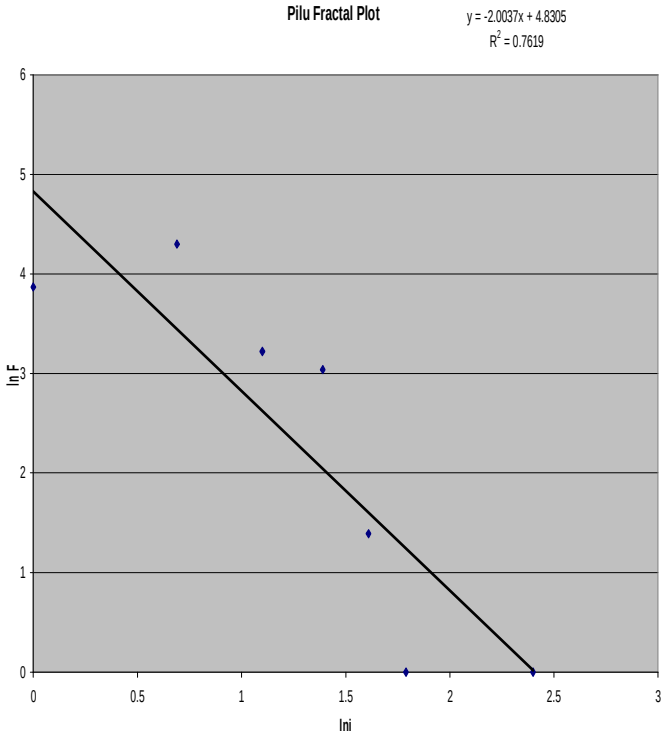

Fig. 2 Fractal Plot for Pilu

i	F	lni	lnF
0	12		2.48
1	43	0.00	3.76
2	108	0.69	4.68
3	7	1.10	1.95
4	4	1.39	1.39
5	3	1.61	1.10
6			
7	3	1.95	1.10

Table 5: Fractal Analysis for Kafi

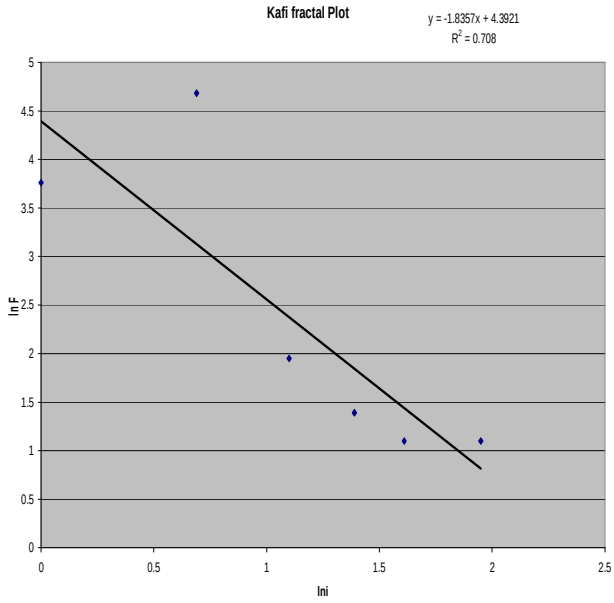

Fig. 3 Fractal Plot for Kafi.

i	F	lni	lnF
0	8		2.08
1	16	0.00	2.77
2	126	0.69	4.84
3	7	1.10	1.95
4	11	1.39	2.40
5	11	1.61	2.40
6	0	1.79	
7	1	1.95	0.00

Table 6: Fractal Analysis for Bhimpalashi

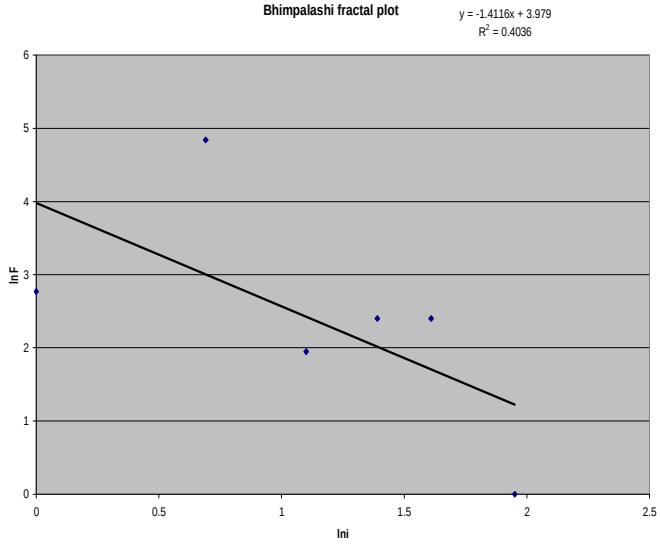

Fig. 4 Fractal plot for Bhimpalashi

4. DISCUSSION

The results on the four ragas are indeed very interesting. The ragas Kafi and Pilu are depicting fractal nature with comparatively higher dimension than the other two ragas (2.0037 for Pilu and 1.8357, i.e., nearly 2). The fractal nature in raga Bhimpalashree is not so prominent as R^2 is not very high with fractal dimension 1.4116 and same is true about the other raga Bageshree which has fractal dimension 1.6798. $100R^2$, also called % coefficient of determination, gives the percentage of variation in the response (here lnF) explained by the predictor (here lni) through the model (here a straight line). In a recent paper [9] it has been argued that fractal dimension is related with the *chalan* (melodic movement) of the raga. Thus our present finding suggests that Kafi and Pilu can be placed in one sub-group within the same *thaat* while Bageshree and Bhimpalashree can be placed in another sub-group within this *thaat*. Musically, we already know that Kafi and Pilu areboth of restless nature and therefore can be placed in one group (*Chanchal prakriti* or restlessness nature). Bageshree and Bhimpalashree are both restful ragas and can be placed in another group (*shant prakriti* or restful nature). Hence the present study confirms once again that fractals do provide interesting mathematical properties that may be related to the melodic movement (in this case, whether restful or restless) of a raga. We caution the reader, however, that the nature (restful or restless) of the raga is not exactly the same thing as the mood or emotional content of the raga. For that matter, Pilu evokes sadness (*karuna rasa*) like Bageshree and Bhimpalashi while Kafi evokes joy in a romantic sense (*shringar rasa*). The paper [10] compares Kafi and Bageshree probabilistically using entropy.

Remarks 1: This is a paper on structure analysis of ragas. Readers interested in performance analysis of a raga are referred to [11]. This paper also gives a brief outline of what a raga is and how Indian classical music differs from Western classical music.

2. It is not correct to conclude in general that the restless ragas are more likely to exhibit a fractal nature. Our study is confined to only one *thaat* and there too, we can study only a limited number of ragas even within a *thaat*. The present work is only illustrative and by no means exhaustive. We caution the reader that Malkauns, a restful raga of Bhairavi *thaat* (some experts say Asavari *thaat* is correct for this grouping this raga [7]), has been found to exhibit good fractal nature! [12]
3. The reader is also referred to the works of H. V. Sahasrabuddhe [13].

5. CONCLUSION

The present work compares four ragas within a *thaat* using fractals. Fractal nature is found to be far more prominent in two of the ragas which happen to be of restless nature as compared to the other two which happen to be restful ones. Although the finding is interesting, yet in the light of the second remark made in the previous section, we have extend the work to other *thaats* as well as compare ragas between *thaats* and investigate a good number of ragas in each of the ten *thaats* in order to concretize things.

REFERENCES

[1] B. B. Mandelbrot. *The Fractal Geometry of Nature*. Freeman, N. Y., 1977

[2] R. F. Voss and J. Clarke, "'1/f Noise' in Music and Speech," *Nature*, **258** (1975) 317–318.

[3] K. J. Hsu and A. J. Hsu, Fractal geometry of music, Proc. Natl.Acad. Sc.,USA, Vol.87, 1990, 938-941

[4] R. F. Voss and J. Clarke, "'1/f Noise' in Music: Music from 1/f Noise,"*Journal of Acoustical Society of America,* **63** (1978) 258–263.

[5] M. Bigerelle and A. Lost, "Fractal Dimension and Classification of Music,"*Chaos, Solitons, and Fractals*, **11** (2000) 2179–2192.

[6] J. Hemenway, "Fractal Dimensions in the Music of Mozart and Bach,"*The Nonlinear Journal*, **2** (2000) 86–90.

[7] D. Dutta. Sangeet tattwa (pratham khanda), Brati Prakashani, 5*th* ed,2006 (Bengali)

[8] K. Adiloglu, T. Noll and K. Obermayer, *A Paradigmatic Approach to Extract the melodic Structure of a Musical Piece*, Journal of New Music Research, Vol. 35(3), 2006, 221-236

[9] S. Chakraborty, S. Tewari and G. Akhoury, What do the fractals tell about a raga? A case study in raga Bhupali,

Consciousness, literature and the arts, Vol. 11, No. 3, Dec 2010, 1-9

[10] S. Chakraborty, S. Tewari, G. Akhoury, How do the ragas of the same *thaat* which evoke contrasting emotions like joy and pathos differ in entropy? Philomusica online, Vol. 10, 2011, 1-10

[11] S. Chakraborty, R. Ranganayakulu, S. Chauhan, S. S. Solanki and K. Mahto, *A Statistical Analysis of Raga Ahir Bhairav*, Journal of Music and Meaning, Vol. 8, sec. 4, Winter 2009 http://www.musicandmeaning.net/issues/showArticle.php?artID=8.4

[12] S. Chakraborty, S. Sundareisan, S. Kashyap and M. Pal, A Simple Fractal Analysis of a North Indian Raga, International Journal of Computational Cognition, Vol. 9(2), June 2011, 31-33

[13] http://www.it.iitb.ac.in/~hvs/paper_1992.html

Ajith Abraham · Hideyasu Sasaki ·
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Contents

An Approach to Store Data in Cloud Based Storage Using Mapping Technique

Saswati Sarkar[1(✉)] and Anirban Kundu[1,2]

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[2] Netaji Subhash Engineering College, Kolkata 700152, India

Abstract. Cloud based data storage technique is going to be proposed in this paper. The paper introduces mapping technique to write data in a disk and to read data from the disk. Proposed cloud based technique is designed to calculate the efficiency and IOPS (Input/output operations per second) of storage. Proposed algorithm is more effective to find out a particular memory location to store data. Comparison graphs have been demonstrated for IOPS, storage space utilization and storage efficiency in cloud. Proposed cloud based data storage technique represents better read and write performance than existing approaches. The paper is going to propose more reliable storage framework than existing techniques. The paper exhibits cloud based framework which shows the utility of data storage in cloud. Proposed framework is better than existing approaches with respect to cost and protection of storage. Performance parameter chart represents the comparison of performances between existing techniques and proposed framework. Comparisons have been shown that performances of proposed approach are better than existing approaches.

Keywords: Cloud storage · Redundant Array of Independent Drives (RAID) · Empty location map · Address location map · Storage efficiency · Storage performance · Data redundancy

1 Introduction

Over the period, hardware architecture and capacity of storage have been improved a lot. Redundant Array of Independent Disk (RAID) [1, 2] is data storage technology that combines multiple physical disk components into one logical unit for the purpose of performance improvement. Different types of RAID architectures [3, 4] are RAID 0, RAID 1, RAID 10, RAID 5 etc.. RAID 0 architecture uses stripping technique to store data across multiple disks for parallel storage and retrieval. The architecture utilizes the full storage capacity. If data is lost, it cannot be recovered in RAID 0 [5]. RAID 1 architecture uses mirroring technique. Each disk has a mirror. Data is stored in two disks. If one disk has failed then the data would be retrieved from another disk. RAID 10 architecture [6, 7] is combination of RAID 0 and RAID 1. RAID 0 + 1 has been designed by mirroring first followed by stripping, whereas RAID 1 + 0 have performed stripping first followed by mirroring [8].

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Contents

Comparative Analysis of Cellular Automata Based Multilingual Encryption Using Syndicate Rules for Data Security

Ayan Banerjee[1](✉) and Anirban Kundu[1,2]

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Abstract. Authors propose cellular automata (CA) based multilingual encryption algorithm to provide data security. Different components (keyset and encryption key) are required in proposed single attractor cellular automata (SACA) based algorithm to prepare multilingual encrypted dataset. A particular set of keyset and encryption key should be applied on a particular set of multilingual raw dataset to prepare multilingual key mapped dataset. Different syndicate rules should be applied in proposed algorithm using CA based state transition mapping. Data security should be increased due to usage of different syndicate rules. Efficiency of proposed algorithm should be measured using experimental results. Superiority of CA based proposed multilingual encryption algorithm should be measured using comparative analysis with existing algorithms (Blowfish, Twofish, RSA, Triple Data Encryption Standard, Advanced Encryption Standard).

Keywords: SACA · CA based multilingual encryption · State transition mapping · Encryption efficiency analysis

1 Introduction

A secure communication system called cryptosystem has been developed for encrypting and decrypting multilingual plaintext based on several rules and regulations. Information secrecy and computation complexity have been increased using cryptosystem. Researchers have introduced different multilingual data encryption technique for providing more security and confidentiality. MTDAS has been developed using character repetition EETUM has been developed using involvement of more characters and Quotient value numerals has been developed using substitution technique [1]. Researchers have introduced MULET based on modulus mapping. Information has been secured from brute force attack and 80% data recovery is possible due to usage of MULET [2].

In proposed approach, authors have applied different syndicate rules to encrypt multilingual data using multilingual keyset.

Authors' aim is to propose a SACA based multilingual encryption algorithm maintaining data security. Objectives of proposed multilingual approach are such as, to establish comparison between proposed multilingual encryption algorithm with existing

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Contents

Cloud Based e-Feedback Services Using Performance Analysis: A Linear Approach

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Abstract. Authors propose an online feedback system having distinct layers to access frameworks through multiple entry points such as, student module, administration module, and teacher module which have been operated from any geographically distributed locations. There is no need to install software based application and no need of extra hardware expenses to access proposed cloud based system due to usage of software-as-a-service, and platform-as-a-service. Students provide specific information to server-side for authenticity regarding entry to feedback questionnaires. Administrative authorities analyze teacher performance based on students' feedback. Teacher observes individual performance from server. Human effort and human activities have been reduced due to usage of paperless feedback. Teacher performance is measured using preparedness, class-performance, responsiveness, effectiveness, and overall grade. Different nodes have been required in proposed system for distributing and replicating data storage in server-side. Time consumption and load distribution of servers are analyzed based on number of users and servers. Different nodes have been accessed by multiple users working with different or same modules of the system. Energy efficient framework has incorporated into proposed system to enhance system performance. Authors have incorporated different weightage factors in energy efficient framework using distinct layers of proposed system. Time complexity and space complexity are measured using proposed algorithms. Web based approach is required in proposed system to reduce manpower consumption and workload. Comparative study between existing feedback systems and proposed feedback system is established based on different characteristics.

Keywords: Cloud based feedback · Multi-user system · Online feedback · Distributed system · Energetic system · Paperless feedback

1 Introduction

Cloud consists of various web services and refers to distinct environment for remote accessing possibilities to the scalable heterogeneous network resources. Cloud Computing provides services to users at minimum cost and interference of service providers. Users access the services of distributed network on demand basis for utilizing a shared

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Data Analysis in Social Network: A Case Study

Mou De[1,2(✉)], Anirban Kundu[1,2], and Nivedita Ray De Sarkar[1,2]

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Abstract. Authors propose a structural design of social networks to study architecture of social networking site and its working principles. Typical social networking sites have three-tier architecture which induces higher searching time for user queries. Our proposal presents a load balancing module for protecting user enquiries before spreading them to data server. In this chapter, query optimization of user queries for faster results has been discussed. Experimentation results exhibit possibilities of data (user queries) failure reduction due to external disturbances. Authors have analyzed large scale data of social network through graph for reducing data loss and minimal network failure to maintain scale free growth in Social network. Properties of interface module and growth coefficient are to be analyzed to exhibit benefits of proposed system architecture for balancing load from web server to data server through Hash table cache, Log table and index control module with scale-free query optimization.

Keywords: Social network (SN) · Query optimization · Social architecture · Distributed network · Data analysis

1 Introduction

SNs provide virtual connections among users by the use of specific domains according to users' choice like sports, cinema, music, and so on. A user is interconnected with SN using share, like, post and joins on particular domains to build their social relationships. User is able to like/follow other profiles unless it is blocked. Users also send friend requests to other persons for connecting to outer world based on particular choices [1–4]. Each social networking site [5–8] needs authenticated/valid users (registered users on particular site and their profiles are visible to public users) who are treated as existing users. Interaction between users through the friendship request using SN makes the relationship/ networking [9–12]. User exchanges their views with other users on SN platform to create a virtual network connectivity using web server and data server working on behalf of users.

User data analysis [13] has a major impact for maintaining data security and network connections among users of SN [14, 15]. In SN [16, 17], user networks are not always structured [18], and do not maintain specific patterns for communication purpose. It is necessary for flawless platform to understand and analyze [19–21] SN data according

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Contents

Security Track

An Automated Reflector Based Traffic Signal System

Somasree Bhadra, Sunirmal Khatua, and Anirban Kundu

Abstract Smart traffic automation is an integral part of smart cities in recent days. Huge amount of energy and power is consumed by the usage of high end computers and electronic devices. An energy optimization technique is proposed in this paper to minimize energy dissipation and power consumption by the existing traffic systems. Green computing concept is implemented in automated traffic system. It is observed that a remarkable amount of energy is dissipated and eventually wasted due to the use of regular electric lights at traffic points. 'Traffic Reflector' concept is introduced in place of regular traffic lights. LED lights or incandescent bulbs in the traffic signal posts would be replaced by the reflectors. Sunlight would be focused on these reflectors by properly placed mirrors. Mirrors would be adjusted automatically to change their angles according to sun's position. Light source would be replaced by solar panel driven light in the absence of sunlight at night or other weather conditions. Energy consumption by traffic signal lights at traffic signal points is minimized by our proposed approach.

Keywords Smart traffic · Green computing · Energy · Reflector · Traffic signal lights

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Contents

Predictive Geospatial Crime Data Analysis and Their Association with Demographic Features Through Machine Learning Approaches

Anupam Mukherjee[1(✉)] and Anupam Ghosh[2]

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Abstract. Crime is a socioeconomic issue that has a negative impact on life quality and economic progress. By identifying crime trends, we will be able to handle difficulties with unique strategies in different criminal categories and improve societal security. This research focuses on the Vancouver crime dataset, with the goal of analyzing and predicting crimes in states using machine learning algorithms. In this work, we develop a model that can be used to estimate the number of crimes committed by category in a given state. Machine learning algorithms have exploded in popularity, making crime prediction possible based on historical data. This work mainly creates ensembled models that perform significantly better results with respect to stability, accuracy and provide more accurate forecasting results compare to the existing algorithms. If we follow data decomposition techniques based on district-wise accuracy rate then the result will outperform the existing methodologies. Geo-spatial crime data analysis is another significant aspect of this work.

Keywords: Geo spatial heat map · Regression · Random forest · Gradient boost · Naïve Bayes · Generalized linear model · Decision tree

1 Introduction

Criminal investigation is a law enforcement activity that includes systematic investigation of trends and patterns in crime and violence. Crime analysis also helps in identifying remedies to crime problems and developing crime prevention methods. Crime investigation is the methodical study of antisocial behavior complications, in addition to other law enforcement issues, such as socio-demographic, geographic, and sequential aspects. Crime analysis, in particular, makes use of both qualitative and quantitative data and procedures [1]. When examining non-numerical data for the purpose of identifying fundamental reasons of corruption, crime predictors employ qualitative data and methodologies. Field research is one of the qualitative tools used in crime analysis (analyzing

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A Novel Noise Removal Technique Influenced by Deep Convolutional Autoencoders on Mammograms

Swarup Kr Ghosh, Biswajit Biswas, and Anupam Ghosh

Abstract Nowadays a lot of deep learning algorithm has been developing for data analytics on both structured and unstructured data. There is a big challenge for biomedical image such as CT image, MRI, X-ray for automatic detection of some deadly diseases. A field of advance deep learning that made available a plethora of architecture as increase the dimension and complexity of the mammogram images has been focused, in this study. Removal of noise is a crucial part for better visibility of noisy mammograms and hence a deep learning method for degrading mammogram restoration scheme has been suggested in this chapter. A deep convolutional denoising autoencoder method based on total variational multi-norm loss function minimization approach has been introduced for the restoration of mammograms. The proposed scheme is utilized to restore the perceptible structural details of mammograms as well as decrease the noise level. Moreover, processing speed for target noisy images is faster than other methods after fine tuning the network. The proposed method has been validated by several state-of-the-art methods.

1 Introduction

Recently, deep learning is becoming very popular tool for feature extraction and classification on large datasets since deep learning in contrast advocates solving the problem end-to-end and creation of abstract feature is a nice property of it. The concept of deep learning is originated from an artificial neural network (ANN). Deep learning takes place a crucial role on medical imaging such that image

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Contents

Machine Learning Based Anxiety Prediction of General Public from Tweets During COVID-19

Shubham Tribedi, Anuraag Biswas, Swarup Kr Ghosh, and Anupam Ghosh

Abstract In this crisis of COVID19, everyone is staying in touch with the world through social media. This has led to social media becoming a significant source of new information for many people and unfortunately this phenomenon has given birth to a lot of misinformation, chaos and fear in people's minds. This fear is often due to the inadequate and wrong information. Therefore, there is a important need to understand this crisis. Patterns need to be established between popular tweets and its effect on the public's sentiments, especially their fear. So, tweets of three different countries namely United States of America, Federative Republic of Brazil and Republic of India. Sentiment analysis reveals that fear of this unknown and mysterious nature of the coronavirus is dominant among the public. Predominant analysis of tweets within past two months will be done and then a model will be built to predict future reaction of the general public based on the crisis level in the country. Machine Learning algorithms such as 'Logistic Regression (LR)', 'Multinomial Naïve Bayes' and 'Support Vector Machine (SVM)'are used for classification purpose preceded by the pre-processing steps of raw data from each country. 90% of accuracy has been achieved from sentiment classification result. Insights to the fear, sentiments have also been provided. Tweets with negative sentiment and emotion indicates the cases for the pandemic outbreak.

Keywords Fear · Sentiments · Negative emotion · Twitter · Machine learning · Public awareness

1 Introduction

Sentiment Analysis is the classification, understanding, interpretation, definition of all sorts of emotions which one uses in his or her text. In one way it can be said that this is an analysis of text technique which allows one to understand the sentiment

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Multi-level Feature-Based Subcellular Location Prediction of Apoptosis Proteins

Soumyendu Sekhar Bandyopadhyay, Anup Kumar Halder, Kaustav Sengupta, Piyali Chatterjee, Mita Nasipuri, Dariusz Plewczynski, and Subhadip Basu

Abstract Apoptosis is considered a vital component of various processes including normal cell turnover, proper development and functioning of the immune system, hormone-dependent atrophy, embryonic development, and chemical-induced cell death (Elmore in Toxicol Pathol 35:495–516, 20). Apoptosis proteins are strongly related to many diseases like neurodegenerative diseases, ischemic damage, autoimmune disorders, and many types of cancer and play an indispensable role in maintaining the dynamic balance between cell death and division. Many apoptosis proteins are identified but their activity at cellular or molecular level needs to be investigated. The prediction of subcellular localization of an apoptosis protein is still a challenging task. The subcellular localization prediction of apoptosis proteins can help to understand their function and the role of metabolic processes. In this paper, we have

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Electronics and Communications

Prediction of COVID-19 Drug Targets Based on Protein Sequence and Network Properties Using Machine Learning Algorithm

Barnali Chakraborty, Atri Adhikari, Akash Kumar Bhagat, AbhinavRaj Gautam, Piyali Chatterjee, and Sovan Saha

Abstract Recently, human health has been critically exposed to a pandemic caused by coronavirus (COVID-19), which has threatened public health for the last 2 years. Some medications that treat other diseases seem effective in treating COVID-19 without explicit support. A search for new drug/drug targets is underway. This research will focus on the main virus-based and host-based targets that may provide valuable insights into discovering drugs in medicinal chemistry. The task of identification and selection of drug targets is becoming very promising research in drug discovery. Computational approach-based analyzes are beneficial in providing information about the principles of proteins and drugs by analyzing drug target features. At the same time, in-silico target identification becomes attractive in terms of time and cost for large-scale human genomic and proteomic data. This work mainly deals with predicting COVID-19 drug targets and non-targets in humans through several machine learning approaches like decision tree, random forest classifier, support vector machine, K-means, and logistic regression based on protein sequence features and network properties. However, the random forest classifier seems to obtain an overall accuracy of 0.83, significantly higher than the other existing *state-of*-the-*arts*.

Keywords COVID-19; Drug targets · Machine learning · Random forest classifier · Protein sequence features · Network features · Protein–protein interaction network · COVID-19 drug targets · COVID-19 drug non-targets

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M-Bagging: A New Modified Bagging Classification Model to Improve Prediction accuracy

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M-Bagging: A New Modified Bagging Classification Model to Improve Prediction accuracy

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ABSTRACT
Ensemble learning is a one kind of machine learning technique that improves the performance and robustness of the classification models and how the outputs of base classifiers are combined is one of the fundamental challenges in ensemble learning systems. Among different types of ensemble learning models, Bagging is most popular due to its simplicity but Bagging has several drawbacks. As for example in bootstrapped creation out of bag samples are not used properly or it does not take care for misclassified samples and it uses homogeneous classifiers. So, in this work, we have developed a modified bagging ensemble classification model by embedding modified bootstrapping techniques so that misclassified samples are specially taken care, out of bag samples are also taken care. Apart from these several heterogeneous classifiers are also used here in novel manner. From experimental results it has been found that the proposed model is superior compared to other existing basic ensemble models as well as other state of the art models.

KEYWORDS
Ensemble learning; Bagging; Bootstrapping; Classification; Class imbalance.

1. INTRODUCTION

In machine learning, ensemble learning [1] is one of the most important algorithms and is based on the supervised learning technique. Ensembles learning systems are inspired from the nature of decision making process of human beings. This is because humans tend to take decisions based on different factors. They also take opinions of other people to make decisions. Let us take an example to describe the process. Suppose when we buy a particular product from an e-commerce portal, we try to check for price of the same product from different sellers. We check the quality and specifications of the product. We also check the ratings of the product and also read the reviews of various customers who bought the product. In this way we decide whether to buy that product or not instead of buying it blindly. In Machine learning, the same thing is done using ensemble learning systems [1].

The word Ensemble means “union of parts” which is derived from Latin [2]. In ensemble learning, results of different classifiers are combined together using different approaches to give a new result which is better than the individual results of those classifiers. This concept of integrating classifiers provided new direction in improving the performance of regular classifiers. The regular classifiers when run independently often give poor performance when applied on large and high dimensional datasets. These classifiers also cannot handle class imbalance problem in an efficient way. To reduce these errors and improve their performance, ensemble learners are needed to construct by combining their predictions [1, 2].Today ensemble learning systems are used in wide range of real world applications such as in biomedical, finance, politics, medicine etc.

There are four different category based ensemble classifiers- Bagging, Boosting, Stacking and Blending [1]. Among these four categories, bagging model, introduced by Breiman, is one of the most popular and successful ensemble classifier to improve accuracy of classification [2]. Bagging [2,3] is also known as Bootstrap Aggregation as it aggregates various versions of prediction accuracy of a weak learner when it is applied independently on various bootstrapped versions of the original training dataset. Every bootstrapped version of the training dataset is created by random sampling with replacement procedure. In this model first different bootstrapped versions are created and then a machine learning model is trained on these bootstrapped datasets independently and run in parallel. After training, the predictions of these models are combined using majority voting or weighted average method or using other approach to get the final prediction. However Bagging work with homogeneous classifier where only a single base classifier or weak learner is used.

Although Bagging is a popular classifier, it has several drawbacks. The first drawback is that as it generates different bootstrapped datasets by selecting samples randomly from the training dataset so some samples are not selected at all (out of bag samples) and so some samples are not used in the training phase. Secondly drawback is that it does not take any special care for the samples which are not properly classified in the training phase. The third drawback is that for every bootstrapped version it uses homogeneous classifiers such as either decision tree or SVM or KNN and so on. It results small variance but stable classifiers like KNN or SVMs generally does not generate in smaller classification error rates. So, there is no significance improvement in result via running computationally extensive classification methods on different bootstrapped versions. Apart from this, it is very difficult to judge that which classification algorithm does have the best

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Contents

IoT-Based Secure Blockchain Framework for Patient Record Management Using MPRESENT Lightweight Block Cipher

Rajdeep Chakraborty and Runa Chatterjee

Abstract This paper deals with the patient record management framework and its security by our novel lightweight block cipher MPRESENT. Blockchain is a distributed data repository and used nowadays in various use cases, and one of them is Patient Record Management. Blockchain also provides a trusted distributed network. Internet of things (IoT) is the one mostly used network to record patient data in various units of a hospital. A Blockchain framework for storing patient records and its management from IoT devices installed at various units in a hospital and the security established by lightweight block cipher is proposed in this paper. Further, we also provided a second layer of security in the IoT sensor layer through MPRESENT.

Keywords IoT · Lightweight cryptography · Blockchain · Patient Record Management

1 Introduction

This section gives a brief introduction of Internet of things (IoT) and lightweight cryptography (LWC). Section 1.1 discusses the basics of Internet of things (IoT), and Sect. 1.2 and Sect. 1.3 discuss lightweight cryptography and the Blockchain, respectively.

1.1 Internet of Things (IoT)

Many advanced devices are currently being used in the progressive world which are highly constrained. To accomplish some tasks, these devices are interconnected and communicated by transferring information to one another. The Internet of things (IoT) is one of the important areas where we use these advanced devices. The IoT

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Contents

Chapter 12
LiFi-Based Energy-Efficient Traffic Sensing and Controlling System Management for Smart City Application

Abhinandan Sarkar, Rajdeep Chakraborty, and Hoimanti Dutta

Abstract Alternative research efforts have been conducted for the last few years to overcome the deficit spectrum of electromagnetic waves which can release the network traffic from the saturated radio frequency domain. With some of the culture and development, it can be stated that optical wireless communication can lead to a new spectrum of data sharing. Consumption of data and its usage has increased more than 100 times in the last 10 years. Development of around 80 billion IOT systems has also contributed to the crisis of radio spectrum availability and increased traffic. It is forecasted that by 2022 there will be use of around 50 zettabytes of data, that can be imagined as many bits of stars and planets in the universe. With the recent contribution from researches, a new domain has been termed as visible light communication (VLC) and will reinforce the communication protocol. In this domain, the architectural transformation resulted in light fidelity (Li-Fi), replacing the wireless fidelity (WiFi) with added security and unrestricted bandwidth allocation.

There are 300 Tetra Hz unused bandwidth (1000 times 300 Giga Hz of radio frequency spectrum) available at higher frequencies in the visible light spectrum. LiFi uses the visible light spectrum for communication, which is much faster than radio frequency, and can be easily used in near field communication. Many researches have served with multiple conceptions and misconceptions in this experimental area. The technology is advancing with the speed of its own concept, visible light. Establishing the liable system and computing the data, parametrical diversity is in progress. Professor Harald Haas of Edinburgh University has provided many clear out reach for the proposed system. Many tech-giants have configured their own. But in our daily life, bringing ease to our society has been a concept and dream till now. Converging all the thought at a point with the recent development and implementation, in this chapter we claim to successfully design a light fidelity-based system, which can be used for traffic signal sensing and managing, and it will be energy efficient. As it is studied that LiFi system transmits data through LED and receives through photocell,

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PSO Optimized Decentralized Secondary Control for Frequency and Voltage Restoration in Islanded AC Microgrid

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***Abstract*—This paper proposes a decentralized secondary control scheme suitable for islanded microgrid consist of multiple VF controlled inverters connected in parallel. The controller is based on proportional-integral control to maintain frequency and voltage under different load switching conditions. Moreover improved system performance and reliability are accomplished by managing proper power sharing among the participating inverters. Particle swam optimization is adopted to find best suitable gain parameters of the proportional-integral controller. Multiple simulation results of the islanded microgrid using MATLAB are discussed in detail to establish the above mentioned two main objectives of the paper i.e. maintaining frequency, voltage and balance load sharing among inverters.**

Keywords*— *Adaptive droop curve positioning, decentralized secondary droop control, islanded microgrid, particle swam optimization.

I. Introduction

The present day microgrid (MG) can be considered as a flexible electrical network consisting of different components like distributed energy resources (DERs), energy storage systems (ESSs), different power electronics converters and different types of loads operating in unison with protection, energy management and different controllers [1]. It can operate efficiently both in islanding mode and in grid connected mode. For grid connected mode MG frequency and voltage is directly controlled by the grid, whereas in islanded mode voltage and frequency control is solely handled by MG by introducing different controllers [2].

The control of parallel operation, having multiple inverters connected DERs is difficult under islanding operation due to absence of utility grid. Thus for islanding operation voltage and frequency (VF) control (grid-forming) is essential for the inverters for proper regulation and control of frequency and voltage under load variation conditions within an acceptable limit [3][4].

In islanding operation various disturbances often take place to create challenges for the participating controllers to sustain system nominal voltage and frequency. Hierarchical control schemes were proposed earlier to handle such difficulties where three layer control approach i.e. primary, secondary and tertiary control are recently used [5].

The responsibility of primary control is to manage active and reactive power sharing and regulate the MG operating voltage and frequency [6]. To accomplish these duties both centralized and decentralized architectures are used [7]. This paper adopts the decentralized droop control approach to ensure communication free 'plug-and-play' function. Since droop control often suffers from poor voltage and frequency regulation secondary controllers are required to accompany primary controller to restore voltage and frequency [8]. Generally due to frequent switching of different types of load, frequent frequency and voltage fluctuations are experienced by MG during islanding operation. The centralized secondary control scheme addresses such disturbances by involving a centralized controller and strong communication network among all the sections of MG [9]. MG with increased size and capacity may suffer from serious reliability; stability issues due to failure or delay in communications [10][11]. Thus decentralized secondary controllers are preferable over centralized one as distributed independent controllers are available for individual DER units to regulate voltage and frequency. Moreover communication free control approach overcomes the unnecessary complexities, reliability and stability issues with increased capacity of MG [12]. The main function of tertiary controller is to accomplish economic dispatch and optimal power flow between utility grid and MG [13].

This paper attempts to put forward a distributed secondary control scheme to restore frequency and voltage fluctuations under frequent load switching conditions in islanded MG. For the above mentioned advantages

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Implementation of Linear Quadratic Regulator in an Isolated Microgrid System

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***Abstract*—This paper elaborates a linear–quadratic–regulator (LQR) technique for an isolated microgrid in presence of electric vehicle (EV) and renewable power system (RPS) participation. Generally, in control theory the state feed-back control can place the poles in the desired locations in order to improve stability but many a time, it is observed that the steady state error is appropriately not achieved as well as the overall cost is compromised. In this connection, LQR control theory helps to obtain the feedback gain optimally using quadratic cost function. The weight adjustment matrices in LQR control theory requires to adjust in order to achieve desired system response. Hence, the weight matrices are adjusted to achieve optimal operating condition based on the proposed flow chart. Numerous, test cases are carried out considering different system configurations to validate performance and efficacy of the controller under MATLAB / Simulink environment.**

***Keywords*—Automatic generation control (AGC), electric vehicle (EV), islanded microgrid, linear quadratic regulator (LQR), optimal state feed-back control.**

I. Introduction

Automatic generation control (AGC) is utilized widely in modern power system to improve the dynamic system per-formances. It regulates the power-frequency balance incorpo-rating a synchronism between total generated power and total load demand. The unwanted frequency oscillation is developed when an imbalance is occurred between the generated power and load demand. Sometimes these oscillations are increasing extensively so that the overall system performance is hampered [1], [2]. In the modern power system, renewable power sys-tems (RPSs) like solar power systems (SPSs) and wind power systems (WPSs) are widely used. Additionally, the widespread usage of energy storage devices (ESDs) (like electric vehicles (EVs), battery energy storage (BES) unit, flywheel energy storage (FES) unit) are increased in a greater extent. These RPSs and ESDs are combined to form microgrid. Further, the output power obtained from the RPSs are intermittent in nature and highly environment dependent. Therefore, integration of these RPSs may cause power imbalance in the system and create frequency oscillation in power network. To overcome this situation ESDs become a unique solution to deliver power immediately whenever sudden load demand is occurred or the demanded power exceeds to the generated power [3]. Nowadays, Diesel engine generators are also utilized with RPSs and ESDs to enhance overall system performance and reliability [4].

In the past few decades, a huge development is observed in utilizing ESD units. ESDs store energy when surplus energy is available from RPG units and utilize it whenever required. Among all, EVs got more popularity and a huge application of EVs can be observed in present scenario. EVs are utilized as portable BES units and highly efficient to fulfill sudden power demand [5]–[7]. In current time, microgrid based power systems are more common. Microgrids can be utilized in grid connected mode or isolated mode operations. Isolated microgrid operation are very much sensitive compared to grid connected operation. In this regard, a special attention must be provided to control and protect the microgrid based isolated power system [8], [9].

Over the years, huge attentions are provided for controlling power-frequency balance in order to perform AGC operation. Among various available controllers proportional, integral and derivative (PID) controller, Fuzzy-PID controllers are gaining utmost popularity [10], [11]. A wide application of optimal control (e.g. LQR) theory is also seen in numerous articles. However, the application is restricted to hydro-thermal based RPS integrated interconnected power systems [12]–[15]. Fur-ther, a huge area yet to be revealed to investigate the effect of optimal control in isolated power system. Many a research arti-cle incorporated several metaheuristic optimization techniques to obtain the proper controller gain parameters. Imperialist competitive algorithm (ICA) [1],whale optimization algorithm (WOA) [2], [17], particle swarm optimization (PSO) [4], [16], flower pollination algorithm [7], genetic algorithm (GA), adaptive differential evolution (ADE), hybrid DE-grey wolf optimization (hDEGWO), water cycle algorithm (WCA) [9]–[11] are considered as popular algorithms. Notwithstanding, due to huge popularity, flexibility and wide application LQR technique is utilized here for conducting the test cases.

After inspecting various published research works, the re-search gap as well as the contributions of this paper are furnished as follows.

- Previously, most of the cases optimal control theory is considered in interconnected power system operation. In this article, special attention is given investigating the isolated power system scenario in presence of optimal control theory.
- In the earlier research work, the application of microgrid

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***Abstract*— Nowadays, microgrid is utilised as a flexible replacement to the conventional power system. Therefore, special attention must be provided for the proper microgrid based power system design. Earlier, various articles presented the interconnected microgrid operation. However, less attention is given towards the proper tie-line modeling considering high resistance-inductive reactance (R/X) ratio in the interconnected microgrid operation. Considering the research gap, towards the proper designing of tie-line modeling, this paper presents an improved power tie-line model in an interconnected microgrid in presence of plug-in electric vehicle. Various case studies are carried out for validating the proper designing technique under various load disturbances in presence of uncertain output power from intermittent power generating units. The functioning of the proposed work is validated, connecting the proposed model in a 12-node distribution network. The proposed model shows its effectiveness and superiority compared to other available designing conditions.**

Keywords- Automatic generation control (AGC), distribution network, interconnected microgrid, modified PID, plug-in electric vehicle (PEV), tie-line design.

NOMENCLATURE

Δf	=	Frequency Deviation	T_{DEG}	=	DEG time constant
K_{SPG}	=	SPG gain	T_D	=	Delay time constant
T_{SPG}	=	SPG time constant	K_{SOC}	=	State of charge of PEV
K_{WPG}	=	WPG gain	T_{BCU}	=	BCU time constant
T_{WPG}	=	SPG time constant	K_P	=	Proportional controller gain
K_{LIC}	=	LIC gain	K_I	=	Integral controller gain
T_{LIC}	=	LIC time constant	K_D	=	Derivative controller gain

I. INTRODUCTION

In modern power system, renewable power generators (RPGs) are gaining tremendous popularities among the researchers and industrialists because it can generate green and clean power without harming the environmental conditions. Now-a-days, solar power generators (SPGs), wind power generators (WPGs), plug-in electric vehicles (PEVs) are gaining more popularities, among various available RPGs. Furthermore, employment of diesel engine generators (DEGs) in combine with mix of RPGs become a suitable option for accurate load demand mitigation [1][2]. Therefore, this paper presents the combined operation of RPGs for suitable power balance between generation and load.

Last few decades, a special attention is given to the microgrid operation as a massive growth of utilisation of RPGs in power grids is observed. Mostly, RPGs are environment dependent and intermittent in nature [3]. This characteristic cause a generation-load power mismatches which results oscillations in the power grids. If this oscillation sustain for a longer duration and not controlled, that may result power system instability [4]. In this connection automatic generation control (AGC) is incorporated to maintain the balance between generation and demanded power [5][6]. This results proper and synchronized power system operation

In recent years, a significant growth of utilisation of PEVs in power system operation is observed. PEVs are utilised both in islanded mode [5][7]-[11] as well as interconnected mode [2][12]-[15]. A PEV based islanded AC microgrid is proposed in presence of system uncertainties [7][8]. Khalghani et al. investigated the effect of false data injection in power-frequency balance in an islanded microgrid operation under real-time test scenario [9]. Further, the effect of participation of PEV in power system stability under islanded mode operation was investigated in [10][11]. Hydro-thermal power system including PEV is examined in [12][13]. The effect of PEV in system performance under interconnected deregulated power system is investigated in [14][15].

A substantial number of controllers and metaheuristic techniques are implemented in AGC studies under isolated and interconnected power system operation. Some of the notable controller can be mentioned as, model free sliding mode controller (MFSMC) [1], fractional order proportional integral and derivative (FOPID) controller [2][14], model predictive control (MPC) [5], cascaded PD-PI [7], fuzzy logic controller (FLC) [7][12][15], PID controller [16][17]. Moreover, some of the notable metaheuristic techniques are presented as, modified black hole algorithm (MBHA) [1], water cycle algorithm (WCA) [2], Whale Optimization Algorithm (WOA) [7], imperialist competitive algorithm (ICA) [12][15], particle swarm optimization [16]-[18].

After analyzing all the previously presented literatures, the specific research gaps can be pointed out for conducting this research work as follows. The resistance / inductive reactance (R/X) ratio is higher in the RES based interconnected microgrid

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A Hybrid Compensator for Mitigation of Power Quality Issues in Distribution Systems

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***Abstract*—This paper proposes a hybrid compensator for mitigating power quality problems in distribution systems. The hybrid compensator constitutes of Thyristor Switched Capacitor (TSC), Thyristor Controlled Reactor (TCR), a lower rating D-STATCOM and a 5th harmonic tuned passive LC filter. The Static var Compensator (SVC) or the TCR-TSC combination works in a coordinated way for the base var compensation. The D-STATCOM works in a coordinated scheme with the SVC and the single tuned LC filter to compensate fundamental var, reduce voltage flicker and also attenuate harmonic currents at the Point of Common Coupling (PCC). The D-STATCOM thus serves a dual role as a var compensator and as an active filter in Selective Harmonic Compensation (SHC) mode to attenuate the 7th harmonic current, hence improving the var compensation and harmonic current filtering at PCC. The proposed hybrid configuration exhibits very low line current THD in accordance with the relevant standards. Also the chance of resonance of the fixed passive filter with the source inductance has been eliminated in the coordination scheme. The simulation results show that the proposed hybrid system compensates var, reduces voltage flicker and harmonic currents at the PCC effectively. The proposed control and coordination scheme is simple to execute besides the hybrid system being highly robust in performance.**

Keywords—hybrid var compensator, Δ-TCR, tuned passive filter, hybrid filter, power quality.

I. INTRODUCTION

The line-commutated thyristor based Static var Compensator (SVC) [1-2] has been widely accepted for utilization in AC transmission and distribution systems owing to its high power handling capability, reliability, robust performance, simple control and economic feasibility. The SVC may comprise of combinations [3] of Thyristor Controlled Reactor (TCR), Fixed Capacitor (FC) and Thyristor Switched Capacitor (TSC). The SVC can provide reactive power support to the distribution system, maintain bus voltage levels and improve power factor. On the contrary, self-commutated Pulse Width Modulation (PWM) based devices viz., D-STATCOM, exhibits better performance to reduce voltage flicker compared to SVC [4-5] and can also control harmonic currents at the PCC [6-7].

The issue of harmonic currents in the system can be addressed using fixed passive filters. However, such filters increase the possibility of resonance with the source inductance and may lead to high current transients at lower harmonic frequencies. The active filter does not involve the use of large reactors and also eliminates the possibility of resonance with the source inductance. However, there are still some limitations and associated costs with using of active filter at very high bus voltage and power ratings. An active filter in Overall Harmonic Compensation (OHC) [4] mode can create great computational burden on the microcontroller due to the effect of phase delay of higher order harmonics in the low pass filter and consequent need for compensation of delay. Hence, a hybrid filter by combination of shunt active filter in selective harmonic compensation (SHC) mode and a passive filter is the right choice to enhance the function of filter.

There are different hybrid filters and hybrid var compensators mentioned in the literature, some of which are briefly discussed in this section. A scheme based on TCR with a combination of passive LC tuned filter and an active filter [8-9] had been presented involving coordination between multiple devices. Another scheme of hybrid active power filters (HAPF) mentioned in the literature comprises of thyristor controlled LC module with active inverter part [10-12]. The LC coupling module reduces the voltage rating of the active inverter part and parallel SVC reduces the current rating. The thyristor controlled part achieves var compensation while the harmonic control is done by the active part. Although the above yields good results, a solution simultaneously addressing the problems of harmonic control, var burden & voltage flicker is yet to be explored.

Some work based on hybrid var compensators have been observed to be constituting of multiple 1st & 2nd generation series and shunt FACTS devices operating in coordination to enhance available transfer capability of line [13-15]. Other work on hybrid var compensators mentioned in the literature have been observed to be constituting of TSC & TCR banks along with self-commutating PWM based converters working in coordination [16-19]. Use of a coordination control system driven by a decision making system has been found in the above work. In these cases, the harmonic compensation at the PCC is not being addressed and hence does not provide a complete and simpler solution to the most significant power quality issues.

In this paper, a 3-phase hybrid system with a simple configuration and control scheme is proposed to cater to the issues of voltage flicker, var demand and harmonic control. The dominant line current harmonics at the PCC due to non-linear loads or PWM based drives are 5th harmonic with negative sequence effect and 7th harmonic with positive sequence effect on the system. The proposed hybrid system comprises of a SVC, a lower rating D-STATCOM and tuned LC filter. The SVC compensates base var demand to maintain unity power factor and voltage level at the PCC. The D-STATCOM works in a combined way with the SVC to mitigate voltage flicker at the PCC and attenuates harmonic currents in coordination with the tuned passive filter. The hybrid system meets the relevant harmonic standards and flicker margins [5-6]. The details of the control and performance indices of the proposed hybrid system have been presented.

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DATA STRUCTURES AND ALGORITHMS IN C AND PYTHON

Chandan Banerjee
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Data structure is a special way of organizing and storing data in the computer memory so that data can be accessed more efficiently. It is indispensible for the proper functioning of many computer algorithms. This book discusses Data Structures and Algorithms, laying emphasis on the concepts and covering the syllabus of B.E., B.Tech., B.Sc., BCA and MCA courses offered in nearly all Indian Universities.

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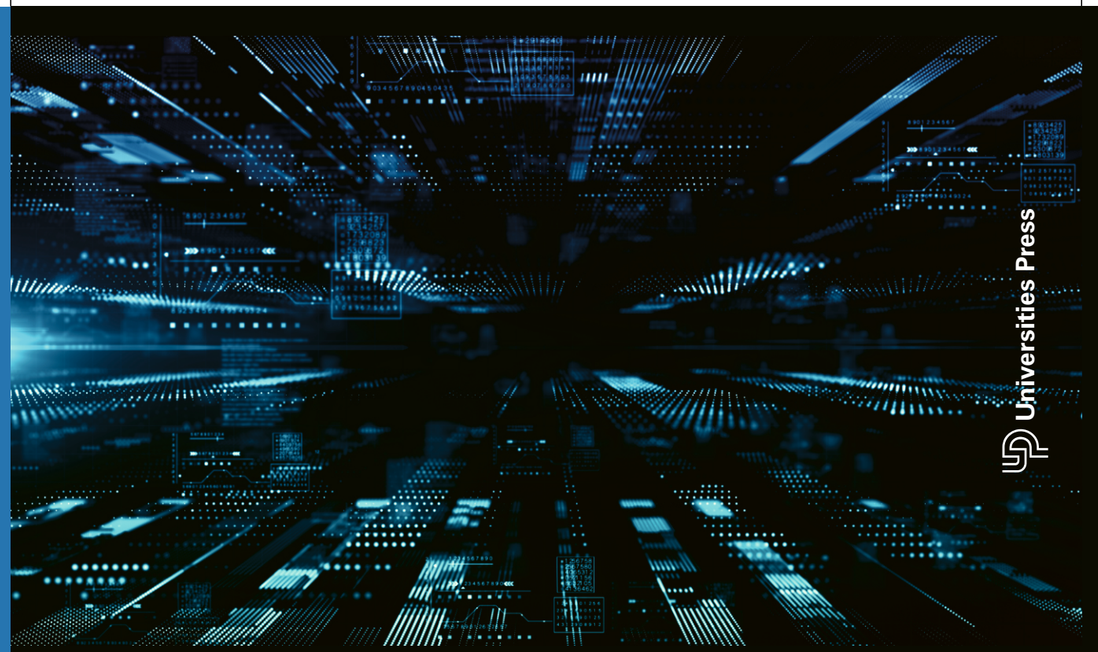

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Skill Oriented Career Goal Recommendation Using Fuzzy Assignment Problem

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Skill Oriented Career Goal Recommendation Using Fuzzy Assignment Problem

Sonali Banerjee, Kaustuv Deb, Atanu Das, Rajib Bag

Abstract— **Learners choose the career path to achieve their goals in lives depending on their individual competency factors like knowledge, skill, interests and abilities. Young learners often find difficulty and confusion due to lack of experience to reach their desired goals. Analyzing the learners' competencies at a personalized level can be vital factor to provide a solution of these problems. This analysis may be conducted using a Fuzzy Assignment Problem (FAP) based on skill analysis. This paper defines a FAP for finding the career path for the learners. FAP is then converted to a crisp assignment problem using the Magnitude Ranking Method which is further solved by the Hungarian Assignment Method. This method is explored to identify goals or career paths according to learners' different skill sets. It is anticipated that this method shall help learners by providing a relevant optimal career path suggestions, maybe in multiple numbers, based on their skills.**

Index Terms— **Carrier Path Recommendation, Fuzzy Assignment Problem, Hungarian Assignment Method, Magnitude Ranking Method.**

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A New Analytical Approach for Smart Retail Shopping Using IOT

Joy Chatterjee, Manab Kumar Das, Sayon Ghosh, Rajib Bag, Atanu Das

Abstract— **Big data management systems that include data reservoirs have greater benefits in the areas of retail shopping. Personalization in physical shopping using Bluetooth enable device connected with mobile devices is introduced to increase the ability to access, analyze, and manage vast volumes of data while rapidly evolving the information from any particular customer. The proposed work represents the current trends and architecture in the field of physical retail shopping using smart system. This proposal helps the retailers to improve business efficiency and performance by employing k-means algorithms to determine which products are really searched. This information is also used to predict the top products across categories for a specific customer. Beacon a most popular Bluetooth device which is introduced to make smart shopping more popular without any internet connectivity from customers end during physical visit. But Beacons are connected to internet to give updated information to the customer regarding the products standing by or searching remotely. The main objective is to improve the analysis of customers' sentiment and to provide the best product with less effort and less time consumption. With the right tools, organizations can run smart retail analytics which help them tackle real-time challenges at different levels. Some retail analytics software can even recommend discounts and recognize associated products by analyzing transactions of customer.**

Index Terms— **Beacon, Internet of Things (IoT), k-means algorithms, Retail Shopping, Sentiment analysis**

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A Thermodynamic Study of a Conventional 500 MW Coal Fired Power Plant Hybridized with Solar Energy

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Abstract

In this work, an effort is made to evaluate the performance improvement and harmful emission reduction of a 500 Megawatt conventional coal-fired thermal power plant by installing a parabolic solar trough at the low pressure heater for regeneration. Here, parabolic solar troughs are used in place of LP heaters for heating the feed water before it enters the economizer of the boiler. As a result, the steam flow rate through turbines will increase, which boosts the work output and also decreases the overall coal consumption, resulting in a huge reduction of harmful emissions of various gases as well as a reduction in the investment cost on coal. As an outcome, the objective of this research is to develop a thermodynamic model that can be used to quantify improvements in network output, total thermal efficiency, and daily coal consumption while reducing ash generation, SO_2, and CO_2 emissions.

1.0 Introduction

Nowadays, the increasing demand of energy has been met mostly by coal-fired thermal power plants. The power conversion efficiency of coal to electrical energy in steam power plants is low and toxic pollutants from the combustion of fossil fuels like coal have a major detrimental impact on the environment and humans. Moreover, inefficient use of coal creates different negative impacts on environment. The primary objective in today's world is to harness the power of the sun. The sun's energy is free, and it's also environmentally friendly, meaning it won't pollute the environment significantly. Solar energy can be used in thermal power stations to reduce the need for coal, which will not only save nature but also save us. Therefore, a strategy is taken to use solar energy in a 500 Megawatt conventional coal-fired thermal power plant for regeneration by installing parabolic solar troughs in place of low pressure heaters. As a result steam flow rate through low pressure turbine will increase with the increase of electricity generation as well as reduction of coal requirement.

Some related research literature has been studied in this work initially in order to comprehend the principles of solar hybridising by parabolic solar trough at the position of LP heater and its thermodynamics performance analysis by thermodynamic 1st and 2nd law.

In a study by Sorour Alotaibi et al. [1], the performance of a 300-megawatt traditional steam power plant in Kuwait was analysed after it was fitted with a solar-aided regenerative system using Parabolic Trough Solar Collectors (PTC) with an aperture area of 25,850 m^2 by eliminating low-pressure (LP) turbine extractions without changing other features. The system study showed that removing the LP turbine extractions increased the

OPEN ACCESS PEER-REVIEWED CHAPTER

Investigation of Strain Effect on Cleavage Fracture for Reactor Pressure Vessel Material

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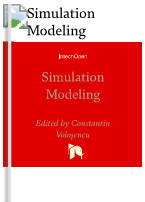

FROM THE EDITED VOLUME

Simulation Modeling

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Abstract

Failure mechanism of 20MnMoNi55 steel in the lower self of ductile to brittle transition (DBT) region is considered as brittle fracture but it has been observed from the experimental analysis of stress-strain diagram that clear plastic deformation is shown by the material before failure. Therefore, strain correction is implemented in the cleavage fracture model proposed by different researchers in the lower self of the DBT region with the help of finite element analysis. To avoid a huge number of experiments being performed, Monte Carlo simulation is used to generate a huge number of random data at different temperatures in the lower self of the DBT region for calibration of the cleavage parameters with the help of the master curve methodology. Fracture toughness calculated after strain correction through different models are validated with experimental results for the different probability of failures.

Keywords

fracture toughness | plastic strain | reactor pressure vessel | master curve | finite element analysis

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1. Introduction

Regular maintenance of the reactor pressure vessel (RPV) is an important criterion that has to be considered where safety is the prime requirement for any country. In that respect embrittlement of the RPV material has to be quantified concerning reference temperature T_0. In the last few decades, several researchers tried to quantify this embrittlement nature of ferritic steel in RPV materials. Among them, the work done by Kim Wallin with the development of ASTM E1921 and master curve [, ,] proved to be quite impressive and acceptable in quantifying embrittlement for different ferritic steels used in reactor pressure vessels with the help of reference temperature T_0.

It has been observed in our previous work that references temperature (T_0) predicted for 20MnMoNi55 steel is constraint dependent [ ] and it varies with different crack length, thickness, and geometry of the specimen. It also shows the variation with test temperature and censor parameter "m".

This observation is also predicted by different researchers [, , , , ,] working in this field of ductile to brittle transition (DBT) region for different RPV materials.

Therefore, in the last few years, the main aim of the researchers was focused to study the constraint effects of reference temperature T_0 for RPV materials. Finite element analysis is considered a useful tool to study the stress distribution near the crack tip of the specimen at different temperatures in the

Chapter sections

the loss of constraint effect on the reference temperature T_0 for these RPV materials with the help of these three stress-based parameters in his earlier work [ ]. A satisfactory correlation of the constraint

Basabi Chakraborty · Arindam Biswas ·
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Contents

Plant Disease Identification Through Study of Leaf Images

Consolidated Handcrafted and Automated Features for Enhanced Feature Generalization

Aniket Das, Piyasi Das, Amlan Chakrabarti, Rik Das, and Chira Dutta

1 Introduction

Enhancements in global population, higher food security, and demand have become a predominant challenge in the field of agriculture and science for the last 5–6 decades. According to the research statistics, by 2050, the world will face massive demographic changes as about two third of the population will migrate to cities [1]. Meeting the food demand and quality requires agricultural development to play a humongous role in upcoming days. But the threats of famine and disease infestations are also increasing due to rapid climate change. Poor disease control, lack of early detection, diversity of pathogens and symptoms, and rapid genetic changes in the pathogens are the key features in the calamity of dwindled food production. The major bottleneck in the sector is the lack of expertise and training of the farmers and the ever-changing genomic nature of the pathogens [2]. Our goal is to analyse a method of computer-aided diagnosis (CAD) of affected crops. The disease detection involves identification of visual patterns on plant leaves and monitoring it. The process is reliant on the feature vector extraction from the leaf images. The high accuracy assurance comes with the challenge of the generalization of feature descriptors. The use of pre-trained models has been done to extract essential feature data from

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Contents

A Novel Dual Metal Double Gate Grooved Trench MOS Transistor: Proposal and Investigation

Saheli Sarkhel, Riya Rani Dey, Soumyarshi Das, Sweta Sarkar, Toushik Santra, and Navjeet Bagga

Abstract Through this paper, we have propounded and investigated a novel structure of a grooved trench MOS transistor with double gate architecture using TCAD simulations. To date, only a single metal trench MOSFET has been reported which having weaker control of the gate bias over the channel charge, unlike improved in our propounded structure. The propounded dual metal double gate grooved trench (DMDGGT) structure incorporated the advantages of enhanced gate controllability and subdued the drain-induced barrier lowering (DIBL) owing to the presence of a bi-metal gate with dissimilar work functions. In addition, due to the inherent advantage of a grooved trench gate device of having a longer effective channel length by the trench gate geometry, the device results in a significant reduction in short-channel effects (SCEs). The acquired results from the SILVACO ATLAS simulation exhibit a significant improvement of the propounded DMDGGT MOSFET as compared to its single metal counterpart for surface potential, electric field, threshold voltage, and drain characteristics, thereby substantiating the efficacy of the propounded device structure.

Keywords Trench gate MOSFET · Double gate · Drain-induced barrier lowering · Short-channel effect · Threshold voltage roll-off

1 Introduction

The ever-increasing demand for improved speed and better as well as higher integration capability has enabled the scaling of the MOSFETs to satisfy the demands. This downscaling has brought down the device dimensions to sub-micron order, which has introduced us to some unavoidable problems in fabricating, realizing, and utilizing

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Statistical Analysis of a Low Power Analog Current Source

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***Abstract* - This paper presents a low power PTAT(proportional to absolute temperature) current reference circuit, designed in 180nm scl technology and simulated using LTspice software. A resistor less circuit is designed to generate 1nA reference current(Iref) at a supply voltage(Vdd) of 0.44 V. Monte Carlo analysis of the circuit is performed with respect to two process parameters ,namely, oxide thickness(tox) and threshold voltage(vth). Individual variations as well as simultaneous variations of these parameters have been considered while analyzing the performance of the circuit. Statistical analysis, of the current values obtained, has been performed and the results have been verified through software like Python and SPSS (Statistical Package for the Social Sciences). At a later part of the project, Python automation is performed, where the LTspice software can be accessed and simulated without actually opening the software, but through Python codes.**

Keywords - low power, weak-inversion region, power supply sensitivity, Monte-Carlo, python automation, skewness, kurtosis, mean, standard deviation.

I. Introduction

Current reference circuits are one of the most important building blocks in analog and mixed- mode circuit systems. These circuits generate a reference current and are used in op-amps, oscillators, phase-locked loops, and A/D and D/A converters. As the demand for efficient low- power circuits has significantly increased in recent times owing to the demand for long-lasting batteries in handheld devices, low-voltage current reference circuits have been investigated. For ultra low power analog circuits where the supply voltage is limited to 1.8V or less than that, it becomes essential to design a stable reference current source of 1nA or less. Circuits with reference currents of only several nano-amperes have also been reported. We have designed the circuit in LTspice software in scl 180 nm technology. The region of operation of MOSFET chosen for our work is sub-threshold or weak inversion region. A resistorless circuit has been designed, with W/L values such that it works efficiently in the weak inversion region. This circuit provides a reference current of 1 nA and operates at a supply voltage of 0.44 V. Thereafter, the circuit has been simulated in LTspice to check its functioning at various conditions. The design of CMOS reference is very challenging as the parameters, such as threshold voltage and mobility, are greatly dependent on temperature. To observe the performance of the circuit with variations in these parameters, the Monte Carlo Analysis in LTspice and in Python has been done and verified through SPSS analysis. Statistical analysis includes determining the values of mean, standard deviation, kurtosis and skewness of the current values obtained from the designed circuit and to measure the correctness or extent of performance of the reference circuit. The aim of this work is to perform the statistical analysis of the designed circuit and integrate Python with LTspice, to make the entire analysis independent of any particular circuit simulating software.

II. Circuit Design

This work is laid out in scl 180nm technology. The technology node is operated at a maximum of 1.8 V supply voltage.
The value of the resistor in the beta multiplier circuit comes in Mega Ohm range if we want to obtain the drain current value in nano-ampere(nA) range. But, this large valued resistor is very difficult to fabricate on chip as the sheet resistance of the silicon is very less. Hence, we have implemented such a high value of resistance by connecting three MOSFETs in parallel giving a high effective output impedance. Table I presents the W/L ratio of various transistors used in the proposed circuit as shown in Fig1.

TABLE I. W/L RATIO FOR DIFFERENT MOSFETS

TRANSISTORS	W/L(μm/μm)	NUMBER OF PARALLEL DEVICES(m)
M1,M2	0.5/10	-
M3,M4	10/10=20*M1	-
M7	0.5/10	-
M5	10/10=20*M7	-
M8	1.5/10=3*M7	-
M6	30/10=3*M5	-
M9	10/0.22	8
M10	10/0.22	8
M11	10/0.22	8

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A 0.6 V 1.6 nA Constant Current Reference Circuit with Improved Power Supply Sensitivity

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Abstract--This paper presents a low power current reference circuit with improved power supply sensitivity. The proposed circuit is designed in SCL 180 nm CMOS technology and simulated using Cadence Virtuoso. It generates a reference current (Iref) of 1.6 nA at 0.6 V supply voltage (Vdd) at room temperature (27° C) with a total power consumption of 10 nW (0.6 V). A new circuit configuration based on composite transistor operating in weak inversion has been proposed in this work. The proposed circuit is an improvisation on beta-multiplier circuits proposed earlier. The circuit improves the power supply sensitivity of the current source and provides a better performance in terms of process variability.

Keywords **-- low power, weak-inversion region, composite transistor, power supply sensitivity.**

I. INTRODUCTION

The demand for on chip current and voltage reference circuits are rising day by day. Manufacturers greatly rely upon the on chip current and voltage references to obtain desired characteristic due to its area optimization factor and also because each reference circuit is integrated with the chip and requires only a single voltage source to operate the entire circuit. The on chip current reference circuit the flexibility to adjust the parameters and to obtain a vast variation in output from a single reference circuit. Design of a stable current reference circuit is challenging with new CMOS technology having reduced technology nodes. The reduced scale current design in the order of nano amperes and pico amperes using process node of 180nm and less is a challenging task and also essential as it suffices the biasing need of the on chip IC Designs [1]. The current source must be well adapted to process variation and temperature. Depending upon the application, circuit may require the three major classes of current references which include Proportional to Absolute Temperature (PTAT), Complementary to Absolute Temperature (CTAT) or Bandgap Current Reference (BGR). PTAT current reference circuit are essentially used in cases where the transconductance varies with temperature due the effect of thermal voltage. This helps to nullify the variation by producing current – temperature characteristic in another direction. Several efforts have been made so as to reduce the temperature coefficient [2] in the biasing circuit. Also current reference circuits are used to bias the voltage reference circuit in the quantizer of Analog to Digital Convertor. The PVT (Process – Voltage – Temperature) variation of the circuit must be as low as possible and also predictable.

The main aim of this work is to design a current reference circuit for use in ultra-low power analog integrated circuit design. The power supply sensitivity (% line sensitivity) of the circuit is attempted to be low and also to reduce its process variability. The large value of on chip resistor is reduced by the help of self cascode structure as mentioned in [3]. The proposed current reference is designed to operate at 0.6 V to 1.8 V due to the reason that the operating voltage for 180 nm CMOS process is 1.8 V, thus any circuit with process node of 180 nm requiring current reference can easily be integrated with this current reference and different bias will not be required. The advancement in the design of current and voltage references have been considerable in the past few years with references that responds to low VDD (sub 1-V design) [4] with improved supply sensitivity and other parameters which makes newer designs to consider upon those parameters and in the proposed circuit we have constant reference up to 0.6 V of Supply Voltage.

The Theoretical Formulation is presented in section II and the Circuit description in section III, Analysis Result in section IV followed by conclusion in section V.

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DESIGN OF BAND-PASS FIR FILTER USING MODIFIED SOCIAL GROUP OPTIMIZATION ALGORITHM AND ITS IMPLEMENTATION ON FPGA

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***Abstract*—This paper proposes a method for the design of a type-I band-pass Finite Impulse Response (FIR) filter using Modified Social Group Optimization. To achieve better performance in filter response, few modifications were made in the basic SGO algorithm. When compared with the well-known Parks- McClellan (PM) and improved Sine Cosine algorithm, this modified version shows better results in terms of pass-band ripple and stop-band attenuation. Moreover, this paper discusses the hardware implementation aspect of filters in the FPGA platform.**

Keywords—FIR filter, Social Group Optimization, stop-band attenuation, pass-band ripple, FPGA

I. INTRODUCTION

In the domain of signal processing, a signal represents any time-varying electromagnetic wave that carries information. These waves are prone to various sources of noise. Traditionally analog circuits were used to limit these noises but accompanied several disadvantages such as bulkiness, response deterioration with time, etc. The introduction of digital signal processing has overcome some issues of the analog signal. Filtering is one of the few topics of discussion related to digital signal processing. Filters mainly allow only a specific frequency band and drop the rest. Thus, it plays a vital role in noise reduction. Digital filter is of two types – IIR (Infinite Impulse Response) filter and FIR (Finite Impulse Response) filter. IIR filters are also known as recursive filters which depend on the previous inputs as well as outputs in addition to the present input. It is considered to be unstable due to the presence of a few poles outside the unit circle. On the other hand, the output response of the FIR filter depends only on the current and previous inputs and it is stable due to the presence of poles at the origin. FIR filter has exactly linear phase response, easy to implement as it deals with only real arithmetic and provides no distortion, only a fixed amount of delay [1-2]. So, FIR filters prove to be more suitable than IIR filters in various engineering applications.

FIR filter design methods have been explored for quite a long time. It basically involves finding the coefficients of the filter such that the resulting pass-band ripple is minimized and stop-band attenuation is maximized [1-2]. The first design method was based on the Windowing technique, which utilized a window function to truncate the Fourier series expansion of the desired frequency response. Initially, the rectangular window was used. But in order to reduce the Gibbs phenomenon, windows lacking abrupt discontinuities like Bartlet, Blackman, Hamming, Kaiser, Lanczos were used. Then the frequency sampling method was developed by Gold and Jordan et al. [4-5, 7]. Here the frequency samples in the pass-band region of desired response are fixed in terms of discrete Fourier Transform coefficients. To reduce side-lobes, linear programming (LP) was used which optimized the frequency specification in the transition region. Instead of its effectiveness, LP is relatively slow, and hence designed filter will be of limited length. Both of these methods are simple but lack precise control of the pass-band and stop-band frequencies. Thus, to limit the drawbacks of the above methods an optimal FIR filter using an iterative approach was proposed by Herrmann et al. [6] by assuming the frequency response as equiripple in both the pass-band and stop-band. The catch was that it is not able to specify the location of cut-off frequencies a priori and the length was limited to 40 [7]. Parks and McClellan utilized a Chebyshev approximation-based method. It involved the Remez Exchange algorithm in order to get optimal parameters [2, 7]. Presently due to the advent of numerous optimization algorithms, the problem of FIR filter design can be easily solved by generating a fitness function based on the Chebyshev approximation problem and then optimizing the same by using meta-heuristic techniques.

Metaheuristic algorithms are strategies that are independent of the problem and can be used to solve a wide range of issues to find an approximate solution more quickly when classical methods are slow or fail to find any exact solution. They offer the advantage of local optima avoidance and require gradient-free cost function [24]. As per the 'No free lunch theorem', there is no such algorithm to solve all optimization problems. Thus, researchers can either improve/adapt/hybridize or propose new ones for solving different problems [9]. The above techniques operate in two important stages: the exploration stage, where the whole search space is explored in order to narrow down the solution region. Second is the exploitation stage, wherein each run of the algorithm moves towards the best answer. Both play a very vital role and a balance needs to be sequentially maintained to find an optimal solution to a problem [21]. There are mainly four different types of metaheuristic approaches: (a) swarm intelligence-based

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Design of Quadrature Mirror Filter using Grasshopper Optimization Algorithm

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***Abstract*— Nature-inspired algorithms have been recently identified as efficient methods of solving complex computational problems. The application of these algorithms is being extended also towards solving the problems of signal processing in the digital diaspora. The Grasshopper Optimization Algorithm (GOA) is a new development of a nature-inspired algorithm with meta-heuristic features. Quadrature Mirror Filters are very important and useful for multi-rate signal processing. This paper renders an alternate method of designing a quadrature mirror filter bank using the GOA. The performance of this design algorithm is demonstrated and simulation results are compared with existing methods.**

Keywords—Optimization, digital filter, multi-rate signal processing, QMF, Grasshopper Optimization Algorithm.

I. INTRODUCTION

Quadrature Mirror Filter (QMF) [1-6] banks are very useful components of a multi-rate digital signal processing system [7]. Since its inception in 1977, numerous design proposals have been introduced. Multi-rate filters have a widespread application in the areas of sub-band coding, processing of audio signals, processing of images, synthesis of communication networks, and synthesis of power networks. A multi-rate system is perfectly exemplified by the QMF filter. Sub-band coding is a signal analysis technique in which the signal is divided into multiple frequency bands and digital encoders are used for each band. The two-channel filter bank was the first to be utilized for speech signal sub-band coding. Thus, QMF bank is a two-channel filter bank that lies at the heart of every multi-rate system.

Optimization is the method of obtaining the suitable values for the parameters of a specific problem to either maximize or minimize the value of an objective function. Optimization problem solving requires several steps. Based on the type of variable utilized in the problem, optimization problems may be divided into many types. Discrete optimization problems deal with variables of discrete nature and continuous optimization problems deal with variables of continuous nature. The problems can be classified also based on the nature of constraints applied to the problem. According to the variables, constraints, and other parameters used in the problem, a suitable optimization method should be selected. Broadly, optimization problems can be solved in two different ways, the traditional gradient-based approach [8] and the modern nature-inspired approach [9]. The function that represents the gradient of the objective cost function is used in gradient-based methods. Due to the widespread use of multi-rate systems, several optimization approaches have been adopted for the design of the QMF bank. In recent years, methods from nature are constantly being put to use in the optimization and design of QMF banks. These nature-inspired methods are of stochastic nature and have meta-heuristic properties. For this reason, these algorithms are very efficient in obtaining solutions to linear and non-linear problems globally. Ant Colony Optimization, Artificial Bee Colony optimization, Dragonfly Algorithm, Salp Swarm Optimization, Cuckoo Search Algorithm, Whale Optimization Algorithm, and more current nature-inspired algorithms are accessible in the literature [10-23]. For example, in Ant Colony Optimization the ant is considered as an agent and it finds the optimal solution in the vicinity of food sources. Recently, the Grasshopper Optimization Algorithm (GOA) has been proposed by Saremi et al. [24]. GOA strikes a delicate balance between exploration and exploitation, resulting in excellent convergence in the search for the best solution.

The rest of the paper's content is arranged as follows: the analysis of a two-channel filter bank is shown in Section II. The design problem is formulated in Section III. The Grasshopper Optimization Algorithm is discussed in Section IV. Section V shows the simulation findings and Section VI concludes this paper.

II. TWO-CHANNEL FILTER BANK ANALYSIS

The most elementary form of the multi-rate filter bank is given by a two-channel filter bank. It subdivides the incoming input signal into two different sub-bands by utilizing the analysis system it possesses. Further, the processing of these two sub-divided signals is performed by establishing the necessary operation and these two different signals are recombined using the synthesis system. In ideal conditions, the signal reconstructed should be a perfect replica of the incoming input signal having some delay introduced. In reality, while reconstructing the signal faces primarily three types of distortion problem and exact reconstruction becomes impossible. The types of distortions that primarily occur are of three types: (a) amplitude distortion, (b) phase distortion, and (c) aliasing distortion.

In the real world, a reasonable near-perfect reconstruction is a preferred approach. By selecting the appropriate synthesis filters in line with the analysis filter, aliasing distortion may be entirely avoided. Incorporating linear phase filters with limited impulse responses can also help to eliminate phase distortion. Thus, the system becomes exempted from aliasing

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Paper Index

Design of High-Pass FIR Filter using Arithmetic Optimization Algorithm and its FPGA Implementation

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***Abstract*—This paper presents an efficient implementation of high-pass filter using the Arithmetic Optimization Algorithm. The result of this algorithm was found to be better in terms of pass-band ripple and stop-band attenuation in comparison to the Park-McClellan (PM) algorithm. Further, the hardware implementation of the proposed design in the FPGA platform have been discussed in this proposed work.**

Keywords—FIR Filter, High-Pass Filter, AOA, meta heuristic optimization algorithm, genetic optimization algorithm, simulated annealing algorithm, Sine Cosine algorithm, whale optimization algorithm, forced switching mechanism, FPGA.

I. INTRODUCTION

Filters can be broadly classified as analog and digital. Digital filter is an important part of digital signal processing. A digital filter is actually used to serve the purposes like signal separation and restoration. Since a digital filter takes a digital input and gives a digital output, with various digital components mixed up, so signal separation separates the noise and signal restoration restores the signal in its actual form. Digital filters are again classified as Finite Impulse Response (FIR) filter and Infinite Impulse Response (IIR) filter [1]. The output of FIR filters fades away due to impulse input within a limited amount of time and they are non-recursive. Due to greater stability and having a linear phase[2] and finite impulse response, FIR filters are preferred over IIR filters in many applications.

The design of a digital FIR filter in an optimum way requires a set of coefficients so that the magnitude response has a maximum stop-band attenuation and minimum pass-band ripple. Conventionally, various well-known methods have been implemented for the design of digital FIR filters like the window method, frequency sampling method, etc. The window method consists of window functions such as Butterworth, Chebyshev, Kaiser, etc. It consists of truncating an infinite filter impulse response by a window function that will be suitable for the respective filter. The windowing method for the digital filter design is fast, robust, convenient but usually suboptimal. For the design of optimal digital filters, the main objective function involves specific control of various parameters of the frequency spectrum which is highly non-uniform, non-linear, non-differentiable, and multimodal. So optimization of the above objective function cannot be done using the above techniques and convergence to the global minimum solution is also quite difficult. So, various optimization techniques or algorithms [1-3] are used to get rid of these problems.

The most important purpose of these evolutionary or meta-heuristic optimization algorithms for the digital filter is to optimize the cost function by reducing or minimizing the error between the desired response and the actual response as much as possible. Due to this the requirement of conventional gradient-based design processes like continuous and differentiable cost function has been eliminated. Again the problem of "Local Optima Entrapment" that is the chance of getting trapped in local minima is very much less for this algorithm. Algorithms like simulated annealing, genetic algorithm, particle swarm optimization algorithm [4], whale optimization algorithm [5], cuckoo search algorithm [6], etc. are significant optimization problems.

According to the theoretical studies it has been published that a single algorithm cannot solve all optimization problems and this theorem is known as the "**No Lunch Free Theorem**". Based on this theorem, the researchers are motivated to design new problems and get better results. In 2020, Laith Abualigah developed Arithmetic Optimization Algorithm (AOA) [7-9]. This algorithm mainly depends on the properties of arithmetic operators which are multiplication, division, subtraction, and addition, which helps in exploring and exploiting the minima within the search region. According to our literature survey this algorithm is applied in various design problems like pressure vessel design, 3-bar truss design problems, etc [8]. Again an improved version of this algorithm is integrated with forced switching mechanism [6], a chaotic mapping strategy introduced in AOA to boost its convergence speed and accuracy[8], etc. Based on this algorithm, various other algorithms hybridized with AOA have been developed. Few examples are advanced AOA for solving mechanical engineering design algorithms hybridizing Sine Cosine Algorithm (SCA) with AOA and fuzzy SCA-AOA in information security, AOA in multi-level thresholding

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Wideband Design of A Circularly Polarized Fabry-Perot Cavity Antenna

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***Abstract*—A novel design of Fabry-Perot cavity antenna (FPCA) is proposed to achieve circularly polarized (CP) radiation over a wide axial ratio (AR) bandwidth. Degenerate orthogonal modes of a square-shaped slotted patch are excited by using the dual-offset feeding technique and the patch has been used as a primary radiator of the proposed CP-FPCA. An approximate gain improvement of 7–11 dB is achieved just by using a specially engineered superstrate which consists of strategic square patches. The boresight gain of the antenna varies between 11.5–16.2 dBi over its 25% matching as well as AR-bandwidth. The AR value remains below 1 dB over the operating bandwidth and has a 25° AR-beamwidth. Estimated values of boresight cross-pol and sidelobe levels are below –27dB and –8dB, respectively.**

***Keywords*—Fabry-Perot cavity antenna (FPCA), circular polarization (CP); resonant cavity antenna (RCA); patch antenna; superstrate; high gain**

I. Introduction

Fabry-Perot cavity antennas (FPCAs) are known for their high gain properties and they are often used as substitutions for a bulky horn or array antenna [1, 2]. The directivity is further enhanced by placing a superstrate above the array underneath and utilizing the constructive interference between [3]. Linearly polarized FPCAs were realized by using various superstrate and primary radiators configurations [3]. However, to-date, very few of the FPCA designs reported in the literature provide circular polarization (CP), for which there is a high demand in both mobile and space applications [4]. But most of these designs were limited due to their poor gain and bandwidth performances. Maintaining higher gain over a wide axial ratio (AR) bandwidth is very difficult to achieve according to the earlier reports.

In this paper, a wideband CP-FPCA is designed by us using a novel feed and superstrate configuration. Two orthogonal resonating modes of a slotted microstrip patch are excited by using two dual-offset microstrip feed lines for CP radiation [5]. The superstrate configuration is strategically designed by using the square patch elements. A metallic cavity wall is used to enhance the gain at the higher frequencies [6]. All antenna dimensions are optimized by using a commercial EM-solver [7]. The broadside gain of the optimized antenna is maintained between 11.5–16.2 dBi, both over its 25% impedance matching as well as AR-bandwidths. An approximate gain improvement of 7–11 dB is achieved just by using a specially engineered superstrate which consists of strategic square patches. The proposed antenna is simulated and a few representative results are included. Experimental of the simulation results are currently in progress.

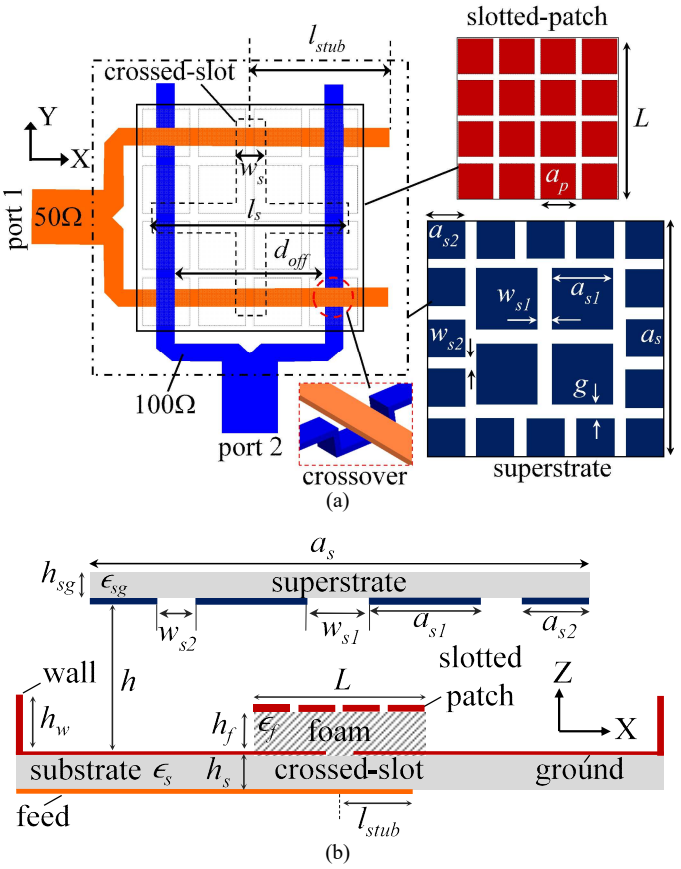

Fig. 1. Schematic view of the proposed CP-FPCA. (a) Top view, (b) side view. Parameters: a_s=71, a_{s1}=20, a_{s2}=10, w_{s1}=3, w_{s2}=5.25, g=4, h_{sg}=0.254, ϵ_s=2.2, ϵ_{sg}=2.55, ϵ_f≈1.07, L=16, a_p=3.85, h_f=3.27, h_s=0.508, h_w=9, h=15.2, l_s=14, w_s=1.5, d_{off}=5.3, l_{stub}=12, ground plane→90×90. All other parameters as in Fig. 2. (all dimensions in mm).

II. The Antenna Configuration

The side and top views of the proposed antenna are shown in Figs. 1(a) and (b), respectively. The substrate and superstrate

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Compact and Wideband Design of Substrate Integrated Waveguide Fed Dielectric Resonator Antenna Array

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***Abstract*—A planar array of dielectric resonator antennas (DRAs) integrated with a substrate integrated waveguide ( ) is designed to operate at millimeter wavelengths. The proposed design is very compact (. λ× .6λ) with 6× DRA array elements excited through the slots on the . An impedance bandwidth (11≤−1 dB) of 1 % is achieved and a pea -gain of approximately 1 dBi is realized over the operating frequency band – 8.5 z. The radiation efficiency is also maintained above % over this band. The front-to-bac ratio and the sidelobe level are satisfactorily maintained below −2 dB and −12dB, respectively.**

Keywords—dielectric resonator antenna (RA); substrate integrated waveguide ( ); illi eter-wave; antenna array; wide bandwidth; high gain; radiation pattern

I. Introduction

Antenna arrays based on substrate integrated waveguides (SIWs) are becoming popular because they are low profile, compact, efficient, and low-cost designs at millimeter waves [1]. The millimeter wave band offers wider bandwidth with compact system components, which is most desirable for mobile and portable communication systems. However, SIW has a high Q-factor and it also exhibits low radiation efficiency for a planar antenna array [2]. A dielectric resonator antenna (DRA) is an excellent candidate to offer low loss when excited by an SIW [3]–[5].

In this paper, a compact design of 6×4 DRA array integrated with an SIW is presented. The proposed array configuration is designed to operate between 34–38.5 GHz, with simultaneous excitation through four ports with microstrip feeds. The antenna is very compact (4.3λ×3.6λ) and it offers approximately 19dBi peak-gain over its 13% matching bandwidth. Illustrative results of simulation studies [6] are included in the paper. Experimental results, based on work currently in progress will be included in the presentation.

II. Antenna Geometry

Fig. 1 shows the schematic diagram of the proposed antenna array. A 31 mil thick Rogers RT5870 (ε_r=2.33, tanδ=0.0012) has been used as the substrate to realize the SIW structure using periodically placed metallic vias. The dominant TE_{10} mode of the SIW is excited through a microstrip-to-SIW tapered transition that promises a wideband performance. The design consists of four SIW-fed DRA-array segments separated by d_y distance. Each segment comprises of 6 rectangular DRA elements made of Rogers RT6010 (ε_{rd}=10.2, tanδ=0.0023). TE_{111} mode of rectangular DRA is excited through the non-resonating longitudinal slots on the top surface of the SIW. These rectangular slots ($l_s \times w_s$) maintain an offset distance d_0 from the SIW center. Four SIW guides are terminated by using the vias to realize a short-circuit wall. The distance x_s is optimized to ensure the maximum power coupling to DRA. All four ports are excited simultaneously by using 50 microstrip-feed lines, and the excitations are all in-phase. All antenna dimensions are provided in the figure caption.

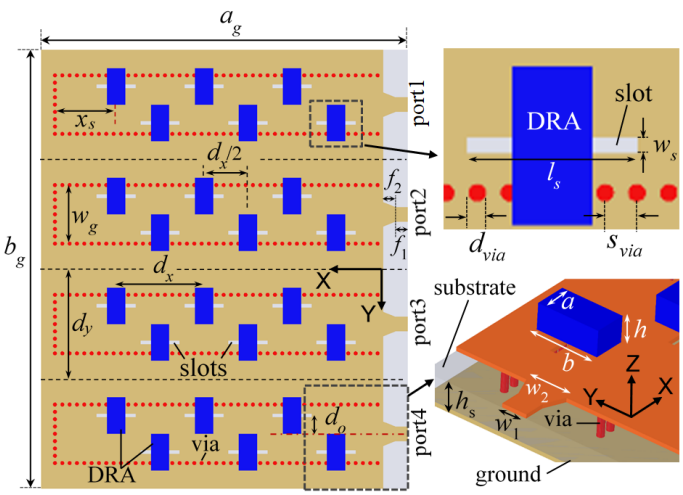

Fig. 1. Schematic view of the proposed antenna array. Parameters: a_g=30, b_g=36, d_x=7.2, d_y=9, w_g=4.8, x_s=5, d_o=1.5, l_s=3.2, w_s=0.3; feed: f_1=f_2=1, w_1=1.2, w_2=1.4; via: d_{via}=0.34, s_{via}=0.6; DRA: ε_{rd}=10.2, a=1.5, b=3, h=1.27; substrate: ε_r=2.33, h_s=0.7874 (all dimensions in mm).

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2

Electro-Optic Switches

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(Presently associated with CNES/ ONERA project)

2.1 Introduction

Superfast transmission of large data sets is now needed to cope with the increasing demand for high-quality audio and video signals in mobile phones, smart TV etc. [1]. Currently, the advanced fiber-optic communication networks serve as the building blocks of the information superhighway. Reliable routing, fast switching, and errorless detection are the three essential goals that need to be fulfilled to accommodate the huge demands within the purview of fiber-optic communication technology. One of the indispensable components of fiber-optic communication is optical switches and, for the current scenario, they need to be reliable, robust, yet inexpensive. A good-quality optical switch can increase the capacity of optical fiber and reliably distribute optical signals and subsequently reduces the overall cost. Moreover, optical switches can convert or redirect light without any electronic to optical conversions and vice versa. In the electro-optic effect, the refractive index (RI) of non-centrosymmetric crystals can be changed upon application of an electric field due to the rearrangement of the position and/or density of the charge carriers and by inducing slight deformations in the crystal lattice. There are two categories of electro-optic effect, namely the linear (Pockels) effect (RI varies in proportion to the field) and the quadratic (Kerr) effect (RI varies in proportion to the square of the field). Electro-optic modulation has distinct advantages over the other mechanisms that can be used for 1.31–1.55 μm fiber-optic communications and optical networks. Moreover, light can be restrained within a tiny area by using guided-wave-type electro-optic modulators, which are much superior to their conventional bulk counterparts in terms of switching speed, power consumption, and compatibility with optical fiber [2]. Thus, an electro-optic modulator-based efficient optical communication system is evidently required for telecommunication, remote detection systems [3], military applications, etc. In this article, a review of current optical switches in terms of operating principle, fabrication material, and device structure is presented. The performance issues and subsequent challenges are also briefly discussed.

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