Applications of Security, Mobile, Analytic, and Cloud (SMAC) Technologies for Effective Information Processing and Management

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Mobile Cloud Computing:
Applications Perspective

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ABSTRACT

Mobile Cloud Computing (MCC) which combines mobile computing and cloud computing, has become one of the industry ring words and a major conversation thread in the IT world with an explosive development of the mobile applications and emerging of cloud computing idea, the MCC has become a possible technology for the mobile service users. The concepts of Cloud computing are naturally meshed with mobile devices to allow on-the-go functionalities and benefits. The mobile cloud computing is emerging as one of the most important branches of cloud computing and it is expected to expand the mobile ecosystems. As more mobile devices enter the market and evolve, certainly security issues will grow as well. Also, enormous growth in the variety of devices connected to the Internet will further drive security needs. MCC provides a platform where mobile users make use of cloud services on mobile devices. The use of MCC minimizes the performance, compatibility, and lack of resources issues in mobile computing environment.

INTRODUCTION

Today's mobile phone users can execute a wide range of tasks by downloading applications to their receiver from online stores. These applications are called resident applications exact to the mobile operating system and they use the computing power and memory restricted in the device to run the application. In complicated applications which requires more dealing out power and memory is not suited

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Chapter 8
Data Classification and Prediction

Pudumalar S
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Rohini K
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ABSTRACT

This chapter describes how we live in the era of data, where every event in and around us creates a massive amount of data. The greatest challenge in front of every data scientist is making this raw data, a meaningful one to solve a business problem. The process of extracting knowledge from the large database is called as Data mining. Data mining plays a wrestling role in all the application like Health care, education and Agriculture, etc. Data mining is classified predictive and descriptive model. The predictive model consists of classification, regression, prediction, time series analysis and the descriptive model consists of clustering, association rules, summarization and sequence discovery. Predictive modeling associates the important areas in the data mining called classification and prediction.

INTRODUCTION

The greatest challenge in front of every data scientist is making this raw data, a meaningful one to solve a business problem. Data is the beginning point of all data mining process. The raw data or the collected data cannot use directly to build the business models. Hence processing added value to the data called information. The information is the processed data which is stored and managed in the large database. The process of extracting knowledge from the large database is called as Data mining. Data mining software analyses relationships and patterns in stored transaction data based on open-ended user queries. In the data mining Major elements are listed follows 1) Extract, make over and load transaction data onto the data warehouse system. 2) Store and manage the data in a multidimensional database system. 3)

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Chapter 9
Ontology Based Feature Extraction From Text Documents

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ABSTRACT

This article describes how semantic annotation is the most important need for the categorization of labeled or unlabeled textual documents. Accuracy of document categorization can be greatly improved if documents are indexed or modeled using the semantics rather than the traditional term-frequency model. This annotation has its own challenges like synonymy and polysemy in the document categorization problem. The model proposes to build domain ontology for the textual content so that the problems like synonymy and polysemy in text analysis are resolved to greater extent. Latent Dirichlet Allocation (LDA), the topic modeling technique has been used for feature extraction from the documents. Using the domain knowledge on the concept and the features grouped by LDA, the domain ontology is built in the hierarchical fashion. Empirical results show that LDA is the better feature extraction technique for text documents than TF or TF-IDF indexing technique. Also, the proposed model shows improvement in the accuracy of document categorization when domain ontology built using LDA has been used for document indexing.

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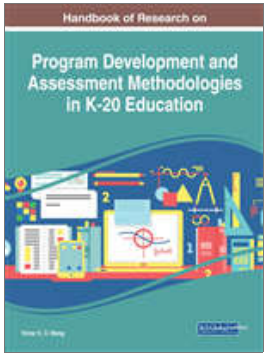

Implications for E-Learning in Adult Education Curriculum

R. Parkavi (Thiagarajar College of Engineering(TCE), India), P. Karthikeyan (Thiagarajar College of Engineering(TCE), India) and Linda Ellington (Southern New Hampshire University (SNHU), USA)

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e-Learning in adult education curriculum. The intent for this chapter is to explore the ılate attention as it relates to the acquisition of knowledge and inferences for higher ners in terms of the contexts of students, embedded technology, and faculty. Conquering ons in any educational system is vital and ideally this chapter offers a means of collective ıd potentially overwhelming components of effective curriculum programs within the field ology. This chapter highlights briefly some of the concepts and identifies simple and tiveness of embedded technology into higher education curriculum and adult education

Chapter Preview

Top

based technology which includes information and communication technology tools. This synchronous; becoming an important part of education and it is well known for its inspired attnayak &Pattnaik,2016). Virtual learning environment is nothing but the integration of g process. The elements of an electronic learning system consist of three layers and nine layama, 2011). The nine functional components are Educators and Learners, Learning tion Technology (ICT) tools, Teaching Content, and Assessment. The most important nly creating an environment for learners to learner the content but also providing them about good innovative and creative ideas. And particularly in higher education, learners s (Scardamalia &Bereite,2003).

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Implications for E-Learning in Adult Education Curriculum

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ABSTRACT

Technology plays a vital role in the field of e-Learning in adult education curriculum. The intent for this chapter is to explore the implications for e-Learning in hopes to stimulate attention as it relates to the acquisition of knowledge and inferences for higher education practitioners and program designers in terms of the contexts of students, embedded technology, and faculty. Conquering the challenges facing technology implications in any educational system is vital and ideally this chapter offers a means of collective literature to increase the quite extensive and potentially overwhelming components of effective curriculum programs within the field of adult education, using embedded technology. This chapter highlights briefly some of the concepts and identifies simple and applicable suggestions for increasing effectiveness of embedded technology into higher education curriculum and adult education teaching.

INTRODUCTION

The goal of this chapter is a review of relevant literature to expand the knowledge of the implications of e-Learning in technology centered curricular and all its undertakings involved within higher education. Relevancy comes into play with the awareness of the many and varied definitions of what e-Curriculum and e-Learning are and how those definitions influence technology centered curriculum. This then continues toward designing and developing curricula in which to promote students to be self-directed with their own thinking habits. Knowing that every student has different learning styles, the approach for embedded technology provides for a pathway for students to learn anywhere and at any time.

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Shriram R · Mak Sharma (Eds.)

Data Science Analytics and Applications

First International Conference, DaSAA 2017
Chennai, India, January 4–6, 2017
Revised Selected Papers

Springer

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Patron's Message

Dr. S. Ganesan
Registrar, Anna University

"I believe in innovation and that the way you get innovation is you fund research and you learn the basic facts," said Bill Gates, CEO, Microsoft Corporation. We believed in this principle and used it to equip the university with the finest and latest infrastructure, state-of-the-art libraries and laboratories, a formal and ideal learning environment with committed faculty and supportive administrative staff. The committed and dedicated faculty members of the university are also well knowledgeable to render consultancy services to government institutions, NGOs, public sector undertakings and private corporate sector on very competitive terms and conditions.

I am happy to see that the Department of Computer Science and Engineering, Anna University, Chennai, organized an international conference for the second time to quench their thirst for knowledge in the areas of data analytics and applications. I am also glad to learn that many academics and research scholars especially from Asia participated in this conference.

International conferences such as these provide an environment for academics to interact, collaborate, and share knowledge derived from their research in the field of data science analytics and applications. I hope this conference results in active coordination among researchers working in similar areas, which would lead to creative and innovative technologies yielding new research ideas for the benefit of society.

As a member of the university family since its inception and being the registrar, it gave me great pride to welcome the conference participants to be a part of this enthusiastic and enchanting environment.

S. Ganesan

Co-patron's Message

Dr. P. Narayanasamy
Dean, CEG Campus

"Research is what I'm doing when I don't know what I'm doing," said Wernher von Braun, developer of the rocket technology of Nazi Germany. In addition, I reinstate research and innovation are necessary and essential components of a knowledgeable and growing society. Research ideas leading to innovative products to serve society are primary inputs for achieving excellence in education. The products that are off-spring of the research input work as catalysts in the socioeconomic progress of the university and in turn of the country.

With this as a primary concept, Anna University, a leading educational institution in India, imparts quality education on par with national and international standards. The aim of the College of Engineering (CEG) is to create world-class facilities to support research and innovation. To facilitate this support, with great pleasure and enthusiasm we hosted the First International Conference on Data Science Analytics and Applications (DaSAA 2017), held at Anna University (CEG Campus), during January 4–6, 2017, in Chennai, India.

The theme of the conference was "Data Science Analytics and Applications" with the focus on thrust areas of computer science. This innovative educational forum enabled attendees to advance their knowledge and connect with their peers, creating new professional contacts among the national and international experts in this field. DaSAA 2017 was designed to be an academic feast, with a structured program in a manner where participants had ample time to interact after the sessions, which were enriched by the presence of distinguished international and national participants.

With the right vision, the right people, and programs in the right place, we at the CEG make an attempt to create the right set of contributions for different disciplines of research. The aim of education at Anna University is to assist the students in developing their intellectual, esthetic, emotional, moral, and spiritual being. We, at CEG, impart futuristic, stress-free education and instill a high degree of discipline among them, thereby setting global standards and making our students think logically and analytically.

I believe DaSAA helps to achieve these goals.

P. Narayanasamy

Convenor's Message

Dr. D. Manjula
Head, DCSE

"Understand well as I may, my comprehension can only be an infinitesimal fraction of all I want to understand," said English mathematician and first computer programmer Ada Lovelace. These words struck me to the core and I believe that we need to gather researchers and students with plenty of ideas and knowledge so that they would get a share of it with the fullest understanding. We at the Department of Computer Science and Engineering started conducting international and national conferences to share and impart knowledge to researchers and students.

It gave me much pleasure to witness another major milestone for the department, in organizing and holding the First International Conference on Data Science Analytics and Applications (DaSAA 2017), during January 4–6, 2017. The success realized in organizing and hosting the conference goes a long way to not only showcase DaSAA as a major hub of academic research, but also inculcate the Department of Computer Science and Engineering as a rich reservoir for research activity.

I wish, on behalf of DaSAA, to take this opportunity to thank all those who contributed in one way or another toward the success of the conference. I particularly appreciate the various presenters who submitted well-researched and highly relevant presentations, and the DaSAA Organizing Committee for the long hours spent to ensure the success of the conference.

My heartfelt thanks to Springer, to have conditionally agreed to publish the conference proceedings. My sincere thanks also goes to the conference sponsors, for the very generous assistance toward the organization of the conference. Continued consultations and the cooperation of all parties mentioned above ensure that the second international conference in the Department of Computer Science and Engineering will indeed be a remarkable success. Thank you once again and I encourage you to maintain this working spirit.

The conference program has been designed to provide ample opportunities for researchers to network and to share ideas and information about data science analytics. I hope all attendees found DaSAA 2017 to be enjoyable, memorable, and productive and I look forward to the technological innovations that result from their networking and discussions.

D. Manjula

Preface

DaSAA 2017

The First International Conference on Data Science Analytics and Applications (DaSAA 2017) was held during January 4–6, 2017, with a preconference tutorial on January 3, by the Department of Computer Science and Engineering, CEG, Anna University, Chennai. Some of the major research areas of the department include networks, database, theoretical computer science, machine learning, cloud computing, text mining, natural language processing, information retrieval, multimedia, image processing, software engineering, data mining, big data analytics, grid computing, and fog computing.

DaSAA 2017 aimed to provide a techno forum with market trend topics to help researchers, engineers, scientists, and academics as well as industrial professionals from all over the globe to present their innovative research ideas and developmental activities in data science analytics and applications. DaSAA 2017 was unique because of its focus on the recent developments in data science analytics and applications, and papers were invited from a wide range of topics including data modeling and analytics, data storage and access, data privacy and security, data mining, cloud computing, machine learning, text classification and analysis, information retrieval, information retrieval query processing, specialized information retrieval, image and video processing.

A total of 77 papers were received from India and the USA, of which 16 were selected for presentation at the conference after a thorough double-blind review process by a Technical Program Committee consisting of distinguished researchers. All accepted papers are published in this *Communications in Computer and Information Science* series by Springer. CCIS is abstracted/ indexed in DBLP, Google Scholar, EI-Compendex, Mathematical Reviews, SCImago, and Scopus. Selected papers after being extended will be considered for publication in one of the following journals: *International Journal of Grid and High-Performance Computing* (IJGHPC; Scopus indexed) or *International Journal of Big Data Intelligence* (IJBDI; Google scholar indexed).

The conference also had a one-day preconference tutorial session consisting of three tutorials by a mix of eminent researchers both from industry and academia in the areas of cloud computing, deep learning and network security. The conference hosted five keynote talks by invited speakers from India, the USA, and UK on varied topics

including symbolic and numeric learning, big data in biology and medicine, Internet of Things and big data modeling.

We hope DaSAA 2017 has set a stage for continuous and sustained research in this trending field.

January 2017

S. Chitrakala
Rajeswari Sridhar
Angelin Gladston

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Towards Secure DNA Based Cryptosystem

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Abstract. Cryptography is an art of secret writing. To ensure data security in both data transfer and data storage cryptographic techniques are used for the data we handle in our day to day activities. The need for cryptographic techniques exists from the period of 150 B.C. till date. Though there are too many cryptographic algorithms, an algorithm with reduced complexity and utmost security is needed. And so, DNA cryptography paves a way towards satisfying the needs with its own biological properties. DNA has greater capacity to store, process and secure data. The existing DNA cryptographic algorithm does not have a standardized approach that involves both biological and arithmetic processes. To meet out the standardized framework we propose a novel DNA based cryptosystem comprising key generation, encoding, and encryption, decryption methodologies. The detailed performance and security analysis with their results are shown to support the strength of our algorithm towards reducing the computational complexity as well as the storage complexity and thereby achieving an enhanced security.

Keywords: DNA cryptography · DNA encoding · DNA computing · Encryption Decryption · Key generation · DNA based encoding

1 Introduction

Cryptography is a technique used for encrypting the plaintext to achieve data confidentiality. Traditional cryptographic algorithms like DES, AES and RSA are less secure as it could be broken with increased computational power and also it involves with greater computations to preserve data security. To minimize the computational complexity and also to achieve maximum security an alternate method of cryptography is needed.

DNA (Deoxyribo Nucleic Acid) is a molecule in the living organisms that carries the genetic information used for the growth and development of the organism. DNA molecules have a double helix structure made up of two strands of polynucleotides. The four nucleotides of DNA molecule are Adenine (A), Guanine (G), Cytosine (C) and Thymine (T). These DNA nucleotides form complementary pairs as Adenine is paired with Thymine and Guanine is paired with Cytosine and vice versa.

Shriram R and M. Sharma (Eds.): DaSAA 2017, CCIS 804, pp. 163–177, 2018.
https://doi.org/10.1007/978-981-10-8603-8_14

Critical Research on Scalability and Security Issues in Virtual Cloud Environments

Part of the Research Essentials Collection (/research-essentials/)

Shadi Aljawarneh (/affiliate/shadi-aljawarneh/327188/) (Jordan University of Science and Technology, Jordan) and Manisha Malhotra (/affiliate/manisha-malhotra/320337/) (Chandigarh University, India)

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ations are shifting their data storage and utilizing cloud computing because of its easy
h, this technology is creating an easy way to store, share, and access data, serious security

Security Issues in Virtual Cloud Environments is a critical scholarly resource that
ing and explores the various shortcomings of using the cloud. Featuring coverage on a broad
ure for scalability, data vulnerability, and server virtualization management, this book is
oners, and researchers seeking current research on developing effective security measures

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A Literature Survey

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Deepika B
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ABSTRACT

Cloud computing is a technology for complex computing, it eliminates the need to have computing hardware, storage space and software. Multi tenancy is considered as important element in which same resources will be shared by multiple users. The users are named as tenants in the cloud environment. The tenants may run their applications in their own cloud environment which will have some vulnerability. These vulnerabilities will cause some attacks to the tenant virtual machine. In general, the cloud providers will not provide that much security to the cloud tenants. So, it is the duty of the tenant to make some countermeasures to avoid these attacks. In a cloud environment, there may be multiple tenants in that there is a possible of malicious tenant also present in the cloud environment. The attacker will do sniffing attack by monitoring all the user traffic. In the cloud, it is a fact that all the user data will resides in same hardware so the attacker monitor the activities of all the user and observes the type of traffic.

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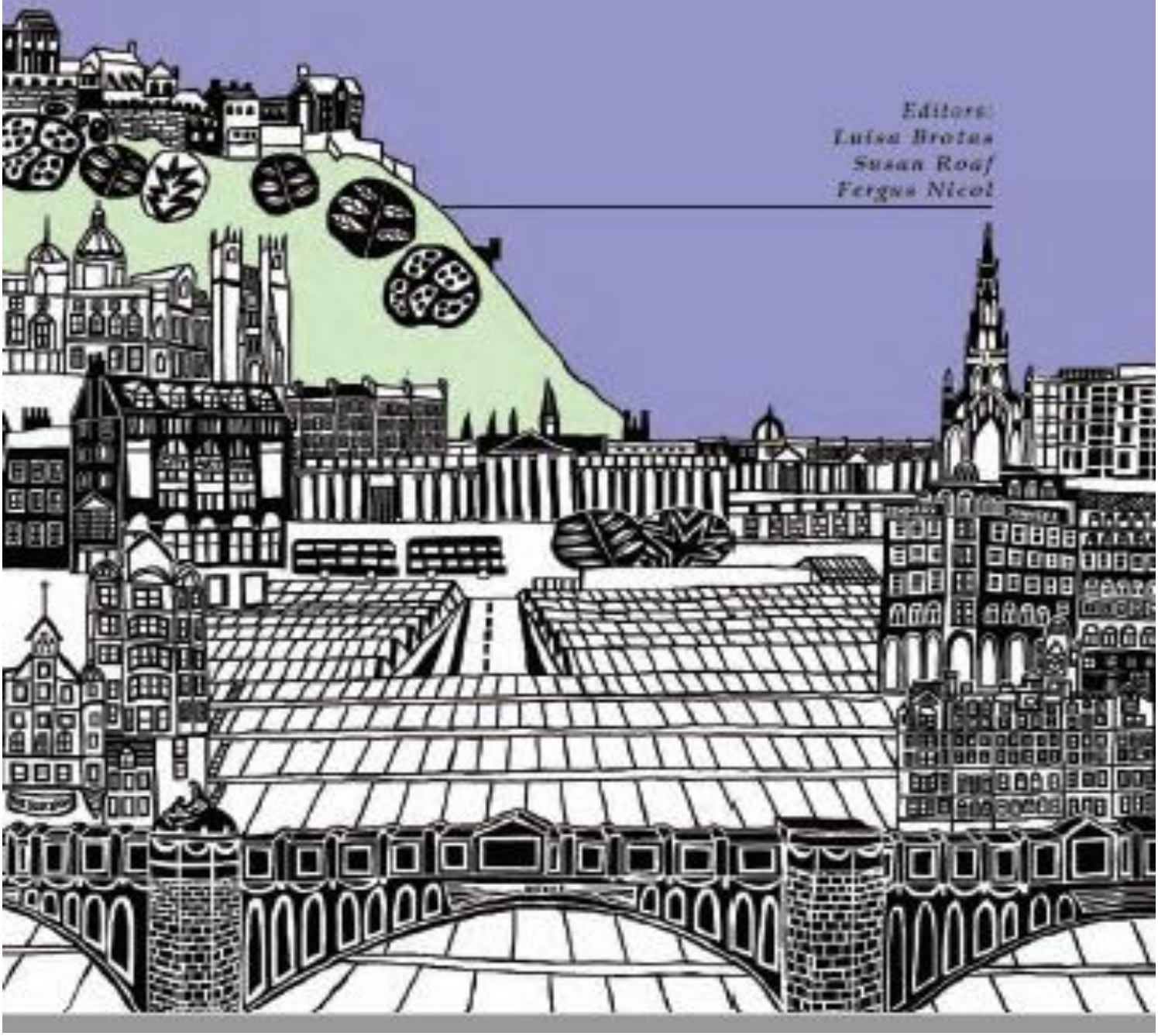

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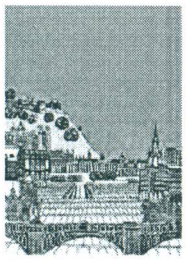

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Design to Thrive

Computational Investigation of Natural Ventilation in an Educational Building in Madurai, Tamilnadu

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[2] Department of Architecture, National Institute of Technology, Trichy, India, email-ktm@nitt.edu;

Abstract: Natural ventilation in educational buildings plays a vital role in energy conservation, thermal comfort, indoor air quality and reduction of carbon emission. This paper investigates the natural ventilation performance of a School of Architecture building located in the warm humid climatic zone of India. The study involves three phases, an evaluation of occupant's perception on overall comfort (summer, winter and monsoon) using Building Use Studies workplace survey, field measurements of outdoor and indoor weather conditions like temperature, air velocity and relative humidity and Computational Fluid Dynamics (CFD)- based simulations for the whole building. The numerical simulation on the discretized domain is carried out using ANSYS Fluent. The boundary conditions necessary for the CFD study were obtained from the experimental data measurements. The lowest air velocity recorded in the summer month has been considered for the simulation to understand the influence of architectural design of the building on natural ventilation. As a result, the unique characteristics of air flows within classrooms and studios were determined, and ventilation processes in various situations have been analysed, discussed and compared with the BUS survey results to validate each other.

Keywords: Natural ventilation, air flow, Computational Fluid Dynamics (CFD); occupant comfort.

Introduction

Natural ventilation may be defined as ventilation provided by thermal, wind or diffusion effects through doors, windows, or other intentional openings in the building as opposed to mechanical ventilation that is ventilation provided by mechanically powered equipment such as motor-driven fans and blowers. These natural ventilation systems may reduce both installation and operating costs compared to mechanical ventilation systems while maintaining ventilation rates that are consistent with acceptable indoor air quality (Emmerich et al, 2001). Occupants of naturally ventilated buildings are often more tolerant of fluctuations in the indoor climate (Brager, 2001). They tend to accept a wider range of temperature and humidity levels.

Consequently, in the recent decades, many researchers have investigated the airflow patterns, the temperature and contaminant distributions, and thermal stratification comfort as well as the effects of thermal buoyancy and wind force for naturally ventilated rooms or buildings (Nielsen 2002, Ramponi et.al, 2011, Yang et.al. 2014, Calautit et.al, 2015). However, the aforementioned most of researches and experiences of natural ventilation

Advances in Intelligent Systems and Computing 459

Balasubramanian Raman
Sanjeev Kumar
Partha Pratim Roy
Debashis Sen *Editors*

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Crowd Disaster Avoidance System (CDAS) by Deep Learning Using eXtended Center Symmetric Local Binary Pattern (XCS-LBP) Texture Features

C. Nagananthini and B. Yogameena

Abstract In order to avoid crowd disaster in public gatherings, this paper aims to develop an efficient algorithm that works well in both indoor and outdoor scenes to give early warning message automatically. It also deals with high dense crowd and sudden illumination changing environment. To address this problem, first an XCS-LBP (eXtended Center Symmetric Local Binary Pattern) features are extracted which works well under sudden illumination changes. Subsequently, these features are trained using deep Convolutional Neural Network (CNN) for crowd count. Finally, a warning message is displayed to the authority, if the people count exceeds a certain limit in order to avoid the crowd disaster in advance. Benchmark datasets such as PETS2009, UCSD and UFC_CC_50 have been used for experimentation. The performance measures such as MSE (Mean Square Error), MESA (Maximum Excess over Sub Arrays) and MAE (Mean Absolute Error) have been calculated and the proposed approach provides high accuracy.

Keywords Crowd disaster · Texture feature · Convolutional neural network · People counting

1 Introduction

In reality, public safety needed places such as malls, stadiums, festivals and in public gatherings, crowd control and crowd management becomes paramount. One of the basic descriptions of the crowd status is crowd density. Counting its flow is an important process in crowd behavior analysis. It can also be used to measure the comfort level of the crowd for detecting potential risk in order to prevent overcrowd

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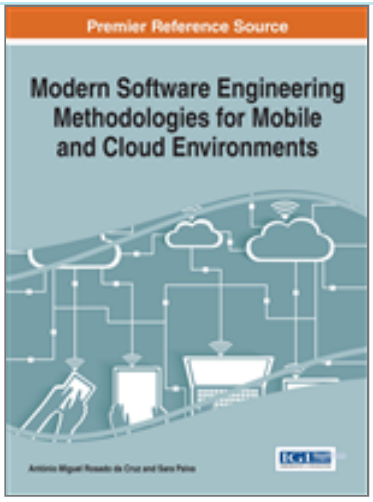

A Study on Software Development Architectures for Mobile Cloud Computing (MCC) for Green IT: A Conceptual Mobile Cloud Architecture Using Artificial Bee Colony-Based Approach

D. Jeya Mala (Thiagarajar College of Engineering, India)

Source Title: Modern Software Engineering Methodologies for Mobile and Cloud Environments (/book/modern-software-engineering-methodologies-mobile/140982)

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Abstract

Mobile Cloud Computing (MCC) at its simplest form refers to an infrastructure where both the data storage and the data processing happen outside of the mobile device. In this chapter, a study on existing software

architectures for MCC is outlined with their way of working. Also, a Nature inspired Artificial Bee Colony (ABC) based architecture has been proposed to provide reliable services from the cloud to the mobile requests. The proposed approach will definitely pave a way for timely services by using three different agents working in parallel, which mimics the behavior of honey bees namely Employed Bees, Onlooker Bees and Scout Bees. As the service discovery from the UDDI, Mobile profile Analysis and Allocation of Cloud resources for the requests are done by these software agents in a parallel execution, it achieves a green IT solution for MCC based software Development.

Top

Background

According to the white paper of Aepona (2010), MCC is described as a new paradigm in which the data processing and storage are moved from the mobile device to powerful and centralized computing platforms located in clouds. These centralized applications are then accessed over the wireless connection based on a thin native client or web browser on the mobile devices.

Some of the typical applications of MCC are: Yang et al. (2010) and Dai and Zhou (2010), proposed a 3G E-commerce platform based on cloud computing. This paradigm combines the advantages of both 3G network and cloud computing to increase data processing speed and security level based on PKI (public key infrastructure).

For practical system, a telemedicine homecare management system proposed by Tang et.al.(2010) is implemented in Taiwan to monitor participants, especially for patients with hypertension and diabetes. The system monitors 300 participants and stores more than 4736 records of blood pressure and sugar measurement data on the cloud.

Doukas et al. (2010) proposed '@HealthCloud', a prototype implementation of m-healthcare information management system based on cloud computing and a mobile client running Android operating system (OS). This prototype presents three services utilizing the Amazon's S3 Cloud Storage Service to manage patient health records and medical images.

Zhao et al. (2010) presented the benefits of combining m-learning and cloud computing to enhance the communication quality between students and teachers. In this case, smartphone software based on the open source JavaME UI framework and Jaber for clients is used. Mobile game (m-game) is a potential market generating revenues for service providers. Here, the m-game can completely offload game engine requiring large computing resource (e.g., graphic rendering) to the server in the cloud, and gamers only interact with the screen interface on their devices.

MeLog proposed by Li and Hua (2010) is an MCC application that enables mobile users to share real-time experience (e.g., travel, shopping, and event) over clouds through an automatic blogging.

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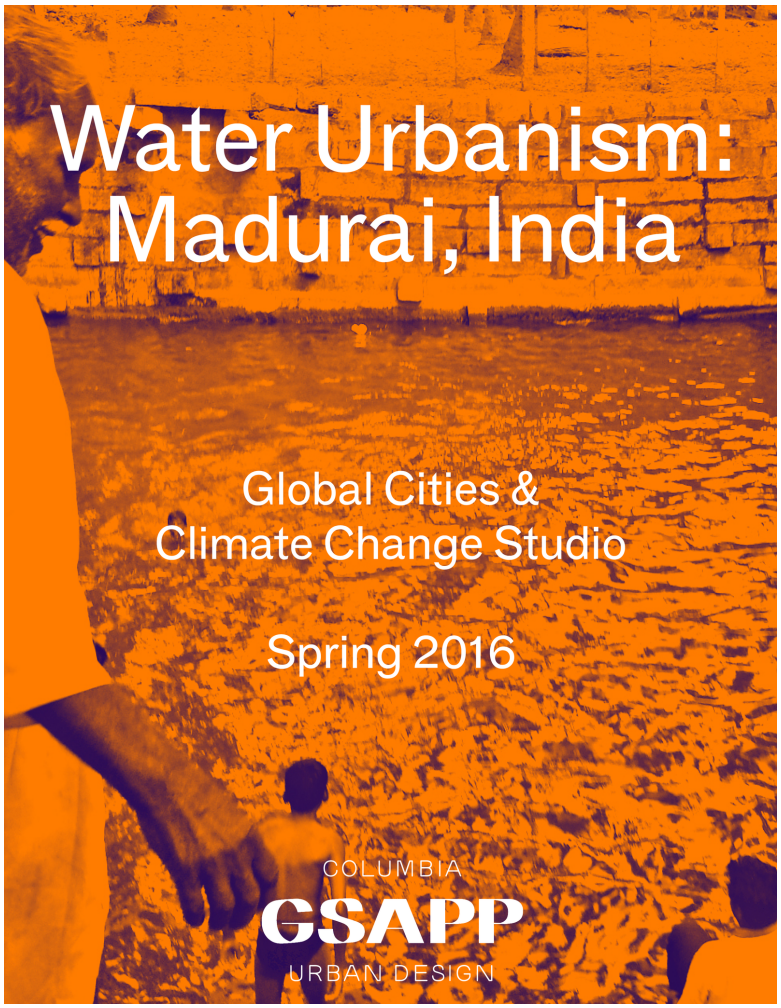
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Madurai, India
Global Cities &
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FOREWORD

MADURAI: CITY OF TANKS

Karumuttu T. Kannan, President TCE

I am pleased that the faculty and students in the Urban Design Studio at Columbia University Graduate School of Architecture, Planning and Preservation and the Thiagarajar College of Engineering have focused on reimagining the issues of water and urbanism in Madurai.

Rapid economic development and urbanization are resulting in increasing real estate pressures and social inequities in the historic city of Madurai. Starting from around the famed Meenakshi temple, the city has now expanded into the agricultural areas, and traditional balance of water systems and urbanism is threatened. The issues of pollution and encroachment of the Vaigai River

PAST, PRESENT AND FUTURE OF URBANISM ALONG THE RIVER VAIGAI

G. Balaji

The article focuses to give an overall picture about the River Vaigai in its present context. The increasing Land use and the urban expansion affect this river to a greater extent. The quality of the city to sustain its cultural capital for more than 2500 years on the banks of a non perennial river Vaigai is a unique feature. This feature exists in a complex web of tanks. In order to understand the river Vaigai one has to understand its geography in terms of physical and culture.

Vaigai River Basin (VRB) is one of the 34 river basins in Tamil Nadu covering an area of 7009 sq km. This River basin is surrounded by Cauvery and Pambar Kottakaraiyar basin on the north, Gundar River basin on the south, West by Periyar Bain and east by Bay of Bengal. The length of this basin is 289 km with its varies from 15 to 55 km. the basin is an arcuate in shape, stretching from the Western Ghats mountains of Kerala in the west to the Bay of Bengal in the east, with a general gradient towards North East up to Theni and then south eastern direction up to the sea.

Physiographical study of the VRB reveals that the basin can be broadly classified into three units namely:

1. Western Mountainous terrain with valley complexes (running to a length nearly 70 km)
2. Central Elevated terrain (nearly length about 110 km)
3. Eastern Coastal Plain (nearly length about 35 km).

Administratively the VRB covers five districts namely Madurai, Ramanathapuram, Sivagangai, Dindugul and Theni Districts of Tamil Nadu. Urban settlements like Madurai, Cumbum, Theni, Manamadurai, Paramakudi located on the banks of Rive Vaigai have huge impacts on VRB

An Ecological Perspective of the Region

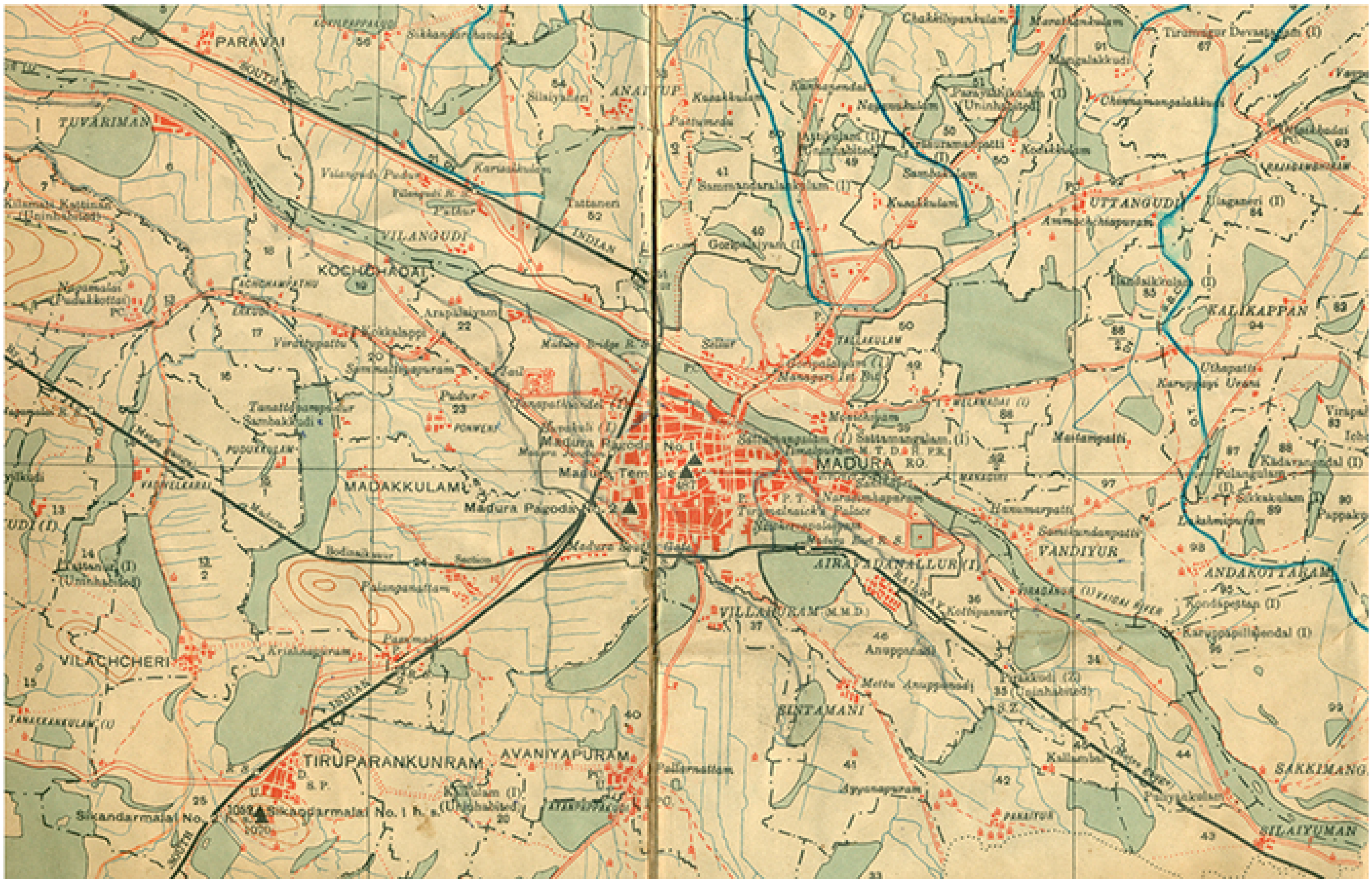
The southern peninsular India has more number of tanks because of its landscape, geography and terrain. Moreover the geological formation of this part is hard granite gneisses which serves as a barrier to the deep percolation from the tanks built above. The topography of Madurai region clearly exhibits numerous low level lands characterized by the shallow depressions and lakes that served as water sources from the historical times.

These tanks were well-connected to rivers. The abundance of water from the river Vaigai is fed into small natural tanks and channels in the region. There are innumerable tanks and lakes on both sides of River Vaigai. These tanks are classified into System tanks (gets water from nearby rivers or reservoirs, may have its own catchment source) and Non system tanks (rain fed tanks). The system tanks get water through supply channels and surplus course. The former is designed as flood channel to carry large quantities of water during floods. The latter is an open channel sufficiently large to carry the surplus water from the tank to the next below tank or to the nearby stream. In the rivers that are not perennial such as River Vaigai, different methods had been adopted to collect all the flows of the basin. A large number (more than 2500 big and small) of tanks were constructed across water courses and small streams which contribute to the River Vaigai flows, thus moderating the floods. The surplus channel are more important in tank irrigation system as they are the links of a chain, which function as the most efficient water harvesting structures in arid plains. Within the urban limits Anuppanadi Channel, Paniyur Channel, Sottathatti channel, Avaniyapuram Channel takes off from the southern bank of the River Vaigai while Sellur channel, Pandalkudi Channel and Vandiyur channel feed into the river Vaigai from the northern side.

Urbanization & River Vaigai

Historically, the development of the city was noticed around the Meenakshi temple complex on the southern banks of River Vaigai. This agriculture based development gave equal importance to water structures in and around the regions. In the year 1866, Madurai city had a population of about 41,600 spread over a small area of 2.6 sq.km. In 1986 the area was extended to 51.85 sq.km having a population of 0.903 million. After independence in 1947, the city underwent major changes in terms of its spatial extent. The years 1951 and 1971 witnessed huge migration of the people from rural to Madurai urban area. During the last two decades Vaigai River basin within the urban limits witnessed radical transformation from agricultural land use till 1970 to its current state- a sprawling urban development in 2013. This growth was facilitated by the network of transportation corridors and other physical infrastructure. There are nine road bridges and two rail bridges across this river. The northern part of the city was urbanized after 1950's and it had strong connections with the southern part of the city. Very high residential pattern is observed in the core city (more than 1000 persons / hectare).

Increase Impervious Surface Cover in these areas increases the surface run off, thereby decreasing the amount of infiltration inside the ground. As a result the availability of ground water in these areas dropped down to 135 m below the ground level in northern part of the city and 145m in stretch southern part of the city. Further the population density in this area is enormous compared to other areas. The ecological impacts of this growth and population re-distribution mark an important statement in these urban streams.


PARAVAI
TUVARIMAN
VILANGUDI
KOCHCHADAI
MADAKKULAM
VILACHCHERI
TIRUPARANKUNRAM
AVANIYAPURAM
MADURA
Madura Temple
Madura Pagoda
VILLAPURAM
SINTAMANI
UTTANGUDI
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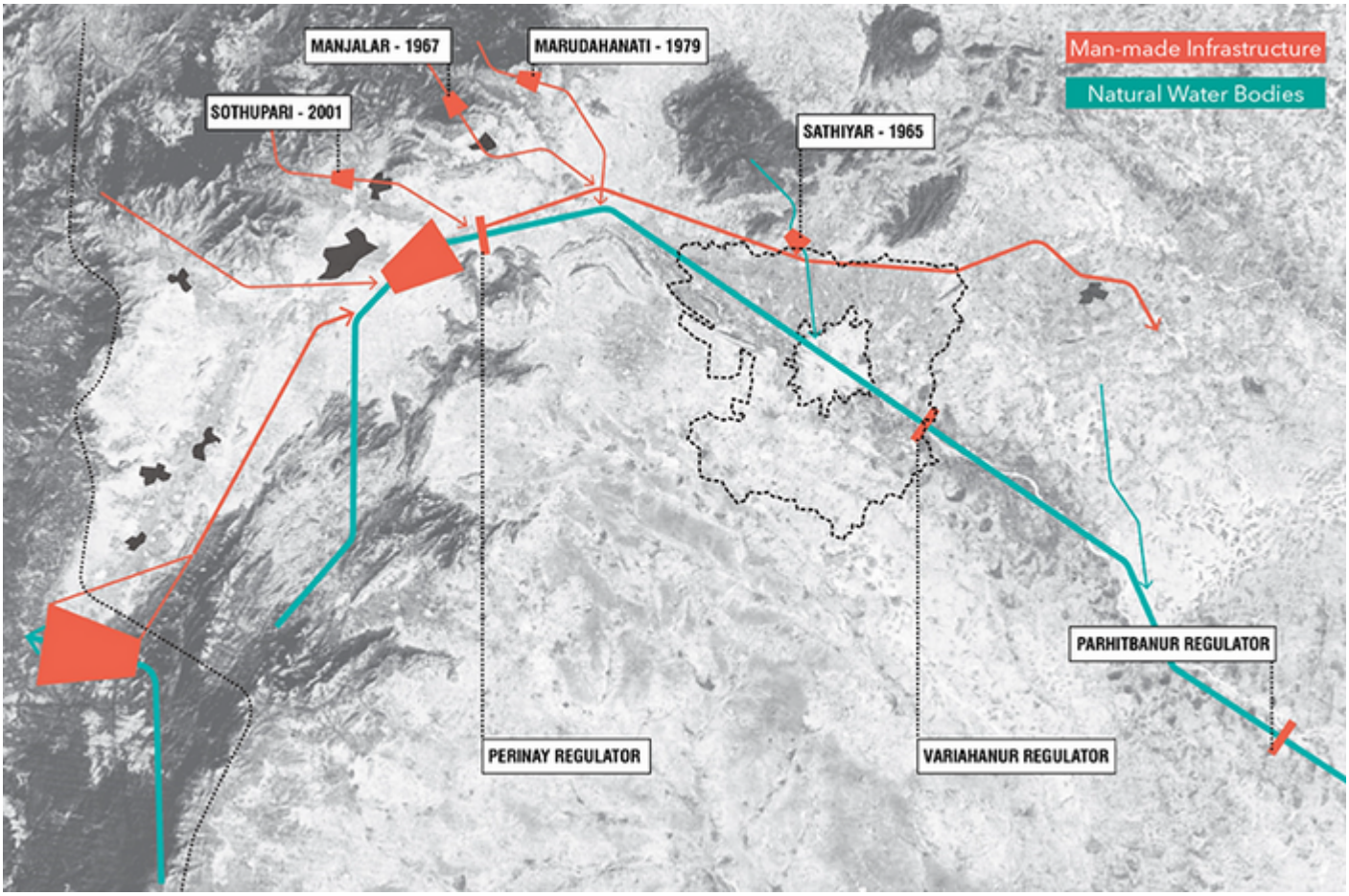
VANDIYUR
ANDAKOTTARAM
SILAIYUMAN
Anuppanadi
Ayyanapuram



Madurai + surroundings.

Changes from the Early 1990's

The changes on either banks of the river Vaigai was drastic from early 1990's as the linkages from north and southern part of the city gained more connectivity.

- Traditionally the southern banks of the river enjoyed many ghat structures (Padithurai) that connects the land surface with water surfaces. Religious processions and rituals happen periodically in these areas.
- The non perennial nature of the river completely provides different picture during different times. The character of the river changes to its peak during Chitrai Festival. Nearly six lakhs of people participate in this festival during April/ May. During June and July where there is least water, many portions of the river is used as play ground, drying yard and other illegal activities.
- Bund road laid in late 1990's on either side of the river that completely destroyed the Ghat structures and also encroached 10 m on both sides of the river. Bund roads are encroached by commercial activities thus extending further 3 to 5 m on the river

side.

- The excess sedimentation caused due to the land use in on the northern side of the river deposits thick layer of soil on top of the river bed. The strength of the non perennial river is the river sand that enables the purifying capacity of the river. This natural layer is drastically affected by the deposit layer facilitating the growth of many plants particularly seemai karuvai (prosopis juliflora) that completely alters the bed characters of the river.
- The storm water drainage acts as sewage drainage in the present state. The sewage from the northern side of the city is carried by Sellur , Pandalkudi channel and Vandiyur Channel, While Anupanadi, Sottathati Channel and panaiyur channel carries Sewage from the Southern side of the city.
- The Dhobiwallahs (washer man community) on the southern side of the river extensively uses the river for their washing purposes. There are around six locations inside the river that is been used exclusively for washing purposes.
- The river houses around 11 small temples along with two main mandabams (Pillared halls) Neeryazhi mandabam and Vandiyur mandabam within its bank. These temples are believed to be clan temples for communities inside the city.
- More residential areas like Nethaji Nagar, SMP colony, Shantiniketan, Madichiyam, Sellur on the northern side disposes solid wastes and raw sewage into to the river on a regular basis.

Emerging Potentials

The river in its present state gains more attention to the people of the Madurai as well as the Government Agencies. The Madurai Municipal Corporation developed City Sanitation Plan and City Perspective Plan for the city. Both the plans focus more on treatment plants for the sewage systems in the city. More than 5 NGO's takes part actively in cleaning the river at sporadic intervals. The Public Work Departments prepares Micro level study of Vaigai River Basin focusing more on treating the entire basin as a single Planning unit. The Educational institutions conduct periodically awareness programs on the revitalization of the river Vaigai to its citizens. Recent study conducted by the Thiagarajar college of Engineering, Madurai clearly indicates that the river still holds self purifying capacity. The water within the urban limits is polluted whereas water on the peri urban area is fit for drinking. Thus river still projects a positive signal to its citizens.

The major missing link is the inclusion of the river as a planning unit in the Master Plan and Structural Plan. This Non Perennial River requires a special dedicated development plan to further sustain its cultural and functional integrity. It becomes a great priority for the educational and governmental organization to focus more developing and regulating a land use on the banks of the river and to adopt a suitable riparian landscape system on its edges.

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Contents

Band Gap Analysis of a novel C Slot Electromagnetic Band Gap Structure

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***Abstract*— Electromagnetic band gap structures, also called as artificial magnetic conductors or high impedance surfaces play vital role in antenna design due to their peculiar electromagnetic properties. This paper presents a novel C slot EBG structure with a band gap around 5.2GHz. The dispersion diagram of the EBG is extracted using the full wave eigen mode solver and the suspended microstrip line method. A parametric analysis is also carried out on the bandgap.**

Keywords*— *Electromagnetic Bandgap Structure, dispersion diagram, FEM analysis, reflection phase, transmission coefficient component

I. INTRODUCTION

Electromagnetic band gap structures have gained more attention recently in the area of electromagnetic and applications. They allow us to control the propagation characteristics of electromagnetic waves for required functionality of any wireless devices. Electromagnetic Band Gap (EBG) materials are periodical in nature comprising metallic or dielectric unit cell. By introducing defects into the periodical structure, demonstrate the control over the propagation of the electromagnetic waves. Frequency rejection is possible within the frequency band and to open localized electromagnetic modes inside the forbidden frequency band. Thus EBGs, finds potential application in increasing the antenna efficiency by suppressing the unwanted surface wave current. It also improves the antenna gain and reduces backward radiation.[1]. They are used to eliminate simultaneous switching noise on power planes [2]. The rapid growth in wireless technology demands for miniaturization of antenna with wideband and good radiation characteristics. EBGs have distinctive properties, such as forbidden gap and co-phase reflection to meet the requirement of recent wireless antennas [3]. To achieve these characteristics, various novel and compact electromagnetic band gap structures have been explored such as mushroom-like structure [4], UC-PBG[5], fork-Like structure[6] and spiral –like structure.

In this paper, a novel C slot mushroom EBG is analysed. This has a band gap around 5.2 GHz and can be integrated with wireless antennas to improve their performance. Its dispersion characteristics is studied using suspended microstrip line method and Eigen mode solver and a parametric analysis on band gap by varying the substrate parameters is also given. The new structure is found to have compact size and better performance than the mushroom EBG of same size.

II. BAND GAP CHARACTERIZATION

A. Suspended Microstripline Method

The proposed EBG structure has slots in shape of C included in the conventional mushroom EBG structure. These novel EBGs are designed on a 2.8mm height FR4 dielectric support with the constant of 4.4. EBG unit cell parameters are: W x L is 5 x 5mm, the slot length L1 is 2mm, L2 is 0.5mm and C is 0.25mm, Periodicity is 5.2mm and the via radius is 0.2mm.The novel EBG design reduces the patch length from $0.5\lambda_0$ to $0.14\lambda_0$ operating at 5.25GHz. This low profile structure will increase its physical form suitable for compact wireless devices and makes it possible for accommodating more EBG cells in a designed area.

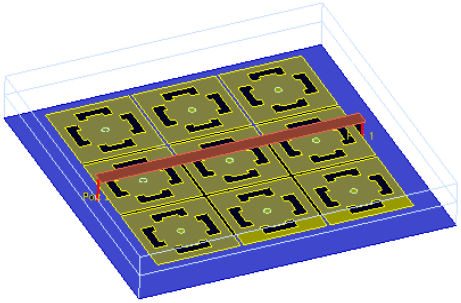

Fig.1 3X3 EBG array with suspended microstrip line

A 3x3 array of conventional mushroom EBGs and the proposed EBGs have been simulated in momentum analysis software using the method of suspended microstrip line to measure the band gap characteristic of the EBGs. A thin microstrip line with a characteristic impedance of 50$\Omega$is connected between two excitation ports as shown in Fig.1. Since the suspended structure has the strong coupling and reduces the effect of other higher order modes, band gap characteristics are more attainable.

The simulated result of the transmission coefficient S_{21} for the proposed EBG is shown in Fig.2. The transmission coefficient is much less for the band gap frequency, from 5.22GHz to 5.38GHz at a center frequency 5.29GHz.

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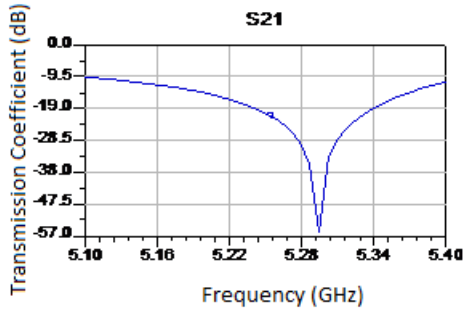

Fig.2 Transmission coefficient for C slot mushroom EBG

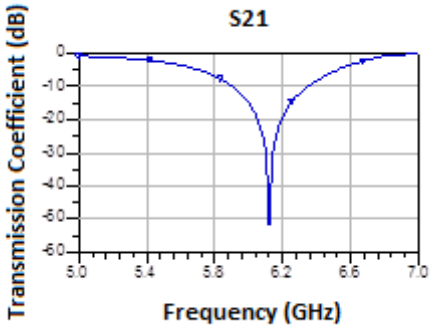

Fig.3 Transmission coefficient for conventional Mushroom EBG

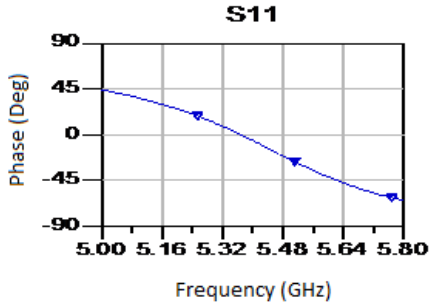

Fig .4 Reflection phase characteristic graph for C slot EBG

For the same parameters of novel EBG, the mushroom EBG produces the band gap from 5.95GHz to 6.22GHz centered at 6.085GHz which is shown in Fig.3. This shows that, for the same dimensions, the proposed EBG has a band gap at lower frequencies compared to the band gap of conventional mushroom EBG, indicating a structural compactness. The comparison between the two structures is listed in Table I.

TABLE I. BAND GAPS OF C SLOT AND MUSHROOM EBG

Structure	Lower	Upper
Mushroom EBG	5.99	6.22
C slot EBG	5	5.8

The reflection phase of the proposed c slot EBG is shown in Fig. 4. This shows decrease of reflection phase smoothly from 180 to -180 with increase in frequency. This is obvious at both low and high frequency regions, and proves its unique property of an artificial magnetic conductor surface. In this design the AMC positioned at 5.4GHz, covering the bandwidth from 5GHz to 5.8GHz.

B. Using Eigen mode solver

The single unit cell of the EBG lattice with the boundaries for Eigen mode model is shown in Fig.5. The 2D dispersion diagram is obtained using a high frequency structure simulator [7]. The FEM simulator is highly time consuming compared to the previous method but gives accurate results. FEM simulator searches frequencies for values of the wave vector. The dispersion curves for the neighbouring modes are found to predict the EBG band gap.

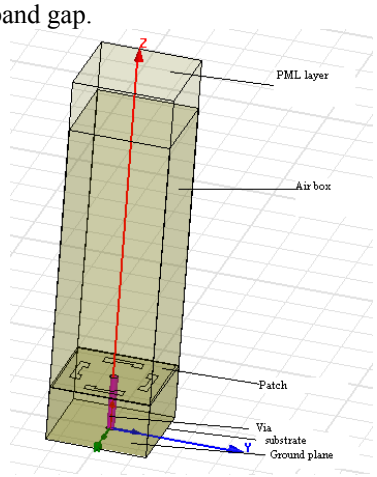

Fig..5 Unit Cell with PML Boumdary

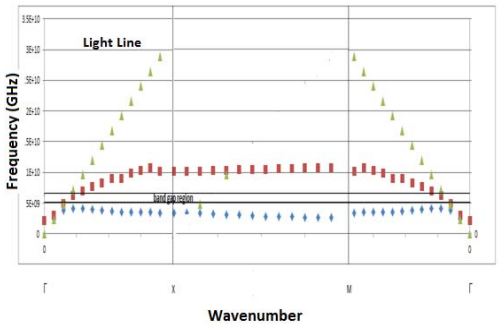

Fig.6 Dispersion diagram of C slot EBG

The horizontal axis of the dispersion diagram of Fig.6 indicates the wave number. The vertical axis indicates solution to the Eigen modes. The upper edge and lower edge of the band gap is determined by the second mode and first mode crossing the light line, respectively. The lower edge of the band gap occurs at 5GHz and the upper edge occurs at 5.8GHz.

From the above two approaches for characterizing the band gap of the C slot loaded mushroom EBG structure, it is found that the proposed EBG structure resonates at a frequency of 5.2GHz and has a band gap from 5 to 5.8GHz.

III. Parametric Analysis

The band gap or the stop band of the EBG structure depends on the parameters of the EBG structure like width of the patch, gap between the patches, via diameter etc., Effect of these parameters on the band gap is analysed by varying the EBG parameters.

A. Effect of Substrate Dielectric Constant:

The dielectric constant of the substrate is related with the capacitance of the structure. If the capacitance is increased, the frequency of operation may be decreased. Variation in band gap frequency for different substrate materials is shown in Table II. In this case all other parameters such as periodicity, thickness and via radius are kept constant.

TABLE II. BAND GAP FREQUENCIES FOR VARIOUS SUBSTRATE MATERIALS

Dielectric Constant	Lower Frequency(GHz)	Upper Frequency(GHz)
2.2	4.5	6.5
4.4	4.167	5.56
6.15	3.35	4.2
9.4	3	3.5
10.2	2.85	3.4

The effect of dielectric constant on band gap of EBG is shown in Fig.7. As the dielectric constant increases, the lower as well as the upper frequency of the stop band (band gap) decreases, effectively lowering the band gap. Hence as dielectric constant increases, the frequency range of the band gap is reduced.

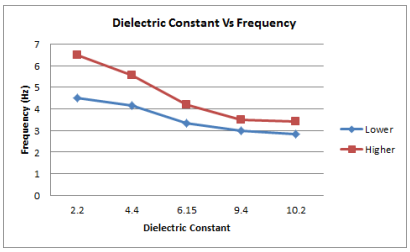

Fig.7 Band Gap frequencies for various Dielectric Constants

B. Effect of Substrate Thickness:

The substrate thickness is directly related to via length which is proportional to the inductance of the structure. As the inductance is increased, the operating frequency of the structure will be decreased. Hence the higher value of thickness of substrate, lower will be the frequency. Variation in frequency for different value of substrate thicknesses is shown in Table III. Here, all other parameters such as periodicity, dielectric constant and via radius are kept constant.

TABLE III. BAND GAP FREQUENCIES FOR VARIOUS SUBSTRATE THICKNESSES

Substrate Thickness(mm)	Lower Frequency(GHz)	Upper Frequency(GHz)
0.8	6.2	8.5
1	5.85	8
2	4.5	6
2.8	4.167	5.56
3.2	3.68	5.15

The effect of substrate thickness on band gap of EBG is shown in Fig.8. It shows the decrease in upper and lower frequencies of band gap for increase in substrate thickness.

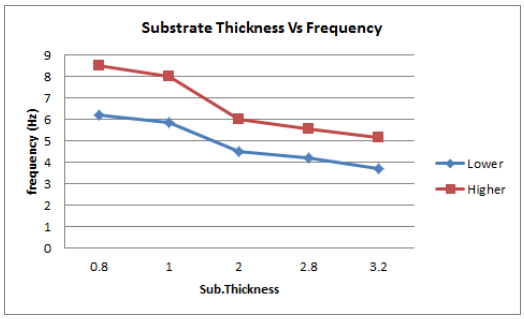

Fig.8 Band Gap frequencies for Substrate thickness

C. Effect of Via Radius:

Variations in band gap for different via radius is shown in Table IV. In this case all other parameters such as gap, thickness and dielectric constant are kept constant. The effect of via radius on band gap of EBG is shown in Fig.9. It is observed that when via radius is decreased, the band gap frequency decreases.

TABLE IV. BAND GAP FREQUENCIES FOR VARIOUS VIA RADIUS

Via Radius (mm)	Lower Frequency(GHz)	Upper Frequency(GHz)
0.2	4.167	5.56
0.4	4.25	5.6
0.5	4.48	5.4
0.8	4.7	6

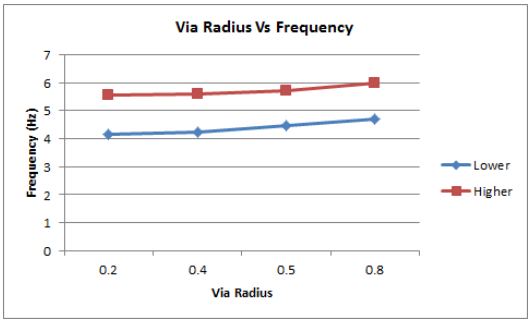

Fig.9 Band Gap frequencies for Via Radius

TABLE V. BAND GAP FREQUENCIES FOR VARIOUS GAPS

Periodicity (mm)	Lower Frequency(GHz)	Upper Frequency(GHz)
5.2	4.167	5.56
5.3	4.2	6
5.5	4.4	6.2
5.8	4.6	7
6	4.8	7.2

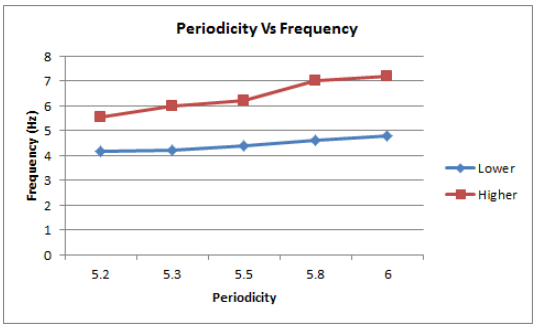

Fig.10 Band Gap frequencies for various Periodicity

D. *Effect of Periodicity:*

Variation in band gap frequency for different gap is shown in Table V. Here all other parameters such as via radius, thickness and dielectric constant are kept constant. The effect of periodicity on band gap of EBG is shown in Fig.10.When the periodicity and hence the gap between the patches is decreased, the frequency as well as the band gap is decreased.

IV. CONCLUSION

A novel C slot loaded EBG structure is proposed for wireless applications which resonates at 5.2GHz. Unit cell dimensions have been reduced from $0.5\lambda_0$ to $0.14\lambda_0$.This compactness increases its form fitness for recent wireless devices and the flexibility to hold more EBG cells in available area.

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PT-BAR: Prioritized Thermo-Buffer based Adaptive Routing Protocol for Network-on-Chip

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Abstract

The Network-on-Chip (NoC) is an important technology that replaced the traditional bus-based architecture for the future of System-on-Chip (SoC). The NoC system provides better scalability, performance, reliability, etc. to the SoC networks by implementing the principles of interconnection networks and packet switching. One of the major problems in NoC is the increase in temperature of the nodes that leads to unbalanced thermal management within the network. This further leads to performance degradation due to damaged nodes. A novel thermal management scheme is proposed in this paper, which makes use of the thermal state and buffer state of the nodes for routing the packets. The proposed Prioritized Thermo-Buffer based Adaptive

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Preface

This important series of Conferences arose from technical cooperation among the Technical University of Wroclaw (Poland), Coventry Polytechnic (UK), Wright State University (USA) and the University of Nevada, Las Vegas (USA). Prior to 1980, a series of International Conferences on Systems Science had been held in Wroclaw, Poland. In 1980, it was decided that the Conference would change venue on alternate years and be held in Coventry, UK and, at the same time, change emphasis from Science to Engineering when hosted in UK. Consequently, the first and second International Conferences on Systems Engineering were held in Coventry, UK in 1980 and 1982. In 1982, it was decided that the Engineering series of Conferences would be held in the USA each third year. The Third and Fifth International Conferences on Systems Engineering were held in Dayton, Ohio, USA. The Seventh, Ninth, Eleventh, Thirteenth, Fifteenth, Seventeenth, Nineteenth and Twenty First International Conferences on Systems Engineering were held in Las Vegas, Nevada, USA. This year, 2014, the Twenty Third International Conference on Systems Engineering is held in Las Vegas, Nevada, USA.

Research in the discipline of Systems Engineering is an important concept in the advancement of engineering and information sciences. Systems Engineering attempts to integrate many of the traditional engineering disciplines to solve large complex functioning engineering systems, dependent on components from all the disciplines. The research papers contained in these proceedings reflect the state of the art in systems engineering from all over the world and should serve as vital references to researchers to follow.

We received 273 submissions. Each paper was reviewed by at least two independent reviewers. A total of 129 papers were selected as full papers that gives an acceptance rate 47.2%. The University of Nevada, Las Vegas is very pleased to host this Twenty-Third International Conference on Systems Engineering. We would like to thank all the authors, reviewers, participants and student volunteers for making the conference a success. Our special thanks go to Michael Luby, Merry Stuber, and Lesley Poliner from Springer for their patience and help while organizing and preparing the proceedings. We wish all the participants a fruitful conference and a pleasant stay in Las Vegas.

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B. C. Mummadisetty, University of Nevada, Las Vegas, USA
A. Puri, University of Nevada, Las Vegas, USA
A. Sudhakar, University of Nevada, Las Vegas, USA

Contents

Special Session: Computational Cognitive Science

Special Session: Nature-inspired Computational Methods and Applications

Special Session: Intelligent Video Surveillance Systems

Special Session: From Boolean Problems to the Internet of Everything

Human Cognition and Vision Based Earlier Path Determination System for Indoor Mobile Robot Path Planning

N. Nithya and D. Tamil Selvi

1 Introduction

Vision is the powerful sensing method for autonomous mobile robot navigation. Computer vision is a process that mimicking the human perception system and helps to acquire the knowledge of the environment and taking decisions autonomously. Mobile Robot Navigation had three important skills such as localization, path planning and map building. Vision helps these three fundamental tasks. For example, Autonomous vehicle localization by object monitoring using scale invariant feature transform method and trajectory deviation errors were recovered using 3D space transformation and calibration line on the detected object[1]. Global navigation done by detecting or locating natural landmarks like doors, walls, and floor for indoor environment [2]. Detect static landmarks and moving human by single camera tracking and recognition system [3]. Cognition allows an autonomous mobile robot to get increased autonomy in matters of learning, knowledge about its environment. Cognitive science processes are explained in terms of functionalities which inside people's head like to perceive, store, recall, taking decisions. An important aspect of cognitive based human like perception and decision making of mobile robots being able to safely move in it is environment like the human brain and its thought process.

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1.1 Cognitive Perception

Perception or sensing an environment is a fundamental state of cognition. Computer vision and its algorithms give robust sensing capabilities to robot needs to perceive the world similar to human. Object detection is used to detect and estimate the location of landmarks [2], obstacles, and goal points [4] in an image and video frames without prior knowledge of its location information. However, in a perception there is typically sensory degradation or lack of perceptual cues affects the cognition. The visual systems are suffer from low image resolution, poor lighting conditions, pose deformation, occlusion, and scale variation. Occlusion is one of the major issues in an indoor clutter environment [5] for navigable space extraction and object localization in vision based path planning. For example, in automated video surveillance system human object partially occludes each other in crowd scenes [6]. Detection of partially occluded doors in landmark based navigation using data-driven Markov chain Monte Carlo(DDMCMC) [2]. Usually multiple objects are situated along the navigation path, in the indoor environment. Due to view point variation of robots, the required goal point may be partially occluded by other objects. In this way vision sensor is more compatible in robot navigation compare than other sensors like laser range finders and ultrasonic sensors. Shape feature is often sufficient cue for object detection. Many techniques have been developed for shape feature based object detection [7–11] is to identify and locate the target object in the environment image. Contour-based methods are more simple and effective for object detection and they work well in partial occlusion. The occluded parts or missing parts of an object, which result in the changes of object shapes, and it greatly decreases the true positive rate of the detection algorithm. Numerous techniques have been proposed for detection of occlusion in shape based and template based detection methods. Shape reconstruction is an efficient methodology to recover the missed portions or edge curves of object shape in the edge map. It computes which contour

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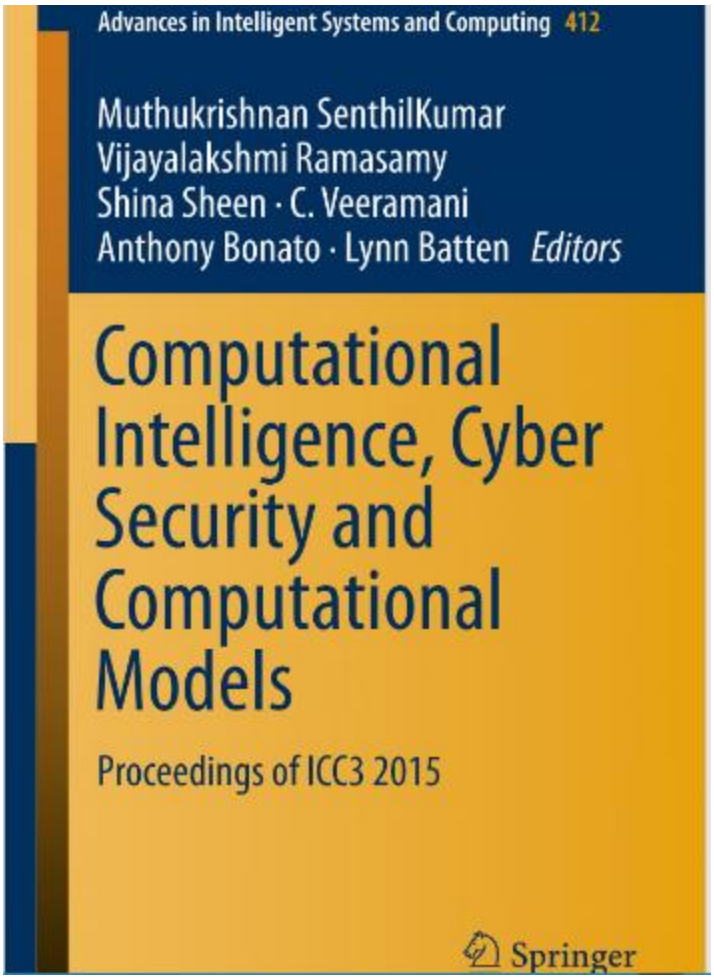
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Muthukrishnan SenthilKumar
Vijayalakshmi Ramasamy
Shina Sheen · C. Veeramani
Anthony Bonato · Lynn Batten Editors
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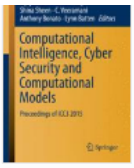

Cost Effective Rekeying Approach for Dynamic Membership Changes in Group Key Management

Authors | Authors and affiliations

Raja Lavanya, K. Sundarakantham, S. Mercy Shalinie

Conference paper
First Online: 19 December 2015

Part of the Advances in Intelligent Systems and Computing book series (AISC, volume 412)

Abstract

Security is an important requirement in reliable group communication over open networks in order to prevent intruder attack. A common secret key called group key is generated for encrypting the group information. A distributed key management methodology based on dynamic decentralized group key agreement protocol is required to handle this issue. Rekeying on new group key generation is based on membership driven or time driven. Rekeying is needed

Artificial Intelligence and Evolutionary Algorithms in Engineering Systems

Proceedings of ICAEES 2014, Volume 1

- Editors
- (view affiliations)

- L. Padma Suresh
- Subhransu Sekhar Dash
- Bijaya Ketan Panigrahi

Conference proceedings

Part of the Advances in Intelligent Systems and Computing book series (AISC, volume 324)

- Papers
- About

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About these proceedings

Introduction

The book is a collection of high-quality peer-reviewed research papers presented in Proceedings of International Conference on Artificial Intelligence and Evolutionary Algorithms in Engineering Systems (ICAEES 2014) held at Noorul Islam Centre for Higher Education, Kumaracoil, India. These research papers provide the latest developments in the broad area of use of artificial intelligence and evolutionary algorithms in engineering systems. The book discusses wide variety of industrial, engineering and scientific applications of the emerging techniques. It presents invited papers from the inventors/originators of new applications and advanced technologies.

Keywords

Artificial Immune Systems Bacterial Foraging Algorithms Data Structures & Algorithms Estimation of Distribution Algorithms Hybrid Intelligent System ICAEES 2014 Natural Language Processing Particle Swarm Optimization Spatial and Temporal Reasoning

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SPRINGER NATURE

Structural Refinement: An Effective OCL-Based Testing Approach

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1. Thiagarajar College of Engineering, , Madurai, India

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Abstract

Formal software development begins with formal specification of the user requirements or design of a system. Hence, formal specification languages are used to resolve ambiguities in user requirements or detect design errors at the early software life cycle. Furthermore, specification-based functional testing derives test inputs from its formal specification. However, formal specifications are expressed using set theory or predicate logics which are non-executable. Thus, functional test execution over abstract expressions would be impossible. Therefore, there is a need to refine abstract specification into a form that can be executable. In this paper, an automatic functional testing framework using object constraint language (OCL) formal specification has been proposed. The major objective of this paper is to describe how the refinement processes are integrated into the specification-based testing framework.

Keywords

OCL Structural refinement Fitness function Specification testing

Notes

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ABSTRACT
Organized Session

Renewable sources of energy

Time: 13:00-14:40, Saturday, August 22, 2015
SatM01, Room No. 01

Chair: Zongxiao Yang (Henan Univ. of Sci. and Tech., China)
Co-Chair: Aihui Wang (Zhongyuan Univ. of Tech., China)

SatM01-01

Cluster analysis on the service oriented alliance enterprise manufacturing resource

Yunxia Wang, Shenghai Qiu, Chengchong Gao, and Jun Wei
(Nanjing Institute of Tech., China)

To alliance manufacturing enterprises, there are some problems in resources such as different kinds, ununiform standards, high repeatability etc. Under cloud manufacturing service platform, using cluster analysis method to classify intelligent resources of alliance enterprise was studied. The same or similar resources are divided into one resources cluster. The uniqueness attribution of resources is solved. According to the cloud user needs, resources in a cluster not in all resources set are searched and matched. Using the evaluation method of manufacturing dynamic capacity, optimal resources are provided. It can improve using ratio of the resources. Finally an instance was verified.

SatM01-02

Performance and exhaust emissions of a turbocharged common rail DI diesel engine fueled with alcohol

Bin Xu, Yibin Liu, Jian Wu, Chuang Li, Weiwei Shang, and Zhihao Ma
(Henan Univ. of Sci. and Tech., China)

Three kinds of alcohol fuels and diesel were blended and combusted in an electronic control high-pressure common rail turbocharged DI diesel engine respectively. Without any modifications in the original engine structure, the combustion characteristics and emissions of alcohol-diesel fuel were investigated. It shows that the peak heat release rate and the brake specific fuel consumption increase with the increase of mixing ratio. At the same blending ratio, the peak heat release rate of methanol-diesel is the highest, but the brake specific fuel consumption is lower; N-butanol/diesel has the lowest CO and HC emissions but has the highest NOX emissions. NOX emissions of methanol-diesel and ethanol-diesel are approximated, but CO and HC emissions of ethanol-diesel is the highest. In consideration of the fuel economy and emission performance, methanol-diesel mixing fuel is better.

SatM01-03

Design and simulation of passive filter based on fundamental magnetic flux compensation

Qun Chen and Zongxiao Yang
(Henan Univ. of Sci. and Tech., China)

The harmonic problem becomes more and more serious in power grid, passive filter is one of the effective way to filter harmonic. This paper presented the design and simulation of passive filter based on the theory of fundamental magnetic flux compensation (FMFC). The primary winding of transformer is in series between the passive filter and the power supply, in the primary winding of series transformer, the fundamental current component of system was detected and tracked to produce a fundamental compensation current by inverter, which was injected into the secondary winding, when the injected fundamental current and the fundamental current component of the system satisfied the FMFC, the system fundamental current could pass transformer successfully, but most of the harmonic current was forced to flow into passive filter, thus achieved the purpose of harmonic isolation, and made most of the harmonic current flow into passive filter. Compared with the using of passive filter singly, it improved the efficiency of passive filter. The validity of the new method of filtering characteristics was verified by simulation through Matlab. The simulation results show that this method can filter out harmonic more efficiency in power systems when the waveform distortion is serious.

SatM01-04

Research on large supermarket fresh food supplier evaluation and selection based on SWOT-entropy weight fuzzy comprehensive model

Ying Yuan, Yi Zhang, Long Di, Ganggang Wu, and Zongxiao Yang
(Henan Univ. of Sci. and Tech., China)

Aiming at the subjectivity and random problems existing in traditional evaluation and selection processes of supermarket fresh goods suppliers, and combined with the perishable and vulnerable characteristics and the current situation and development trend of supermarket fresh food, the paper constructed the ladder type evaluation framework by using SWOT analysis method, which is used to study the external environment and capacity of the suppliers of supermarket fresh goods. In view of the deficiencies of common comprehensive evaluation methods on weight determination, therefore, this study proposed a structured methodology for supplier selection and evaluation based on the Entropy Weight Fuzzy Comprehensive Evaluation. In the end, the method was applied on the course of the fresh goods suppliers optimization in one supermarket to validate the feasibility and correctnessexample.

SatM01-05

A novel outer rotor axial primary magnetic circuit permanent magnet generator

Ximei Li and Zongxiao Yang, and Dongliang Song
(Henan Univ. of Sci. and Tech., China)

Wind energy has attracted persistent attention as a renewable energy, so it is very significant to research the permanent magnet generator which is an essential part of wind energy conversion system. This paper proposes a novel outer rotor axial primary magnetic circuit permanent magnet generator. For the sake of small size and light weight with extra low speed for direct coupling, the outer rotor structure is used. The stator windings are adopted double fractional-slot concentrated to reduce the cogging torque. The most highlight is a novel axial primary magnetic circuit. Through the air gap magnetic flux density test experiments, there exist the linear relationship of the negative slope between the magnetic flux density and the air gap. This novel type of magnetic circuit structure makes greatly improved the sensitivity gap, so that the key Tech. such as structure design、process route determined and manufacturing become easier to achieve, significantly reduce generator costs, ease of construction practical application. Meanwhile, the novel outer rotor axial primary magnetic circuit permanent magnet generator can overcome the problems of the lager overall start reluctance generator torque and the lower wind energy conversion rate under the condition of small wind.

Organized Session

Advanced intelligent control in robotics and mechatronics

Time: 13:00-14:40, Saturday, August 22, 2015
SatM02, Room No. 02

Chair: Luige Vladareanu (Romanian Acad., Romania)
Co-Chair: Zengguang Hou (Chinese Acad. of Sci., China)

SatM02-01

Active training research of a lower limb rehabilitation robot based on constrained trajectory

Hongbo Wang, Dong Zhang, Hao Lu, Yongfei Feng, and Peng Xu (Yanshan Univ., China)
Razvan-Viorel Mihai and Luige Vladareanu (Romanian Acad., Romania)

In order to help patients achieve effective and coordinating multi-joints movement easily, the paper presents an active training method of a lower limb rehabilitation robot based on constrained trajectory. The realization process of the method is as follows. The patient's movement intention is recognized by analyzing the signals from torque sensors installed in rehabilitation robot joints, and the moving velocity of the mechanical arm terminal is calculated through the establishment of the damping function and the design of constrained trajectory. The velocity of joints can be calculated through kinematic Jacobi matrix, and is used to drive the joints. The moving velocity of the mechanical arm terminal on a constrained trajectory can be controlled through adjusting the damping function, in order to achieve the active rehabilitation training for different patients at different levels. Finally, the feasibility of the method is validated by the experiment.

SatM02-02

Fuzzy controller design of the wire feeder of invasive vascular interventional surgery robot

Hongbo Wang, Shuaishuai Wang, Wen Zhang, and Liyu Xie (Yanshan Univ., China)
Xue Yang (Univ. of Jinan, China)
Luige Vladareanu and Radu Munteanu (Romanian Acad., Romania)

A fuzzy controller is analyzed for the wire feeder of the invasive vascular interventional surgery robot in this paper. First of all, the mechanism of the wire feeder is introduced, and the axial motion is analyzed. Second, the dynamic model of the wire feeder is established. Next, the fuzzy PID controller is analyzed to improve the positioning accuracy. At last, the controller is simulated by MATLAB. Comparing with normal PID controller, the fuzzy PID controller has better dynamic properties and anti-jamming ability. The result verifies the effectiveness of the controller strategy.

SatM02-03

Advanced intelligent walking robot control through sliding motion control and bond graphs methods

Ionel Alexandru Gal and Luige Vladareanu (Romanian Acad., Romania)
Hongbo Wang (Yanshan Univ., China)
Hongnian Yu (Bournemouth Univ., UK)
Mingcong Deng (Tokyo Univ. of Agri. and Tech., Japan)

In this paper, we tested a dynamic control law on a 2DOF robot walking leg. To achieve this, we modeled the system using bond graphs, and the Sliding Control Method for real time control. To increase performance of the robot trajectory tracking control a fuzzy gain adjustment inside the dynamic control method has been used and the new results include the systems' influence on the sliding parameter. The research results lead to improve of the walking robot movement control on unstructured and bumped surfaces.

SatM02-04

Versatile intelligent portable robot platform for flexible robotic cells with AGV

Luige Vladareanu, Cristian Spirleanu, and Mihaiela Iliescu
(Romanian Acad., Romania)
Hongnian Yu (Bournemouth Univ., UK)
Mingcong Deng (Tokyo Univ. of Agri. and Tech., Japan)
Weizhong Guo and Feng Gao (Shanghai Jiao Tong Univ., China)

The paper studies the flexible robotic cells in cooperation with automated guided vehicle (AGV), in the presence of obstacles, at constant or variable speed and variable load, aiming to optimizing the interaction between AGV and flexible robotic cell components. Overall system performance is analyzed by using modeling tools for discrete event systems like Generalized Stochastic Petri Net (GSPN). The interaction between AGV and flexible robotic cell components is implemented through communication messages using serial data received from an optical XY encoder, communication protocol receive function is modeled with GSPN. Improving of the stability performances and real time motion control are analyzed and the virtual projection method is adopted using the Versatile Intelligent Portable Robot Platform VIPRO. The obtained results, validated on the experimental RTOS robotic platform and DMQX language extension for robotic applications, lead to higher performance in relation to interaction optimization, decreased the flexible cell's cycle time, increased mobility and stability of the AGV and also the development of new technological capabilities of the control systems.

SatM02-05

Haptic intelligent interfaces for NAO robot hand control

Octavian Melinte, Luige Vladareanu and Ligia Munteanu
(Romanian Acad., Romania)
Hongnian Yu and Shuang Cang (Bournemouth Univ., UK)
Zengguang Hou and Guibin Bian (Chinese Acad. of Sci., China)
Hongbo Wang (Yanshan Univ. , China)

The paper presents a new approach on haptic interface control for NAO robotic hand. The haptic teleoperation of NAO robot's hand raises some issues, the most important being mapping the haptic device dynamic for NAO robot hand. The mapping was achieved by determining a dynamic gain of robot haptic feedback through Neural Network. The results lead to the achievement of the haptic intelligent interfaces for the NAO robot hand control which can be integrated into an innovative haptic robot control system.

Regular Session

Optimization methods and application I

Time: 13:00-14:40, Saturday, August 22, 2015
SatM03, Room No. 03

Chair: Shuhui Bi (Univ. of Jinan, China)
Co-Chair: Huimin Xiao (Henan Univ. of Economics and Law, China)

SatM03-01

Weak reachability of probabilistic boolean control networks

Zhiqiang Li and Huimin Xiao
(Henan Univ. of Economics and Law, China)

This paper concerns the weak reachability of probabilistic Boolean control networks (PBCNs). Using semi-tensor product, PBCNs are expressed as discrete time bilinear systems with respect to states and controls. From the algebraic form of PBCNs, the maximum transfer probability matrix for PBCNs is constructed. From the matrix, necessary and sufficient condition for weak reachability of PBCNs is given. Also, a numerical example is presented to show the applicability of our approach.

SatM03-02

Oscillation criteria for a class of nonlinear impulsive parabolic system under dirichlet boundary condition

Junhong Liu, Wenxue Liu, Lifeng Li, and Qi Jin
(Acad. of Armored Force Eng., China)

In this paper, the authors discuss oscillation of non-zero solutions for a class of impulsive parabolic system. Several oscillation criterias are obtained under Dirichlet boundary condition by using the Green formula and Jensen inequality.

SatM03-03

Operator-based left coprime factorization for nonlinear systems

Fazhan Tao and Mingcong Deng
(Tokyo Univ. of Agri. and Tech., Japan)

In this paper, a class of nonlinear systems are considered with the left factorization approach. More specially, the stability of the nonlinear systems are guaranteed using the proposed design scheme that links the stability to the Bezout identity. At the same time, through the proposed scheme, the left coprime factorization of the nonlinear systems is verified. Based on the proposed design scheme, a sufficient condtion is found to establish a relationship between the left coprime factorization and the right coprime factorization. Finally, a numerical simulation is given to confirm the effectiveness of the proposed method.

SatM03-04

Passivity-based robust control for uncertain nonlinear feedback systems

Ni Bu (Qingdao Univ. of Sci. and Tech., China)
Mingcong Deng (Tokyo Univ. of Agri. and Tech., Japan)

This paper is concerned with passivity-based robust control and tracking performance for nonlinear feedback system with unknown perturbations. By designing the feedforward controller in smaller norm, not only the nonlinear system with nominal plant but also that with perturbed plant can be stabilized, moreover, the plant output can be proved to be closer to the reference output. The effectiveness of the proposed is confirmed by the simulation results.

SatM03-05

Correlated neural activity in spiking networks with topographic couplings

Jinli Xie, Qinjun Zhao, and Jianyu Zhao (Univ. of Jinan, China)

A neural field model with topographic feedforward and feedback is chosen to confirm how correlated activity in spiking neural networks depends on spatial couplings. Numerical simulations reveal that the intensity of the correlated firing is suppressed as the feedback spatial scale decreases. Afterwards, as the feedback becomes topographic, the correlation coefficient is almost unchanged with further decreases in feedback spatial scale. Correspondingly, the relatively flat values of correlation coefficient with decreasing feedforward spatial scale imply that the effect of spatial spread of feedforward on correlated firing of the neurons keeps almost invariable. Therefore, the correlation coefficient and the spatial scales are uncorrelated in the network with topographic couplings. In brief, the global feedback enables the system to modulate correlated neural activity with the spatial scale, while the introduction of topography in couplings brings little effect on network correlations.

Regular Session

Optimization methods and applications II

Time: 14:50-16:30, Saturday, August 22, 2015
SatP01, Room No. 01

Chair: Guangdong Tian (Northeast Forestry Univ., China)
Co-Chair: Zongxiao Yang (Henan Univ. of Sci. and Tech., China)

SatP01-01

Scheduling of rescue vehicles to forest fires via multi-objective particle swarm optimization

Yaping Ren and Guangdong Tian (Northeast Forestry Univ., China)
Mengchu Zhou (New Jersey Institute of Tech., USA)

It is complex and difficult to perform the rescue vehicle scheduling to handle forest fires in order to reduce the operational cost and improve the efficiency of fire-extinguishing services. A new research issue arises when a) decision-makers want to minimize the number of rescue vehicles while minimizing the rescue time; and b) decision-makers prefer to complete the fire-extinguishing task given limited vehicle resources. To do so, this work presents a novel multi-objective scheduling model to handle forest fires subject to limited rescue vehicle constraints, in which a fire spread speed factor is introduced into this model to better describe a practical forest fire. Also, a Multi-objective Particle Swarm Optimization (MPSO) algorithm is proposed to yield a set of Pareto solutions for this problem. This approach is applied to a real-world emergency scheduling problem of the forest fire in Mt. Daxing'anling, China. Both theoretical and simulation results demonstrate that the proposed approach is able to quickly produce Pareto solutions for decision makers.

SatP01-02

An effective VNSSA algorithm for the blocking flowshop scheduling problem with makespan minimization

Chaoyong Zhang, Zhanpeng Xie, and Xinyu Shao
(Huazhong Univ. of Sci. and Tech., China)
Guangdong Tian (Northeast Forestry Univ., China)

This paper proposes a hybrid algorithm based on the variable neighborhood search (VNS) and the simulated annealing approach (SA) for minimizing the makespan in a blocking flowshop scheduling problem. The proposed hybrid algorithm (VNSSA) adopts simulated annealing approach (SA) as the local search method in the third stage of variable neighborhood search (VNS), and uses a perturbation mechanism consisting of various neighborhood operators to diversify the search. The destruction and construction phases of iterated greedy algorithm are used to generate a trial solution during the perturbation process of SA to further promote the search capability. To validate the performance of the proposed VNSSA algorithm, computational experiments and comparisons were conducted on the well-known benchmark problems of Taillard. The computational results of the proposed algorithm when evaluated against the state-of-art algorithms from the literature show good performance, some new best solutions for Taillard's instances are reported for this problem.

SatP01-03

Simulation modeling of shuttle racking system based on automod

Bingfeng Sang and Yukun Liu
(Beijing Univ. of Posts and Telecommunications, China)

The paper researches modeling method of shuttle racking system based on Automod. By analyzing the real system, the system model of shuttle racking system was put forward. A method of simulation modeling of LIFO type and the modeling step for the shuttle racking system are provided. At last, an example of some warehouse of refined grain verifies the feasibility, the effectiveness, and the reusability of the method.

SatP01-04

An expected value multi-objective optimization model to locate a vehicle inspection station

Guangdong Tian (Northeast Forestry Univ., China)
Mengchu Zhou (New Jersey Institute of Tech., USA)

Optimally locating a transportation facility and automotive service enterprise is an interesting and important problem. In practice, many related factors, e.g., customer demands, allocations, and locations of customers and facilities, are changing, and thus the problem features with uncertainty. To account for this uncertainty, some researchers have addressed its stochastic time and cost issues. A new research issue arises when a) decision-makers want to minimize the transportation time of customers while minimizing their transpiration cost when locating a facility; and b) users prefer to arrive at the destination within the specific time and cost. By taking a vehicle inspection station as a typical automotive service enterprise example, this work proposes a novel stochastic multi-objective optimization approach to address it. Moreover, some regional constraints can greatly influence its solution; while vehicle velocity is an uncertain variable due to the influence of some unpredictable factors in a location process. This work builds a practical stochastic expected value multi-objective programming model of its location with regional constraints and varying velocity. A hybrid algorithm integrating stochastic simulation and Genetic Algorithms (GA), namely a random weight based multi-objective GA, is proposed to solve the proposed models. A numerical example is given to illustrate the proposed models and the effectiveness of the proposed algorithm.

SatP01-05

Experimental study on nonlinear vibration control of an L-shape arm

Yanfeng Wu and Mingcong Deng
(Tokyo Univ. of Agri. and Tech., Japan)
Longguo Jin
(Qingdao Technical College, China)

In this paper, an experimental system is set up to control the vibration of an L-type arm which is driven by linear motor. Firstly, the vibration dynamics the L-shape arm is modelled based on Euler-Bernoulli beam theory, the relation between motor motion and arm vibration is investigated. Secondly, based on nonlinear operator control theory, two nonlinear control schemes are designed to control the motion of the motor and suppress the vibration of arm by using piezoelectric actuator, respectively. The vibration of arm is considered when controlling the motor. A tracking compensator is designed to eliminate the hysteresis effect of the piezoelectric actuator. Finally, by using two piezoelectric sensors to measure the transverse displacement and one piezoelectric actuator to suppress the vibration of arm, the experimental system is set up, and some experiments are conducted to verify the effectiveness of the proposed control scheme.

Regular Session

Advanced nonlinear control in robotics

Time: 14:50-16:30, Saturday, August 22, 2015
SatP02, Room No. 02

Chair: Hongnian Yu (Bournemouth Univ., UK)
Co-Chair: Yukinori Nakamura (Tokyo Univ. of Agri. and Tech., Japan)

SatP02-01

The mechatronic system of eco-dolphin - a fleet of autonomous underwater vehicles

Hong Liu (Embry-Riddle Aeronautical Univ., USA),
Xudong Shi (Civil Aviation Univ. of China, China)
Junzhen Shao, Qi Zhou, Stacey Joseph-Ellison, Johnathan Jaworski, and Ci Wen
(Embry-Riddle Aeronautical Univ., USA)

This paper presents the mechatronic system of a fleet of three autonomous underwater vehicles (AUVs) called Eco-Dolphin. Besides common features of robots, the unique challenges for underwater robots such as water proof Tech. and underwater communication are addressed. The Eco-Dolphin fleet is built to serve both societal and the academic needs specified below. Coastal areas have the densest human populations and serve as critical economic and recreational areas. However, they are sensitive to both human-induced and natural alterations as well as disasters. While robots are widely used to replace humans for dangerous work in many other fields, environmental monitoring missions in coastal waters still mostly rely on human divers. To serve the societal need, the Eco-Dolphin fleet presents a novel prototype of cost effective robots for monitoring coastal environments. The fleet can collect data cooperatively with minimal supervision from the users on a nearby boat. To contribute to academic research, the fleet is used to test swarming algorithms for robot formation in 3D space. To contribute to Sci. education, the Eco-Dolphin project offers a platform for students to gain hands-on research experiences and an incubator to find first-hand scientific research problems.

SatP02-02

Extended development of LinuxCNC for control of a delta robot

Feng Huo, Geoksoon Hong, and Aunneow Poo
(National Univ. of Singapore, Singapore)

In recent years, open architecture motion controllers, including those for CNC machines and robots, have received much interest and support among the global control and automation community. This paper presents work done in extending a well-known and supported open-source control software called LinuxCNC for the control of a Delta robot, a translational parallel mechanism. Key features in the development process are covered and discussed and the final customized system based on LinuxCNC described.

SatP02-03

Minimizing energy consumption in a U-shaped robotic assembly line

J. Mukund Nilakantan and S.G. Ponnambalam
(Monash Univ. Malaysia, Malaysia)
George Q. Huang (The Univ. of Hong Kong, China)

Manufacturing industries these days are more concerned about the energy consumption due to the increasing energy cost. It is observed that industries can achieve significant savings in the energy cost even when a small percentage of energy consumption is reduced. In a manufacturing industry, assembly lines are equipped with robots to perform the assembly tasks and there is a need for efficiently balancing the assembly line by reducing the energy consumption during the production phase. The authors could not find any research on optimizing energy consumption in U-shaped robotic assembly line systems to date. The objective of this paper is to propose an optimization models with an objective of minimizing the energy consumption in a U-shaped robotic assembly line when the number of workstations are fixed. Since the assembly line balancing problems falls under the category of NP-hard, an efficient bio inspired algorithm is implemented to solve the problem. The model proposed is very well applicable for automobile assembly line where robots are employed. The energy consumption is evaluated on the benchmark data and energy consumption obtained by the U-shaped robotic assembly line is compared with the energy consumption obtained with straight robotic assembly line. The cycle time of the layouts are also compared. The results obtained using this proposed model can be used for the decision making process in the industry. The paper also proposes an optimization model for minimizing the cycle time. The energy consumption of the assembly line when the cycle time is minimized is evaluated and presented.

SatP02-04

Charged system search algorithm for robotic drill path optimization

G. Kanagaraj (Thiagarajar College of Eng., India)
S.G. Ponnambalam (Monash Univ. Malaysia, Malaysia)
C.K. Loo (Univ. of Malaya, Malaysia)

This paper presents a Charged System Search (CSS) algorithm to solve for robotic drill path optimization involved in printed circuit board (PCB) manufacturing industries. Most of the operational time of a PCB Robotic Drill are spent on moving the drill bit between the holes. An optimized path translates to a minimal cost of operating the robot. The drill path consists of a number of potential locations where the holes are going to be drilled. As the number of holes required increases so thus does the complexity to find the optimized path. Recently developed CSS algorithm proposed to solve this complex problem with minimal computational time. The performance of CSS algorithm is tested and verified with four case studies from the literature. The computational experience conducted in this research indicates that the proposed algorithm is capable to efficiently find the optimal path for PCB holes drilling process with reasonable computational time.

SatP02-05

Implementation of remotely controllable mobile robot system over mobile Ad-hoc network

Mohammad Shahidul Hasan (Staffordshire Univ., UK)
Hongnian Yu (Bournemouth Univ., UK)

Remotely controllable wireless mobile robots are being used in many applications now days. Such systems can be restricted by the range of wireless signal. Mobile Ad-hoc Networks offer a number of advantages e.g. multi hop communication i.e. longer range; can be deployed without any infrastructure etc. This paper presents the implementation details of a wireless mobile robot system over Mobile Ad-hoc Network. It consists of a target mobile robot and a relay / observer robot. The target robot is equipped with a robotic arm to execute various tasks. The relay / observer robot can route network packets between the controller and the target robot. It also produces visual feedback of the target robot to the user at the controlling end.

Regular Session

Control of mechatronic systems I

Time: 14:50-16:30, Saturday, August 22, 2015
SatP03, Room No. 03

Chair: Shinji Wakui (Tokyo Univ. of Agri. and Tech., Japan)
Co-Chair: Kazuyuki Ito (Hosei Univ., Japan)

SatP03-01

An interpretation of unbalance vibration compensator for five-axes active magnetic bearing systems based on internal model principle

Taiki Nakamura, Shinji Wakui, and Yukinori Nakamura
(Tokyo Univ. of Agri. and Tech., Japan)

Five-axes active magnetic bearing (AMB) systems are widely utilized for the field of precision such as semiconductor exposure machines. This paper considers an interpretation of an unbalance vibration compensator PGC for five-axes AMB. As methods for the rejection of periodic disturbance, repetitive control and PIS control, which are based on internal model principle, have been known. The PIS control can be considered as a special case of the repetitive control. This paper investigates the relationship between the PGC and the PIS control from the similarity of the pole assignment and shows that the PGC suppresses the unbalance vibration from the perspective of the internal model principle.

SatP03-02

Vibration suppression of galvano mirror considering whirling of shaft

Keisuke Nakade, Taiki Nakamura, Shinji Wakui, and Yukinori Nakamura
(Tokyo Univ. of Agri. and Tech., Japan)

Main movement of a galvano mirror is the rolling motion. However, since the structure of galvano mirror is cantilever, this mirror is vertically vibrated to mirror reflective surface. This paper considers the suppression of the above vibration, which is called pitching vibration. Although the galvano mirror is equipped with an encoder to detect the roll angle of mirror, the pitching vibration of mirror cannot be detected. To overcome this problem, the pitching vibration is verified by the frequency response and the time response using two dimensional position sensitive detector. Moreover, three rubbers with different hardness are inserted on the basis of a structure of the motor shaft in order to suppress the vibration.

SatP03-03

A consideration of parameter identification of a linear stage using particle swarm optimization

Marino Watanabe, Yukinori Nakamura, and Shinji Wakui
(Tokyo Univ. of Agri. and Tech., Japan)

This paper considers the model-based controller in order to achieve the high speed and high precision positioning of a linear stage. In the controller design, particle swarm optimization (PSO) is employed for the parameter identification of the linear stage. Particles of the PSO are updated so that the difference between simulation and experimental results becomes small. After the parameter identification, the feedforward controller whose parameters correspond to the identified model of the linear stage is designed. Effectiveness of the proposed method is shown by simulation and experiment.

SatP03-04

Development of a torque-sensorless viscometer for food processing applications

Seiji Hashimoto, Yuqi Jiang, and Amat Basari (Gunma Univ., Japan)
Wei Jiang (Yangzhou Univ., China)

Demands for automatic food processors are growing rapidly year by year. In this paper, a novel viscosity measurement method which can provide real-time monitoring in food processing application has been proposed. Instead of using a torque sensor for the viscosity measurement, the proposed method applies disturbance observer-based estimation technique to the viscometer. The effectiveness of the proposed method is verified through simulations and experiments.

SatP03-05

Study on detection of earthquake using DI value and its application to switching control for air type anti-vibration apparatus

Masayuki Kubota, Hirokazu Mineo, Shinji Wakui, and Yukinori Nakamura
(Tokyo Univ. of Agri. and Tech., Japan)

In semiconductor manufacturing, air type-vibration apparatuses (AVAs) are widely employed. When an earthquake occurs, the AVAs have to be stopped in order to avoid serious damage to semiconductor exposure machines. Spectrum intensity (SI) value is the metric effective for the detection of earthquake though it takes time to calculate this value. To avoid long computation time, this paper uses destructive intensity (DI) value instead of SI value. Simulation demonstrates that DI value, whose computation time is short, can be applied to switching control for AVAs.

Invited Session
New developments on ESP

Time: 16:40-18:40, Saturday, August 22, 2015
SatE01, Room No. 01

Chair: Jie Shi (Univ. of Electro-Communications, Japan)
Co-Chair: Yan Yu (Univ. of Electro-Communications, Japan)

SatE01-01

An overview of supplementary teaching materials for advanced EST students in Japan

Yan Yu and Jie Shi (Univ. of Electro-Communications, Japan)

EST (English for Science and Technology) is an important area of ESP in Japan. The success of EST courses for science and technology/engineering disciplines is partially dependent on the choices of teaching materials. As shown in previous research done by the same presenters of this study in ICAMechs 2014, the quantity of teaching materials for lower and intermediate levels of EST courses in Japan is considered to be satisfactory though the concerns over the quality and variations of technical disciplines still exist. This research is a continuation of the investigation of teaching materials for EST courses in Japan with a focus on the supplementary or reference materials for advanced students of EST at Japanese universities. This study aims to conduct an overview of the market available reference books for advanced EST students at Japanese universities. The categories of the overview include languages used, publication information, main content themes/topics and/or skills, target audience/level of English, and length.

SatE01-02

Profiling Japanese EST students' vocabulary ability using the new general service list test (NGSLT) and the new academic word list test (NAWLT)

Shin'ichi Hashimoto, Yan Yu, Jie Shi, and Haiyan Zhan
(Univ. of Electro-Communications, Japan)

Understanding the vocabulary profiles of students is an important point for improving classroom-based pedagogy as well as materials development based on students' abilities and needs in ESP (English for Specific Purposes). As the second phase of a longitudinal research to assess Japanese university students' vocabulary competency, the researchers collected data on the performance of second and third-year students majoring in science and engineering on the New General Service List Test (NGSLT) and the New Academic Word List Test (NAWLT) developed by Phil Bennett and Tim Stoeckel in 2015 using words from the New General Service List 1.01 (NGSL 1.01) and the New Academic Word List (NAWL) developed by Charles Browne, Brent Culligan and Joseph Phillips in 2014. The NGSL 1.01 consists of 2,801 of the most frequently-appearing words in general use, and is a revision of the original General Service List (about 2,000 words) which was compiled by Michael West in 1953. The NWAL consists of 963 frequently-appearing words in academic text, and is a revision of the original Academic Word List (570 words) which was compiled by Averil Coxhead in 2000. Both the NGSLT and NAWLT are diagnostic tests of written receptive knowledge of the New General Service List and the New Academic Word List respectively. The NGSLT and NAWLT use the same specifications as the Vocabulary Size Test (VST) which was developed by Paul Nation and David Beglar in 2007, and have relatively good test reliability. This paper introduces the background about the tests, the participants in the study, and the data collection method. It also interprets the results of the collected scores, and discusses the implications of the results between departments and years. In future studies, the researchers hope to find ways to perceive the vocabulary abilities of students in their particular ESP fields. By doing so, they can be better informed providers of instruction and create materials tailored to students' particular needs.

SatE01-03

Peer evaluation of academic presentations by Japanese graduate students: qualitative evaluation

Jie Shi and Cross John
(Univ. of Electro-Communications, Japan)

This study reports an investigation on the qualitative data of Japanese graduate students' evaluation on peers' academic presentation in English which is designed to be part of a collaborative learning project. A total of 772 peer comments was extracted from 265 peer evaluation on 10 group presentations as the dataset of this investigation. Results indicate that students' focuses are on the quality of slides including figures, tables and texts, the understanding of the technical content of the research presented by peers though students come from various laboratories, and peers' delivery abilities such as eye contact, reading from prepared notes and rate/speed of speech. The data also shows that students gave more positive comments than negative ones and that the suggestion type of comment is the least in terms of the quantity.

SatE01-04

Teaching poster by using genre approach to science and technology students of a Japanese university

Rajagopalan Maheswari Uma
(Toyo Univ., Univ. of Electro-Communications, Japan)
Jie Shi (Univ. of Electro-Communications, Japan)

Science and technology students require the specialized skill of making poster and the explicit teaching of which is lacking in the curricula of general Japanese English tertiary education. This paper considers posters as an expanded form of abstracts and reports teaching of posters to 20 third-year students of an undergraduate ESP course at a Japanese university of science and engineering. First, students were taught to write an abstract using genre theory which required teaching of the generic moves of an abstract of a research article (RA). Teaching of the abstract involved the explicit teaching of the basic moves of background, purpose, methods, results and summary that are needed to construct RA abstract. Following that, students deconstructed abstracts taken from authentic research articles selected by both the teacher and the student themselves into moves. Having understood the moves, a democratic choice of several topics from the experiments done as part of the subject curriculum was chosen for constructing abstracts. The abstract drafts were peer evaluated with checklists, followed by teacher's comments based on which the students submitted a final draft. Next, with the final draft, the students expanded the abstract to construct a poster. This task involved writing the contents of each of the moves in the abstract to detailed content expanding each of the sections, Introduction, Methods, Results and Summary. Contents of all the sections except for the Results were prepared in groups of three or four with each member being responsible for each section. Although group members constructed the contents through discussion, poster making and presentation were done individually. Though there were some overlaps in the contents, the current project was found to empower the students with the required poster making and presentation skills which was also shown from the post survey.

SatE01-05

Corpus-based analysis of academic RA genre: the "Results" sub-genre

Louvigné Sébastien and Jie Shi
(Univ. of Electro-Communications, Japan)

Research Article (RA) is the kind of academic publication that all researchers must produce constantly but not necessarily have learned systematically in their university education. RA consists of multiple parts as typically summarized to be IMRAD (Introduction, Method, Result and Discussion) which is a considered to be one of the academic genres. Each of the multiple parts of the RA genre is comprised of one or more sub-genres, which makes the RA genre complex and challenging, especially for novice EST (English for Science and Technology) researchers. As an effort to decode the RA genre in order to help the novice EST researchers, the researchers of this study analyze the sub-genre of "Results" using corpus-based approach, after they analyzed the Abstract, Introduction and Method sub-genres in previous studies. The purpose of this study is threefold: to determine the linguistic features of the common moves (structure) in the "Results" sub-genre of RA using corpus analysis, to compare the linguistic features of "Results" with those of the whole RA, "Introduction", and "Method".

SatE01-06

Understanding the most essential types of words for Physics undergraduate students

Sonia Sharmin (Univ. of Tsukuba, Japan)

The field of English for Specific Purposes (ESP) concerns not only English practitioners or EFL (English as a Foreign Language) but also disciplinary specification and the teaching faculty of disciplines of English learners, commonly known as subject-matter specialists because those specialists could also instruct or assist the EFL students in terms of proper usage of science and technological English. The participation of the specialists in ESP education is a growing area of both ESP and disciplinary research fields and has become a fast developing area of ESP research. Identifying content-area English academic language is essential for proper instruction of students. This study analyzed a well-known and widely used physics textbook for undergraduate students of first year, namely, Fundamentals of Physics by David Halliday, Robert Resnick, and Jearl Walker (8th edition), to understand the words of highest frequency used in this book. The high frequency words as well as a low frequency words in the textbook were assessed. In this study, investigation of the language functions based on the analysis of the corpus and identification of the words that construction the functions are the ultimate aim of this study. The free corpus software, AntWordProfiler, was employed for the analysis.

Regular Session
Information processing

Time: 16:40-18:20, Saturday, August 22, 2015
SatE02, Room No. 02

Chair: S.G. Ponnambalam (Monash Univ. Malaysia, Malaysia)
Co-Chair: Ken Nagasaka (Tokyo Univ. of Agri. and Tech., Japan)

SatE02-01

Modelling a 20MW scale solar farm in an unused angled area near Fukushima nuclear power plant

Amin Mohammadirad and Ken Nagasaka
(Tokyo Univ. of Agri. and Tech., Japan)

Mega-Solar generation becomes one of the important parts in the global energy supply with current situation of the fossil fuels exhaust and replacement of nuclear power energy after the nuclear power plant acceded caused by Great East Japan Earthquake and tsunami on March 11,2011. Also, the CO2 emission must be reduced based on the Kyoto protocol. One of the effective ways to reduce the CO2 emission is to use renewable energy such as wind and solar energies. For this reason, how to make optimal allocation of large-scale PV and wind farms with maximum power become necessary both for the world as well as Japan. In this study we are focusing on Mega-Solar issue for the flat and angled lands. As different slop directions will affect the Maximum Point Power Tracking (MPPT) of each PV systems. We also consider the MPPT for these angled lands. So far, Mega-Solar farms are installed in flat lands. However, recently, there are great needs (almost more than 1000 projects are waiting to run) for introducing Mega-Solar farms not only in flat but also in hills or angled lands. These lands with slope are no longer omitted from the planning of a Mega-Solar farm. In this paper, we consider on Mega-Solar farm which combines flat and angled lands and solve the Maximum Power Point Tracking (MPPT) of PV , cost and environment issues. In this study, for analysis the slope directions and site selection, the Geographical Information System (GIS) technique is used. Maximum Power Point Tracking (MPPT) using Perturb and Observe (PandO) Mega-Solar components are all designed on MATLAB/SIMULINK environment. One of the unique points of this study is to use the lands located near the area where affected by the radiation. These lands cannot be used for living and agricultural activity, however, as for Mega-Solar farm, it is suitable. The targeted site was a golf-course which we are planning to install about 20[MW] solar farm.

SatE02-02

Temporal and spatial projection of wind speed based on modular netrowk SOM for installation of off-shore wind generation

Mitsuharu Hayashi and Ken Nagasaka
(Tokyo Univ. of Agri. and Tech., Japan)

Wind generation is one of the fast growing and introduced resources among renewable energies through worldwide including Japan. As Japan, on the other hand, is an island country surrounded by ocean, the topography suitable for wind generation is limited for the on-shore. Therefore, based on the wind map of up to 2030, it is expected that new introduction suitable for wind power generation will be more on off-shore. For this reason, it is very important to determine the wind characteristics of the candidate area for installing wind generation, however in most cases of off-shore installation, existence of weather condition data is poor and it may need lots of time and cost for collecting such weather condition data as a new pin-point information. In this study, the goal of this research is to project a wind speed of an unseen area (where its weather condition data are not available) by mapping the modularized Artificial Neural Network (SOM: Self-Organization Map) of seen areas (where their weather condition data are available) around the target area. By learning the correlation between modularized ANNs of seen and unseen areas, the result of this temporal and spatial projection will be the prediction of wind speed of target place. It is believed, by the help of the proposed technique, a huge amount of time and cost will be saved in the selection of installation point of off-shore wind power generation. Moreover, it is intended to contribute to the introduction increase in the amount of wind power.

SatE02-03

A household load priority scheduling model based on real-time electricity price

Bo Hu (State Grid Energy Research Institute, China),
Xiao Zhong, and Song Liu
(North China Electric Power Univ., China)

In this paper, we present a household load priority scheduling model based on real-time electricity price, the optimization objective is to satisfy user's comfort demand and reduce the electricity cost. The constraints are electric power Co.'s response to electrical and the working time of household appliances that user expect. The model divides all appliances into three categories: important appliances which cannot be dispatched, non-interruptible appliances which can be dispatched and interruptible appliances which can be dispatched, and the third type can be subdivided into demandable appliances and rechargeable appliances. The proposed model not only takes various electrical models of appliances into account, but also includs user's psychological satisfaction. Electricity bill and users' satisfaction curve will generated by the system, through adjusting the proportion of satisfaction, different users can get different power saving and comfort effect according to their different demands, it has important practical significance. Finally, the article verify the effectiveness of the proposed optimization model by simulations.

SatE02-04

Study on cutting surface stripe and wettability of AZ91D magnesium alloy by WEDM-HS

Jinkai Xu, Kui Xia, Rongxian Qiu, Linshuai Zhang,
Zhanjiang Yu, and Huadong Yu
(Changchun Univ. of Sci. and Tech., China)

Low discharge energy was used to machine AZ91D magnesium alloy using reciprocating type high speed wire electrical discharge machining (WEDM-HS). Different microstructures were found on bright and dark stripes. Using water contact angle of the droplet at the magnesium alloy surface evaluated the wettability. Results show that contact angle value of magnesium alloy surface after WEDM-HS was higher than magnesium alloy matrix. There were differences surface microstructures between bright and dark stripes, which is the key reason of hydrophoby. Compared with the bright stripe, the value of contact angle of dark stripe was higher and more stable. On submillimeter groove surface, the value of contact angle was increased to 154.71°. This paper provided the facile and cost-effective process method for support the industrialized fabrications of super-hydrophobic AZ91D surface.

SatE02-05

Influence of microstructure on surface wettability

Xinxin Zhang, Jinkai Xu, Zhongxu Lian, Zhanjiang Yu and Huadong Yu
(Changchun Univ. of Sci. and Tech., China)

Wettability is one of the important performance measuring the hydrophobicity of metal surface. There has important relationship between microstructures and surface wettability. In this paper, square pillar microarrays with different geometrical parameters were processed on hydrophilic metal substrates by high-speed micro-milling Tech., observed superficial morphologies and apparent contact angles of microstructures, and analyzed the influencing laws of geometrical parameters on surface wettability. Experimental results showed that the wetting transition from hydrophilicity state to hydrophobicity state was successfully achieved by fabricating micron-grade regular array on aluminum alloy surface, and the hydrophobic property on solid surface is a common coupling results of micronano-binary structures both microscale pillars and nanoscale pits and convexities. In this experiment, a good hydrophobic surface with larger apparent contact angle can be obtained when pillar width is 20 μm, pillar spacing is 100 μm, pillar height is 50 μm and the droplet volume is 3 μl. In addition, the water droplets on aluminum alloy surface with square pillar microarray is in a mixed state between Wenzel and Cassie-Baxter, and the surface wettability can be control by changing the geometry parameters of microstructures.

Regular Session

Nonlinear systems modeling, control and applications

Time: 16:40-18:20, Saturday, August 22, 2015
SatE03, Room No. 03

Chair: Shiwen Tong (Beijing Union Univ., China)
Co-Chair: Dianwei Qian (North China Electric Power Univ., China)

SatE03-01

Influences from LCL filter on behaviors of three-phase three-level PWM rectifier

Dongsheng Yu, Hong Zhu, and Ciyan Zheng
(China Univ. of Mining and Tech., China)

In this paper, system description of a three-phase Neutral-Point-Clamped (NPC) rectifier is briefly given by depicting its power circuit and controller. In consideration of tracking target current and minimizing current ripples, the allowable parameters of inductor–capacitor–inductor (LCL) filter are calculated. The filter inductor is then adopted to investigate the influences from LCL filter on dynamic behaviors of this three-phase three-level rectifier. Based on proportional-integral control method, the simulation analysis is carried out to explore the operational behavior differences caused by the variation of filter inductor. The curves of output variables and their phase trajectories are comparatively addressed in terms of different parameters of the LCL filter. The simulated results indicate that the filter parameters has significant impacts on the operational performance of rectifier system, which implies that suitable control method is required to eliminate unexpected influences.

SatE03-02

Sliding mode output tracking control based on a fuzzy clustering model

Shiwen Tong (Beijing Union Univ., China),
Dianwei Qian (North China Electric Power Univ., China)
Jianjun Fang (Beijing Union Univ., China)

A sliding mode output tracking control method based on a fuzzy clustering model has been proposed in this paper. This technique describes the controlled system by rulebased fuzzy models. Parameters (antecedent membership functions, consequent parameters, etc.) in this structure can be fine-tuned with input-output data. By means of this technique, the complicated system can be decomposed into a number of simpler local models with a characteristic of smooth transitions between these sub-models by means of overlap membership functions. Then the implicit membership functions have been transformed into explicit functions of the antecedent variables with neural networks. Thus the control actions of a discrete sliding mode controller can be designed. Simulative results demonstrate the effectiveness of this method.

SatE03-03

PID control of air tank temperature system with parameters tuning through network

Shiwen Tong, Yushan Li, Junjie Ren, and Yinong Zhang
(Beijing Union Univ., China)

This paper presents an application of Networked Control in the air tank temperature system. The system is controlled by Proportion-Integration-Differential (PID) algorithm running in the Siemens S7-200 PLC. Through an OPC server component, controller parameters (proportion, integration, differential) can be remote tuning by Matlab. Thus, complex control algorithm such as fuzzy inference, expert system and genetic optimization can be utilized. The process is supervised by configuration software, for example King Views, located in different geographical areas at the same time.

SatE03-04

Sliding-mode-based disturbance rejection control of nonlinear power systems with renewable sources

Hong Liu and Dianwei Qian
(North China Electric Power Univ., China)

In this paper, an integral sliding mode control (I-SMC) method for load frequency control (LFC) is investigated in interconnected power systems in the presence of wind turbines. Generation rate constraint (GRC) has been considered. For implementation, neural networks are adopted to approximate the entire uncertainties. The integral sliding mode controllers and the neural networks work in parallel to achieve disturbance rejection control. It has been observed from simulation results that the presented method was able to maintain the feasibility, validity and robustness.

SatE03-05

Research and application of predictive control algorithm based on fuzzy model

Yuan Li, Sen Cong, Shiwen Tong, and JianJun Fang
(Beijing Union Univ., China)

In this paper, predictive control algorithm is described in detail and the ANFIS (Adaptive neuro fuzzy inference system) is introduced. The fuzzy model is built by ANFIS. Fuzzy model and predictive control are combined to form a predictive control based on fuzzy model which is used to complex system with time delay. For example, as system of three –water tanks. First, using matlab software, we established the model of three-water tank with ANFIS, and verified it by the prior data. Simulation shows that the model is effective. Then we design the actual control system of three-water tank in which AC800F is controller. Predictive control based on fuzzy model is programmed with Function Block language. It is also demonstrated that, by comparing the operation results of the PID with predictive control based on fuzzy model, the control method introduced in the paper is practical and effective, has great value in practical application.

Poster Session

Time: 10:20-11:30, Sunday, August 23, 2015
Poster, Main Conference Hall

Chair: Changan Jiang (Ritsumeikan Univ., Japan)
Xiaoguang Zhou (Beijing Univ. of Posts and Telecommunications, China)
Co-Chair: Shin Wakitani (Tokyo Univ. of Agri. and Tech., Japan)
Yixin Yin (Univ. of Sci. and Tech. Beijing, China)

Poster-01

Bipolar neutrosophic sets and their application based on multi-criteria decision making problems

Irfan Deli (Aralik University, Turkey),
Mumtaz Ali (Quaid-e-azam Univ., Pakistan)
Florentin Smarandache (Univ. of New Mexico, USA)

In this paper, we introduce concept of bipolar neutrosophic set and its some operations. Also, we propose score, certainty and accuracy functions to compare the bipolar neutrosophic sets. Then, we develop the bipolar neutrosophic weighted average operator (Aw) and bipolar neutrosophic weighted geometric operator (Gw) to aggregate the bipolar neutrosophic information. Furthermore, based on the (Aw) and (Gw) operators and the score, certainty and accuracy functions, we develop a bipolar neutrosophic multiple criteria decision-making approach, in which the evaluation values of alternatives on the attributes take the form of bipolar neutrosophic numbers to select the most desirable one(s). Finally, a numerical example of the method was given to demonstrate the application and effectiveness of the developed method.

Poster-02

Evaluation method of main production resource in society and industrial park of extreme arid region (1)

Litifu Zulati
(Xinjiang Univ. of Finance and Economics, China)

Three kinds of alcohol fuels and diesel were blended and combusted in an electronic control high-pressure common rail turbocharged DI diesel engine respectively. Without any modifications in the original engine structure, the combustion characteristics and emissions of alcohol-diesel fuel were investigated. It shows that the peak heat release rate and the brake specific fuel consumption increases with the increase of mixing ratio. At the same blending ratio, the peak heat release rate of methanol-diesel is the highest, but the brake specific fuel consumption is lower; N-butanol/diesel has the lowest CO and HC emissions but has the highest NOX emissions. NOX emissions of methanol-diesel and ethanol-diesel are approximated, but CO and HC emissions of ethanol-diesel is the highest. In consideration of the fuel economy and emission performance, methanol-diesel mixing fuel is better.

Poster-03

Research on control methods of permanent magnet synchronous motor position servo system

Fen Yang, Zhengfeng Ming, Tao Wen, and Tong Zhang
(Xidian Univ., China)
Zhanxia Zhu (Northwestern Polytechnical Univ., China)

This paper compares common PI controller with proximate time-optimal servomechanism (PTOS), composite nonlinear feedback (CNF) control law, and a mode switching control (MSC) scheme .The structure of PI controller is simple and easy to implement .The PTOS control law devotes to fast acceleration and deceleration ,while the CNF control law consists of a linear feedback part for achieving fast response and a nonlinear feedback part for suppressing the overshoot caused by the linear part, so as to improve the transient performance in set-point tracking. The MSC scheme is proposed to achieve fast and precise set-point tracking in servo systems .The control scheme incorporates a CNF control law into PTOS control. These control laws were then applied to the position-velocity control loop in a permanent magnet synchronous motor (PMSM) servo system in simulation. The simulation results verify that the PTOS control is capable of tracking the target position fast, the CNF control can achieve the target position with a small overshoot and under the MSC scheme the servo system is able to track a wide range of target positions fast and accurately.

Poster-04

Comprehensive functions of eco-industrial park in conserving energy and improving ecology

Litifu Zulati (Xinjiang Univ. of Finance and Economics, China)
Ken Nagasaka (Tokyo Univ. of Agri. and Tech., Japan)

This research explained the comprehensive function of eco-industrial park in the aspects of intensive utilization of energy and other main resources used in production in extreme arid areas, such as Turpan Prefecture of Xinjiang, China, in which water resource is seriously lack of. On the other hand, this research analyzed environmental efficiency formed by eco-industrial. Extended service of eco-industrial parks can be realized by greening area around the parks by using waste water. Three basic functions of eco-industrial park are considered, namely expanding carrying capacity of limit energy and other main resource of production, formation of concentrated district based on industrial park, and the function of expanded service of eco-industrial park for ecology and agriculture. Mentioned three functions are important for the extreme arid area.

Poster-05

Study on fuzzy-logic PID control system of synchronous jack-up system of turbine runner static equilibrium experiment

Yongxing Hao, Chaofeng Wang, and Lihui Song
(North China Univ. of Water Resources and Electric Power, China)

Basing on the LabVIEW platform, a Fuzzy-logic PID controller is developed. And the controller is applied to a control system of synchronous jack-up system of turbine runner static equilibrium experiment. Inputting with a unit step signal, the control system was simulated. The result shows that, with only a small amount of overshoot, the control system using fuzzy-logic PID controller responses and stabilizes faster than the one using normal PID controller. Fuzzy-logic PID controller shows great value in the practical implementation of the hydraulic system control. It also can be extended to other areas such as bridge reinforcing and migration of cultural relic and so on.

Poster-06

The straight line mechanism base on peaucellier inversion instrument

Kai He, Lei Guo, and Yuan Song
(Beijing Univ. of Posts and Telecommunications, China)

This paper gives the preliminary analysis based on the Peaucellier inversion instrument, and calculates the inverse apparatus according to the theory of inversion, a straight mechanism based on the Peaucellier inversion is designed and calculate the maximum circle radius of inversion instrument. Then instrument could switch between the straight line and circle by improving the straight line organization of inversion instrument. An assembly of straight-line mechanism is drew. The prototype is built, and the validity of the mechanism is verified by experiments.

Poster Session

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Yixin Yin (Univ. of Sci. and Tech. Beijing, China)

Poster-07

Mechanical design and realization of automatic docking mechanism

Xinhu Mo, Lei Guo, Yuan Song, and Ying Zhang
(Beijing Univ. of Posts and Telecommunications, China)

Automatic docking technology is broadly used in the fields of aerospace and mechanical manufacturing. However, the technology is rather complicated to understand. In this paper, an effective automatic docking model based on the mechanical properties of the four-bar parallelogram linkage is proposed for teaching demostration. To make the docking mechanism keep equilibrium, the auxiliary link and leveling mechanism are added to the original four-bar parallelogram mechanism. In order to keep the two docking objects in the correct attitude during docking, movement status of the model is analyzed. Then the modeling, virtual assembling and motion simulation are realized in the software Solidworks. At last, a physical prototype is built, and the feasibility of the docking mechanism is verified by experiments.

Poster-08

Design and implementation of a mechanical calculator for quadratic equation with one unknown

Bin Xing, Lei Guo, Shimin Wei, Yuan Song, and Ying Zhang
(Beijing Univ. of Posts and Telecommunications, China)

The mechanism structure and the mechanical measure method of the calculator are designed, which are the key technology of calculator for the quadratic equation with one unknown. Firstly, the basic principle of a kind of mechanical calculator for quadratic equation with one unknown is proposed. Secondly, the function and performance requirements of the system is analyzed and the linkage mechanism is selected as the core computing mechanism. Then the overall structure is designed. Finally, the control system is designed, after designing the system operation process, the GUI is realized. The ability of solving quadratic equation with one unknown is verified through the physical prototype debugging.

Poster-09

A comparative study on inter-tern short circuit fault of PMSM using finite element analysis and experiment

Yongcan Li and Yongchun Liang
(Hebei Univ. of Sci. and Tech., China)

Permanent magnet synchronous machines (PMSM) are used in many applications, inter-turn short fault is the most probably fault in permanent motor. The motor we use in this reaearch is a 3-phase, 10-pole, 12-slot PMSM machine. Model the motor by using MAXWELL 14, the waveform and the frequency spectrum of stator current under normal and inter-turn short-circuit fault condition is given out. In order to verify the result, we conducted experiments on normal and fault motors by using LabVIEW. Obtain the waveform and the frequency spectrum of stator current under normal and inter-turn short-circuit fault condition. The research was under without load and with load condition.The comparison result shows that the simulation result is correct and FEA method is an effective method to study the inter-tern short circuit fault of PMSM.

Poster-10

A research on construction of 30 bus large-scale smart grid model

Sho Kainose and Ken Nagasaka
(Tokyo Univ. of Agri. and Tech., Japan)

This study aims at constructing a large-scale smart grid model on the MATLAB/Simulink. Smart grid is the next-generation power network which introduces information and communication technology into a power system. In our laboratory, a power system simulation model based on the IEEE 30 Bus Test System was constructed on the MATLAB/Simulink in past. In this study, we concentrate on modeling a suitable communication system model combined with the IEEE 30 Bus power system model on the MATLAB/Simulink. This communication model can reproduce influence which usually occurs in communication, such as noise, delay, fluctuation of arrival time of packets, and packet loss. In model construction, effective design is given to prevent a drop of simulation speed. Finally, it is tried to incorporate the communication blocks into the 30 bus power system model.

Poster-11

Modeling a lithium-ion battery based on a threshold model

Zhi Zhang
(Beijing Jiaotong Univ., China)

Modeling a lithium-ion (Li-ion) battery is the core issue for electric vehicles applications. The valid battery model and accurate model's parameters can improve accuracy of the state of charge (SOC) estimation and thus promote the commercialization of electric vehicles. Considering an electrical battery model with two resistance-capacitance (RC) parallel networks, the series resistance and the open-circuit voltage (OCV)-SOC function, the accurate estimate of battery parameters through a threshold model, namely threshold autoregressive and moving average with exogenous inputs (TARMAX) model is proposed, in this paper, which only needs online terminal voltage and current data. The approach is built by dividing voltage data into several regimes according to the thresholds. For each regime, a linear ARMA model is established which can be represented by the state-space equation for the linear battery model. Thus, the battery's parameters can be identified. To facilitate obtaining the time-variant model parameters, the terminal voltage and current data are collected by the sliding window. Finally, the effectiveness of the proposed modeling approach is verified by the simulation.

Poster-12

Modelling the relationship between constituents and anti-RSV effect of baikal skullcap root

Ke Li (Shandong Acad. of Sci., China),
Bonian Zhao, Yan Gao, Bianli Wang, and Zongyuan Yu
(Shandong Acad. of Chinese Medicine, China)
Hongpeng Zhao (Qianfo Mountain Hospital of Shandong Province, China)

In this work, based on least squares support vector machine regression, a model that characterizes the relationship between constituents of Baikal skullcap root and therapeutic index of anti-respiratory syncytial virus was established. The computational simulation showed that this model fits well with the experimental data, and validation experimental results also supported the theoretical predictions.

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Poster-13

Energy-saving improvement and simulation study on digital hydraulic system

Fei Song, Jingjun Lou, and Likun Peng
(Naval Univ. of Eng., China)

In order to solve the inefficiency problem of the constant pressure digital hydraulic system, this paper built the model of the system and found primary reasons leading to power losses through model simulation. With the pressure compensation technology and the variable frequency hydraulic technology, a new load-sensing digital hydraulic system was designed to instead of the original system and the energy-saving controller of the new system was also designed. Through the simulation comparison study of two systems, it was found that the load-sensing system can effectively reduce the overflow loss and the throttling loss and that the average efficiency of the new system is 30% more than the original system.

Poster-14

Path planning of airfoil surface for robotic fibre placement

Lina Li, Xingang Wang, De Xu, and Min Tan
(Chinese Acad. of Sci., China)

In this paper, a new path planning algorithm based on triangular meshes of the airfoil open surface for four commonly used laying angles in robotic fibre placement is proposed. In the proposed algorithm, the 0o paths are easily computed by the slicing method, the ±45o paths are obtained by general rotation transformation, and the method for equally divide arc is adopted to get the 90o paths which can ensure the complete fibre tows connecting the root and tip part distributed evenly on the surface. Then the redundant path points are deleted, the final path points are obtained to generate the poses of the fibre placement head which is mounted at the robot manipulator's end-effector. Finally the simulation is carried out in software RobotStudio and the effect of laying is displayed using OpenGL. The results of the simulation verify the effectiveness of the proposed method.

Poster-15

Strongly stable GPC with suppression of steady state gain and closed-loop poles

Akira Inoue (Okayama Univ., Japan),
Tomohiro Henmi (National Institute of Tech., Kagawa College, Japan)
Mingcong Deng (Tokyo Univ. of Agri. and Tech., Japan)

Strongly stable control system is defined as a system having both of stable poles of closed loop systems and stable poles of controllers. The strong stability is important for safety, that is, the system is stable even when feedback loop get breakdown by an accident. The authors have already derived a strongly stable controller for GPC systems. In designing the strongly stable GPC, three characteristics should be specified. (1) The poles of the closed loop system. (2) The poles of the controller. (3) The steady state gain. The existing strong stable GPC by authors is extended from the standard GPC to two degree of freedom compensators by using coprime factorization approach and introducing new design parameters. In the extended GPC, there exist hidden poles brought by pole-zero cancellation. And in initial condition mismatch or sudden change of state by impulsive disturbances, the effect of the hidden poles appears. This means for safety, all the poles including the hidden poles should be stable. To design safe GPC, it requires to satisfy these three characteristics and needs complicated trade-off between design parameters. The paper proposes to calculate the mathematical expressions by using symbolic computation software to make the trade-off simple. In an example of a water level control plant, the mathematical expressions are obtained explicitly and using the expressions, a controller is designed to satisfy the three specifications.

Poster-16

Model free fault detection using one set of reference input and output data

Akira Inoue (Okayama Univ., Japan),
Tomohiro Henmi (National Institute of Tech., Kagawa College, Japan)
Mingcong Deng (Tokyo Univ. of Agri. and Tech., Japan)

This paper proposes a method for fault detection of control plants without using plant models. Safety is the most important issue in control and for safety, fault detection is inevitable. So far, mainly, there exist two methods to detect faults. The first is a statistical method, which uses statistical characteristics of input signals and fault signals. To extract the statistical characteristics, this method requires sufficiently fluctuated signals, which is not satisfied in practical applications. The second method is to use a model, such as to estimate an output in normal state of the plant using an observer and compares the estimated output to a measured output of the plant to be detected. But usually plant models are not available in industry. Hence, a method for fault detection without using signals of sufficient richness and also without using plant models is required. The method in this paper does not require sufficient richness of signals and plant models, hence it is practically useful. The method uses a pair of input and output data of a normal state as reference data instead of using a model. From the data, the method derives an impulse response sequence and compares the output estimated from the sequence with the measured output and detects a fault from the difference of the outputs. A simulation example of a water level control experimental plant is given to show the effectiveness of the method.

Poster-17

Research on algorithm of nonlinear self-adaptive flight control system

Hao Long (Beijing Union Univ., China)
Shujie Song (Aviation Industry Co. of China, China)

For the nonlinear control problem of Super-maneuver aircraft, a nonlinear flight control law was presented based on the nonlinear structure adaptive model inversion system. The sufficient and necessary condition of the control law was analyzed. Finally the results of the height-angle maneuver simulation shows that the designed control system has good performance.

Poster-18

The indoor real-time 3D localization algorithm using UWB

Xuehong Li and Shuhua Yang
(Univ. of Sci. and Tech. Beijing, China)

The actual location application always demands rapid initial positioning, high real time performance and high accuracy. In order to meet the demands above, this paper mainly focus on the UWB indoor real-time 3D TDOA localization algorithms based on the kalman filter. Firstly, the LKF, EKF and UKF algorithms are applied to 3D localization, and the model parameters are given. And then, this paper proposes a collaborative algorithm which is the Chan algorithm provides the initial value and the LKF, EKF, UKF real time positioning algorithms do the subsequent operations, and proposes a method to switch the algorithms dynamically. Finally, the result of the simulation shows the indoor real-time 3D dynamic positioning algorithms achieve a good performance in both speed and precision.

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Poster-19

Operator and sliding mode based nonlinear control for cooling and heat-retention system actuated by Peltier devices

Takafumi Hatano, Mingcong Deng, and Shin Wakitani
(Tokyo Univ. of Agri. and Tech., Japan)

In this paper, a nonlinear control system is designed for a Cooling and Heat-retention system using peltier devices. First, stability of this system is guaranteed by the operator theory. Second, tracking performance is compensated by Sliding mode control with reducing the chattering using sigmoid function. Third, tracking perforance is proven. Finally, the effectiveness of the designed controller is showned by simulation results.

Poster-20

Control system design for ionic polymer metal composite using a single neuron based adaptive PID approach

Yiping Chang and Hui Wang
(Zhongyuan Univ. of Tech., China)

Owing to simple structure and strong robustness characteristics, the traditional (proportional-integral-derivative) PID controllers have been widely used in designing control systems of industrial process. However, due to complex nonlinear properties in some dynamics plants, it is difficult to obtain accurate mathematical models, and vulnerable to the object and environment. So, it is difficult to set controller parameters, especially no online self-tuning. Addressing an ionic polymer metal composite (IPMC) artificial muscle with high nonlinear properties and model uncertainties, an IPMC position tracking control system based on single neuron adaptive-PID control approach is proposed by using neural network self-learning and nonlinear mapping ability. The designed system can not only achieve position tracking and online self-tuning, but also guarantee robust stability in the presence of effect of uncertainties, the effectiveness of the proposed method is confirmed by simulation results.

Poster-21

Evaluation method of main production resource of society and industrial park of extreme arid region (2)

Litifu Zulati
(Xinjiang Univ. of Finance and Economics, China)

This research presented three kinds of evaluation methods that can be feasibly applied for the short energy and water sources areas, such as the evaluation methods of regional potential energy including the estimation of general potential energy, and the energy used in the industrial production process, and also the available renewable energy that may be developed. The Potential Energy Index that can describe the effective support period for society economy is presented in this paper. The Input and Output Theory is used for converting the renewable energy into the regular energy resources that can be regarded as a steady energy element in the society economy system. This paper also considered the evaluation method of the degree of energy intensive utilization in the process of industrial production and society utilization, the evaluation of industrial process mainly deals with the Industrial Parks that widely exist in short energy area.

Poster-22

Dynamic and energy analysis based on bumper system low-speed collision test

Zhiming Wang and Li Chen
(Shanghai Univ., China)

The dynamic load strength test of bumper system is an important parameter for vehicle passive safety, but different test standards, different test requirements, which caused much trouble to the test authority. So dynamic and energy analysis based on bumper system low-speed collision test is very impotant. Build parameterized model of bumper system, analyse the dynamic characteristics and energy conversion characteristics when the bumper system low-speed collision occurs, which is based on the ADAMS virtual prototype technology. At the end of the paper we will use the test machine for the dynamic load strength trials of bumper system on the basis of three typical standards, the result is compared with the below result that is analysed by ADAMS. According to the comparison, we can find the correctness of the simulation result is verified.

Poster-23

Feasibility of neucube spiking neural network architecture for EMG pattern recognition

Long Peng and Zengguang Hou (Chinese Acad. of Sci., China),
Nikola Kasabov (Auckland Univ. of Tech., New Zealand), Guibin Bian (Chinese Acad. of Sci., China),
Luige Vladareanu (Romanian Acad., Romania), and Hongnian Yu (Bournemouth Univ., UK)

Multichannel electromyography (EMG) signals have been used as human-machine interface (HMI) for the control of pattern-recognition based prosthetic system in recent years. This paper is a feasibility analysis of using recently proposed NeuCube spiking neural network (SNN) architecture for a 6-class recognition problem of hand motions. NeuCube is an integrated environment, which uses SNN reservoir and dynamic evolving SNN classifier. NeuCbube has the advantage of processing complex spatio-temporal data. The preliminary experiments show that Neucube is more efficient for EMG classification than commonly used machine learning techniques since it achieves better accuracy as well as consistent classification outcomes. The performance of NeuCube combined with TD features reaches up to 95.33% accuracy after a careful selection of the features. This paper demonstrates that NeuCube has the potential to be employed in practical applications of myoelectric control.

Poster-24

Optimal fiber orientations and topology of compliant mechanisms using lamination parameters

Xinxing Tong, Wenjie Ge, and Yonghong Zhang
(Northwestern Polytechnical Univ., China)

A design approach for compliant mechanisms with straight fiber laminate is presented to obtain the optimal fiber orientations and topology structure simultaneously in this paper. Firstly, an equivalent constitutive relation of straight fiber laminate is parameterized in terms of lamination parameters. Taking lamination parameters and relative density as design variables, minimizing the weighted linear combination of the mutual strain energy (MSE) and the strain energy (SE) is considered as objective function to achieve the desired deformation and enough load carrying capacity with the volume constraint. The nonlinear optimization problem is solved via the well known method of moving asymptotes (MMA). The outcomes of first step are the optimal topology structure and lamination parameters. Secondly, the optimal fiber orientation for each layer is found by matching the optimal lamination parameters. Finally, the numerical examples of designing compliant inverters are investigated to demonstrate the effectiveness of the proposed method.

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Yixin Yin (Univ. of Sci. and Tech. Beijing, China)

Poster-25

A software platform for interactive analysis on 3D medical data

Wei Cheng and Yongfei Xiao (Shandong Acad. of Sci., China)
Youlei Zhao (Taikoo (Shandong) Aircraft Eng. Co.,Ltd., China)

Analysis on the anatomical relationship between the conventional 2D medical images and correlative tissues is vital to both the physicians and the interns in surgery planning. However, regular measures are not intuitive and greatly depend on the physicians' experience and their medical knowledge. In this paper, a software platform is developed for a more intuitive and accurate analysis on the anatomical relationship in the diagnosis and surgery planning. Both the oblique clipping image and a 3D tissue model with an interactive transfer function module are showed in a stereoscopic scene to illustrate the 3D human pathology and anatomy in real time. For convenience, a software interface is also designed so that different 6DOF interactive devices can be applied in the project. This article offers a novel resolution for the improvement in the assessment of anatomical structures and understanding of medical imaging technology in a more realistic manner.

Poster-26

Master-slave force control based on Grey GM(1,1) model of robot grippper

Wei Cheng, Xuelin Wang, and Haiyan Ma
(Shandong Acad. of Sci., China)

This paper describes the position and force control of a novel two-finger gripper using force control technology, a master-slave force control strategy is deveoped for making the force track the desired force quickly with lower overshoot. PID controller is adapted to the position system for the master finger, and force control is used to the slave finger with grey GM(1,1) model, the prediction models are built by the signal of force acquired from sensors, the force controller enforces a relationship between the position of each finger and the force on the manipulated objects, and the weights of the current and the future force errors are automatic adjusted in integrated error according to the model precision. The force controllers can employ the information of past, present and future force to calculate an appropriate control correction to pre-compensate the force errors, thus it can obtain lower overshoot and faster response. Simulation results are presented to demonstrate the efficacy of the proposed master-slave force controllers.

Poster-27

Remote automatic test system based on MATLAB using VISA over LAN

Wei Cheng, Fenggui Wang, and Haiyan Ma
(Shandong Acad. of Sci., China)

VISA over LAN was used to design remote automatic test system, in which MATLAB was selected as the application development environment to enhance the capability of data processing and analysis. Native GPIB commands and queries were funneled to/from VISA instrument object using Instrument Control Toolbox functions, and then used to control electrical measuring instruments through VISA I/O Library API and VXI-11 protocol. An example system for microwave imaging test with digital oscilloscopes integrated was developed to perform the test of radio frequency and intermediate frequency signals.

Poster-28

Cubic spline solution for a class of boundary value problems using spectral collocation method

Tianjun Wang, Qixian Zhou, and Tengteng Cui
(Henan Univ. of Sci. and Tech., China)

In this paper, we investigate the numerical solution of a class of boundary value problems of ordinary differential equations using parametric cubic spline function and spectral collocation method. Efficient algorithms are implemented. Numerical results demonstrate the high efficiency and accuracy of the proposed method.

Poster-29

Maximum efficiency control method of permanent magnet synchronous motor based on three-dimensional table

Gensheng Li, Jinfa Xie, and Liyou Xu
(Henan Univ. of Sci. and Tech., China)

Increase the operating efficiency of the motor can reduce energy consumption and the requirements for the radiator, for some applications, the operating efficiency of the motor even become one of the most important factors. In order to improve the efficiency of the motor, in this paper, the maximum efficiency permanent magnet synchronous motor control method is proposed, the method takes into account the copper and iron losses based on the motor model, and can make a permanent magnet synchronous motor to achieve optimal efficiency at different speeds by the way of look-up table. The proposed method reduces the amount of computation greatly, and it is easy to implement in practical control. The simulation results showed that the method can improve the efficiency of permanent magnet synchronous motor effectively.

Poster-30

Modeling and simulation of hydro-mechanical continuously variable transmission system based on Simscape

Zhili Zhou and Jiazhen Zhang (Henan Univ. of Sci. and Tech., China)
Zhiqiang Guo (YTO Group Corporation, China)
Liyou Xu (Henan Univ. of Sci. and Tech., China)

The traditional methods of dynamic modeling for the simulation of hydro-mechanical continuously variable transmission (HMCVT) are cumbersome and complex. The physical simulation models of engine, hydraulic speed regulating mechanism, mechanical speed regulating mechanism and the load were established based on Simscape, and the dynamic characteristics of the components were analyzed in the paper. The simulation results show that with the change of displacement ratio e, the output speed of the system is continuous and stepless, and the output torque of the system is constant when the torque of load is constant. From the analysis results, it is concluded that the physical models are feasible. The research provides a theoretical foundation and a verification platform for further development and improvement of HMCVT shifting strategy.

Poster Session

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Poster-31

Performance comparison for savonius type wind turbines by numerical analysis approaches

Lei Song (Henan Univ. of Sci. and Tech., China)
Hongzhao Liu (Xi'an Univ. of Tech., China)
Zongxiao Yang (Henan Univ. of Sci. and Tech., China)

Wind energy is a clean and renewable energy resource and has been paid more and more attention by scholars around the world. As a drag-driven type Vertical Axis Wind Turbine (VAWT), traditional Savonius wind rotor has disadvantage of low wind energy utilization but has a lot of the advantages compared with Horizontal Axis Wind Turbines (HAWTs) and lift-driven VAWTs. A fish-ridged wind rotor is proposed based Savonius rotor to improve the flow field characteristics. In this paper, the two wind rotors are analyzed and compared by computational fluid dynamics approach. The simulation results show that the flow field of the fish-ridged rotor is smoother than the Savonius rotor and the maximum value of wind energy utilization of the former rotor is bigger than that of the latter. It indicates that the new type of the rotor has good performance.

Poster-32

Fuzzy clustering analysis of batch production recipe

Shanzhong Liu and Xiaonan Song
(Henan Univ. of Sci. and Tech., China)

According to the recipe information model specified in batch standard (ISA S88), via the modified recipe similarity measurement method, an improved fuzzy clustering algorithm (IFCA) is proposed based on fuzzy c-means (FCM) algorithm in the PNN network. IFCA can effectively improve the choice of clustering center and has a good clustering effect for the recipe of batch production. Then is used IFCA to cluster for production recipe of an equipment unit wort evaporator in beer production. Finally, the recipe classification result is compared with the classification of FCM algorithm, and the effectiveness of IFCA is proved.

Poster-33

Fully discrete subgrid stabilized finite element method for the Darcy-Brinkman equations in double-diffusion convection

Yunzhang Zhang, Zhoufeng Wang, and Qili Tang
(Henan Univ. of Sci. and Tech., China)

We present a fully discrete subgrid stabilized finite element method to solve the Darcy-Brinkman equations in Double-Diffusion convection. The time is advanced by one order Backward Euler scheme. With the proper choosing of stabilized parameters, the optimal error estimates in space can be obtained for velocity, temperature and concentration in H^1 semi-norm. The derived theoretical results are supported by numerical experiments. One example is to verify the convergence results and the other example is a pure thermal convection in a porous medium to verify the stability of ours method.

Poster-34

The simplified homogeneous balance method and its application to Whitham-Broer-Kaup-Like equations

Wei Li (Henan Univ. of Sci. and Tech., China)
Xinrui Wang (Univ. of Chicago, USA)

In this paper, we have simplified the homogeneous balance method (HB). Using this simplified approach, the Whitham-Broer-Kaup-Like (WBKL) equations are investigated. Various exact solutions of the WBKL equations are obtained via a nonlinear transformation with the aid of solutions for the linear equation.

Organized Session

Advanced control systems design - theory and applications

Time: 13:00-14:40, Sunday, August 23, 2015
SunM01, Room No. 01

Chair: Shiro Masuda (Tokyo Metropolitan Univ., Japan)
Co-Chair: Shin Wakitani (Tokyo Univ. of Agri. and Tech., Japan)

SunM01-01

Tracking control of quad-rotor helicopters suspended a power supply cable with on-line estimation of disturbances

Hayami Hayakawa, Shogo Obata, and Manabu Yamada
(Nagoya Institute of Tech., Japan)

In this paper, we propose a tracking controller for quad-rotor suspended a flexible cable. The first contribution is to present a new disturbance observer to estimate online both the tension of the cable and unknown disturbances applied to dynamics. The second one is to propose a new exact linearization method which reduces the nonlinear closed-loop system to a linear controllable state equation by changing coordinates in the state-space. By using the linearization, a new tracking controller based on disturbance observer is presented for obtaining asymptotically rejection against unknown constant disturbance.

SunM01-02

Multivariable controller design evaluating closed-loop interaction by iterative LMI optimization using frequency response data

Shogo Shinoda, Kazuhiro Yubai, Daisuke Yashiro, and Junji Hirai
(Mie Univ., Japan)

This paper proposes a multivariable controller design method using frequency response data. The proposed method evaluates a diagonal dominance in a closed-loop manner by using a singular value and designs a controller by solving an optimization problem that involves nonconvex quadratic matrix inequalities. This optimization problem is rewritten as linear matrix inequalities (LMI) by introducing iterative LMI constrains. The controller achieving highly diagonal dominance is designed by repeating an update of the optimization problem and the convex optimization. This optimization algorithm guarantees monotonically convergence of an evaluation value in terms of the iteration. The experimental results show the effectiveness of the proposed method in comparison with the conventional method.

SunM01-03

Flow disturbance suppression for a pneumatic vibration isolator using a central pattern generator

Yukinori Nakamura, Daishi Funaki, Mami Kimura, and Shinji Wakui
(Tokyo Univ. of Agri. and Tech., Japan)

This paper presents the suppression method of flow disturbance, which is the variation of compressed air supplied to a pneumatic vibration isolator. A central pattern generator (CPG) is utilized to compensate effect of flow disturbance. In order to implement a CPG-based controller, feedback type control scheme, which does not require a pressure sensor, is adopted. Moreover, CPG-based and displacement controllers are connected in parallel so as to avoid the vibration of isolation table during the start-up of isolator. The proposed approach is verified by simulation and experiment.

SunM01-04

Design of a fault tolerant control system using Mahalanobis-Taguchi(MT) system

Shin Wakitani and Mingcong Deng
(Tokyo Univ. of Agri. and Tech., Japan)

In this research, a failure tolerance control system design scheme using Mahalanobis-Taguchi (MT) system is proposed. In this method, we consider a situation that an actuator such as a heater gradually deteriorates and eventually breaks down. The failure detection component in a control system detects whether the system is broken, and switches to a backup actuator if a fault is detected in the actuator. In the proposed algorithm, an augmented system including an actuator is described as a first-order plus time-delay system, and their system parameters are estimated by the recursive least squares method. Unit space is designed using the estimated system parameters that are obtained during normal operation; based on the Mahalanobis distance, the failure detection component determines whether a newly obtained system parameter in operation belongs to the unit space. The control system switches to a backup actuator if the newly estimated parameters do not belong to the unit space. The effectiveness of this method is evaluated by simulation experiments.

SunM01-05

Data-driven PID gain tuning for unknown impulse disturbance attenuation

Shiro Masuda
(Tokyo Metropolitan Univ., Japan)

Data-driven design approaches based on input-output measurements with no need for help from a plant model have attracted attention from several researchers. We have proposed such a disturbance attenuation Fictitious Reference Iterative Tuning (FRIT) using input-output data generated by a step or impulse disturbance, and showed the effectiveness of theapproach through experiments of DC motor control and helicopter attitude control. The present work applies the approach to the experimental data for temperature control. The PID gains are tuned so that temperature of a piece of metal would follow a disturbance reference model output signal. From the experimental result, the disturbance attenuation FRIT is effective for PID gain tuning from closed-loop input and output experimental data generated by a impulse disturbance with unknown magnitude.

Regular Session

Mechatronic systems analysis and control I

Time: 13:00-14:40, Sunday, August 23, 2015
SunM02, Room No. 02

Chair: Xinkai Chen (Shibaura Institute of Tech., Japan)
Co-Chair: Hongbo Wang (Yanshan Univ., China)

SunM02-01

Size and weight reduction of semicircular duplex manipulator for rescue operation

Soichiro Kimura and Kazuyuki Ito
(Hosei Univ., Japan)

Applications of robots for rescue operations have attracted considerable attention. However, at real disaster sites, some of the spaces in the rubble are so narrow that conventional rescue mobile robots cannot pass through them. Hence, the development of a robotized endoscope is expected. In this study, we redesigned our previous rescue manipulator to downsize its body without losing robustness. We developed a new small-sized duplex manipulator and successfully reduced its size by 70%.

SunM02-02

Adaptive fault diagnosis for continuous time-delay repetitive system subject to sensor fault

Haigang Zhang, Sen Zhang, and Yixin Yin
(Univ. of Sci. and Tech. Beijing, China)

This note proposes an adaptive fault diagnosis scheme for the continuous time-delay repetitive system subject to the sensor fault. The theory of iterative learning control (ILC) is employed in the fault reconstructed method. With the increase of iterative step, the sensor fault estimation signal can track the actual fault tightly including slow- and fast- varying fault. In order to verify the effectiveness of the proposed fault diagnosis method, three kinds of sensor faults are taken into consideration in the simulation part. The results show that the reconstructed fault signal can track the actual fault well despite of the kinds of sensor faults.

SunM02-03

Model identification and adaptive control design for a 6 DOFs manipulator

Weiliang Ge (Univ. of Electronic Sci. and Tech. of China, China),
Wei He (Univ. of Sci. and Tech. Beijing, China)
Yunchuan Li (Univ. of Maryland College Park, USA)
Chenguang Yang (Plymouth Univ., UK)

In this article, kinematic modeling design of a humanoid robot is presented by using Devanit-Hartenberg (D-H) model. Based on the coordinate frame, the model identification of a 6 degree-of-freedom (DOF) upper limb is investigated with Newton-Euler (NE) formula. Particle Swarm Optimization (PSO) is used to optimize the trajectory of each joint, the adequate excitation of the robot is provided and the estimated result is improved. The estimated inertia parameters are taken as the initial values of the Recursive Newton-Euler (RNE) adaptive control algorithm. Simulations are provided to verify the result of the identification algorithm.

SunM02-04

Precise tracking control for Piezo-actuated stage using inverse compensation and model predictive control

Nguyen Manh Linh, Tran Vu Minh, and Xinkai Chen
(Shibaura Institute of Tech., Japan)

In this paper, we consider tracking control problem of piezo-actuated stage which is composed by a piezoelectric actuator (PEA) and a positioning mechanism (PM). This plant can be modeled by cascading a hysteresis with a linear dynamical system. The tracking performance of this system is significantly affected by hysteresis phenomenon of PEA. In order to improve the performance, a modified Bouc-Wen model is proposed to describe the hysteresis more accurately. Then, inverse Bouc-Wen is used to compensate hysteresis nonlinearity. Finally, model predictive control (MPC) with integral of error state variable is employed for control design. Experimental results show that the proposed method has excellent tracking performance in comparison with conventional proportionalintegral (PI) controller.

SunM02-05

Oscillatory behavior based fault feature extraction for bearing fault diagnosis

Juanjuan Shi and Ming Liang
(Univ. of Ottawa, Canada)

An intelligent fault signature extraction scheme based on oscillatory behaviors is reported in this paper for bearing fault diagnosis. The proposed method is based on the joint application of morphological component analysis (MCA) and tunable Q-factor wavelet transform (TQWT) to decompose a signal into two signal components (i.e., low- and high-oscillation components) according to whether they having sustained oscillations. As bearing fault-induced transients (low-oscillation component) oscillate differently from periodic interferences and noise (high-oscillation component and residual), they can be separated via the MCA with the aid of TQWT which is parameterized by Q-factor and plays a role of distinguishing signal components presenting different oscillatory behaviors. The low- and high-oscillation components can be obtained by solving the objective function formulated based on MCA and TQWT. The determination of Q-factor for each signal component representation is also explored in this paper. The effectiveness of the proposed method is examined by experimental data.

Regular Session

Complex systems control and applications I

Time: 13:00-14:40, Sunday, August 23, 2015
SunM03, Room No. 03

Chair: Ni Bu (Qingdao Univ. of Sci. and Tech., China)
Co-Chair: Zhengfeng Ming (Xidan Univ., China)

SunM03-01

Switched reluctance motor/generator simulation research based on compressed air energy storage system

Xiaoshu Zan and Hong Zhu
(China Univ. of Mining and Tech., China)

Compressed air energy storage (CAES) system has become a popular energy storage device for micro grid because of many advantages. The principle, structure, simulation model and the simulation results of the switched reluctance motor/generator system based on the CAES system have been studied in the paper. The nonlinear simulation model by the flux linkage data calculated by two-dimensional finite element is built firstly. Then the sliding+PI control method is put forward in the motor process and the fuzzy+PI control method is put forward in the generation process. The simulation results have validated the effectiveness of the control strategy and control parameters. The switched reluctance motor/generator system has well rotor speed tracking and voltage output performance and it has reference value and application prospect in the CAES system.

SunM03-02

Surface flaws detection algorithms for large aperture optical element

Zhengtao Zhang, De Xu, Xian Tao, and Feng Zhang
(Chinese Acad. of Sci., China)

In this paper we consider the inspection of surface flaws in large aperture optical element. A high efficiency and precision instrument is proposed which contains two kinds of imaging systems. One is dark-field imaging system(DFIS) constructed by line scan camera with 10μm resolution. The other is bright-field imaging system (BFIS) constructed by microscope with 1μm resolution. Considering the small depth of field of DFIS, an adaptive scanning method based on collimation laser and several focusing points is proposed to keep the clarity of DFIS in large scope scanning. After the scanning, an image mosaic algorithm for the DFIS is presented based on SIFT features and clustering algorithm. Then, the feature extraction algorithm of flaws in DFIS and BFIS is designed. In order to check the flaws more precisely, a location algorithm that can guide the BFIS to inspect the same flaw in DFIS is introduced. Finally, the calibration method of two imaging systems is studied. Experiments show that the device can scan an optical element with size of 810mm×460mm in less than 6min without complex manual operation and the detection precision can reach 3μm satisfying the requirement of practical need.

SunM03-03

An adaptive observer-based fault detection and diagnosis for nonlinear systems with sensor and actuator faults

Xiaomo Yan (Univ. of Manchester, UK),
Bailing Tian (Tianjing Univ., China),
Hong Wang (Univ. of Manchester, UK)

A novel fault diagnose method is presented for the nonlinear systems with coupled fault and disturbance viaadaptive observer technique. Residual matrix is used in this paper to describe the values of unknown inputs. Instead of adding robustness on the estimate states, this novel observer structure focuses on eliminating the disturbance signal on the residual matrix by using vector unitization so that the residual matrix can be approached precisely. The adaptive law is obtained by using Lyapunov stability theory. Finally, an application on second order system is included in the end of this paper to show the effectiveness of the proposed strategy.

SunM03-04

Minimum mutual information control for multi-variable non-Gaussian stochastic systems

Qichun Zhang (Univ. of Manchester, UK)
Aiping Wang (Anhui Univ., China)
Hong Wang (Univ. of Manchester, UK)

In this paper, a novel control algorithm is presented to minimize output statistical couplings for a class of dynamic nonlinear multi-variable non-Gaussian stochastic systems. Using Cauchy-Schwartz mutual information, a new performance criterion is given and this associated control algorithm is presented to minimized the mutual information of the system outputs so as to minimize the statistical couplings among system outputs. The convergence of this presented control algorithm is analyzed and the effectiveness of the proposed algorithm is shown by simulation.

SunM03-05

Design and simulation of dual fuzzy self-adjusting immune PID controller for grain drying system

Aini Dai, Xiaoguang Zhou, Chi Zhang, Xiangdong Liu, and Huiling Zhou
(Beijing Univ. of Posts and Telecommunications, China)

The grain drying process has the characteristics of large time delay, nonlinearity, multi disturbance and strong coupling. In order to reduce the grain moisture content during drying process, to ensure the grain quality of the grain, and enable the uniform moisture content of outlet grain, a new improved controller model for grain drying which called the dual fuzzy self-adjusting immune PID controller in this paper is proposed based on immune feedback mechanism, and the problem of fixed change rate of the parameters of general fuzzy immune PID controller is solved. Matlab simulation tool is used to simulate the control models of grain drying system, and the effectiveness of this new improved control method for the grain drying system is shown by simulation on the performance comparison with the other control methods, such as: general PID, fuzzy self-adjusting PID and general fuzzy immune PID. The simulation results show that the new fuzzy immune PID controller has better dynamic performance in the aspects of overshot, stability and anti-jamming.

Regular Session

Control of mechatronic systems II

Time: 14:50-16:50, Sunday, August 23, 2015
SunP01, Room No. 01

Chair: Changan Jiang (Ritsumeikan Univ., Japan)
Co-Chair: Junming Xiao (Zhongyan Univ. of Tech., China)

SunP01-01

A brushless DC motor speed control system based on DSP controller

Songming Cao, Yong Liu, Ming Hu, Xin Fu
(Beijing Univ. of Posts and Telecommunications, China)

In this paper, the control system of brushless DC motor, using the TI Co.'s digital signal processor TMS320F2812 as the main control chip, design for hardware of system are as follows :a rectifier circuit, inverter circuit, drive circuit, control circuit, voltage and current detection circuit; software program design in DSP software development environment CCS, using C language and assembly language a hybrid programming, the realization of the PWM wave generation and brushless DC motor speed control and other functions.

SunP01-02

Precision size measurement instrument for irregular objects

Wanji Liu (SIPO, China)
Xian Tao (Chinese Acad. of Sci., China)

Precision size measurements are widely used in industrial production such as candies and cookies in the food industry. However, it is a challenge to measure irregular objects in a universal device because of poor adaptability and low precision. In this paper, a high-precision measurement device for irregular objects based on machine vision is designed. It consists of a rotational adjustment platform, two imaging units, a weighing device and a host computer. Armed with this device, a novel algorithm with good robustness is proposed to rapidly measure irregular objects. The sub-pixel location algorithm based on spatial moment is used for the accuracy size measurement. Experiments show that the measurement accuracy is less than 25μm.

SunP01-03

A new method of periodicity estimation for mechanical acoustic data

Zhipan Hong and Guoliang Lu
(Shandong Univ., China)

Periodicity estimation in mechanical acoustic time-series data is a well-established problem in data mining as it can be applicable in variety of disciplines either for anomaly detection or for prediction purposes in industry. In this paper, we develop a new approach for capturing and characterizing periodic patterns in time-series data by virtue of the dynamic time warping (DTW). We have conducted extensive experiments to evaluate the proposed approach with synthetic data and our collected data in practice. Experimental results demonstrated its effectiveness and robustness on periodicity detection in highly noised data.

SunP01-04

Acoustic emission signal harr wavelet denoise research

Kenan Shen (Southwest Forestry Univ., China),
Mingcong Deng (Tokyo Univ. of Agri. and Tech., Japan)
Ming Li (Southwest Forestry Univ., China)

In order to obtain wood acoustic emission signal waveform. A multi channel acoustic emission signal acquisition system based on NI high-speed data acquisition equipment was constructed. At the same time, a signal wavelet extraction and processing platform based on LabVIEW software was designed, which can be used to collect , separate , extract the acoustic emission signal, spectral analysis and other basic functions. The system was proved to be effective through the acoustic emission experiment. Through the comparison of three different signal extract ways, further verify the advantages of harr wavelet analysis. As a platform for wood acoustic emission signal acquisition and processing, this system provides the necessary foundation for the processing of wood acoustic emission signal.

SunP01-05

Operator-based nonlinear networked control system with packet error

Tomohito Hanawa and Mingcong Deng
(Tokyo Univ. of Agri. and Tech., Japan)

This paper is concerned with the operator-based nonlinear networked control systems with packet errors. In communication network, packet may include errors caused by noise in network, and in conventional control method, these packets are regarded as lost packets. This means information of control signals is also lost completly, even if the disturbance caused by errors acceptable for control systems. The proposed system treats packets in communication networks with errors as control signals with perturbation. This control scheme reduces the numbers of dropped packets caused by noise in communication network. Firstly, the operator-based plant model and packet communication model with packet error are proposed. Secondly, the operator-based nonlinear control system is proposed. Finally, the effectiveness of the proposed control scheme is confirmed by simulation.

SunP01-06

Optimal control of non-prehensile manipulation control by two cooperative arms

Changan Jiang, Satoshi Ueno (Ritsumeikan Univ., Japan)
Yoshikazu Hayakawa (Nagoya Univ., Japan)

In this paper, an optimal control method to non-prehensile manipulation control by two cooperative arms is proposed. In details, based on the dynamic model of the two-rigid-link object, an approximate model is derived. According to the obtained model, an optimal regulator is designed to realize the holding motion of two cooperative arms which is used to keep the two-rigid-link object stable on the arms. Finally, simulation results are shown to verify the effectiveness of the proposed method.

Regular Session

Mechatronic systems analysis and control II

Time: 14:50-16:50, Sunday, August 23, 2015
SunP02, Room No. 02

Chair: Shengjun Wen (Zhongyuan Univ. of Tech., China)
Co-Chair: Dongyun Wang (Zhongyuan Univ. of Tech., China)

SunP02-01

SVR-based input-output mapping of a micro-hand

Kou Fujita (Tokyo Univ. of Agri. and Tech., Japan)
Shuichi Wakimoto (Okayama Univ., Japan),
Mingcong Deng and Shin Wakitani
(Tokyo Univ. of Agri. and Tech., Japan)

Micro-hand is one of soft actuators. It has many merits, however, it is of nonlinearity. Moreover, it needs sensorless control. Sensorless control with SVR-based mapping of a micro-hand is proposed in this paper. Effectiveness of the proposed method is verified by the experiment of the control system.

SunP02-02

Nonlinear remote temperature control of a spiral plate heat exchanger

Ryohei Fujii, Mingcong Deng, and Shin Wakitani
(Tokyo Univ. of Agri. and Tech., Japan)

In this paper, the time-delay is considered when process equipment is controlled by a wireless network in a large-scale plant. To prevent a decline of a control performance by the time-delay, the time-delay compensation controller is designed. What's more, the experimental environment which simulates the remote control is made, and the effectiveness of the designed control system is confirmed by simulation and experiment results.

SunP02-03

Operator based voltage control experiments of thermoelectric generation system

Ryuji Yoshida, Mingcong Deng, and Shin Wakitani
(Tokyo Univ. of Agri. and Tech., Japan)

Boost converters have nonlinear characteristics by semiconductor switching elements in a circuit.Generally, controllers are designed by a linearized model of the boost converter based on state space averaging method.This study proposes design scheme considering discontinuous conduction mode without linearization.
In detail, firstly, modeling of boost converter in discontinuous conduction mode is derived.Secondly, control system designed based on operator theory is shown.Finally, the effectiveness of the proposed control system is verified by simulation and experimental results to the change of the load and the input voltage.

SunP02-04

Robust controller design for networked control system with packet dropout and quantization error

Haiquan Wang, Rongxiang Gao, Qian Zhang, and Shengjun Wen
(Zhongyuan Univ. of Tech., China)

The stability of networked control systems with packet dropout and quantization error is researched in this paper. As a typical distributed closed-loop control system connected with network, quantization errors and packet dropouts frequently occur that the previous model of networked control system tend to ignore them. So in order to describe exactly how the system will behave during control, the nonlinear quantizer to quantify status signals is introduced and Markov jump system model is established to describe the packet dropout existing in networked control system. Subsequently, based on the established model, state feedback controller is designed to ensure the stability of system and the Linear Matrix Inequality (LMI) is used to solve the controller. The simulation results show that state feedback controller can ensure the stability of controlled system with packet dropout and quantization error.

SunP02-05

Active power filter design for improving power quality

Junming Xiao, Xiangming Zhang, Shengjun Wen, and Zhengbo Liu
(Zhongyuan Univ. of Tech., China)

The paper design a current control based active power filter (APF) for improving power quality by reactive power compensation and harmonic filtering. The designed APF is based on a voltage source inverter (VSI), where the VSI is controlled by two loops, the voltage control loop and the current control loop. The voltage control loop is used to regulate the DC link capacitor voltage of the VSI. Via triangular wave control, the current control loop is used to produce a tracking PWM signal to shape the harmonic current such that it is in-phase with the same shape as the input voltage. The major advantage of the proposed APF is to search the reference current for improving power quality by using dq0 detecting method. Simulation results are given to validate the proposed scheme. From the results, it shows that the reduction of THD is better in power system networks.

SunP02-06

Fractional PID based stability control for a single link rotary inverted pendulum

Wudai Liao, Zhengbo Liu, and Shengjun Wen
(Zhongyuan Univ. of Tech., China),
Shuhui Bi (Univ. of Jinan, China)
Dongyun Wang (Zhongyuan Univ. of Tech., China)

Fractional order based stability control for the system of the single link rotary inverted pendulum is presented. The mathematical model is derived using Lagrange Equation and the G-L fractional calculus. Then the integer order PID controller and fractional order PID controller are designed respectively. Under the condition of the same parameters, and, the integrator of order and a differentiator of order of the fractional order PID controller are adjusted adaptively. Finally, comparing with the integer order PID controller, the results show the system of fractional order PID controller is more quickly swigged, and the stability control performance is more effective.

Regular Session

Complex systems control and applications II

Time: 14:50-16:50, Sunday, August 23, 2015
SunP03, Room No. 03

Chair: Aihui Wang (Zhongyuan Univ. of Tech., China)
Co-Chair: Hong Wang (Univ. of Manchester, UK)

SunP03-01

Design of the automatic sample preparation system

Xin Fu, Shimin Wei, Yong Liu, Ming Hu, and Songming Cao
(Beijing Univ. of Posts and Telecommunications, China)

This paper introduces a kind of automatic device(called ASPS), wihch implements the function of automatic sample preparation. The components and design principles of the device are described in detail. The device consists of the membrane feeding system, the x-y-z manipulator and the boxes feeding and retriving mechanism. The design principles mainly involve tension control and the avoidance of slippage.

SunP03-02

IPMC robust nonlinear tracking control design based on a multi-objective particle swarm optimization-based RRCF approach

Wudai Liao, Tongbin Yan, Aihui Wang, and Yiwen Fu
(Zhongyuan Univ. of Tech., China)

In this paper, a robust nonlinear tracking control design for an ionic polymer metal composite (IPMC) is proposed by using a multi-objective particle swarm optimization-based robust right coprime factorization approach. Addressing the difficult in obtaining the PI control parameters K_p, K_i of the former proposed nonlinear robust tracking control system based on PI-based robust right coprime factorization approach, how to obtain the optimal control parameters K_p, K_i is investigated by using MATLAB system identification toolbox and multi-objective particle swarm optimization algorithm. That is, firstly, a new equivalent transfer function model of the robust stable control system of IPMC is identified. For the obtained transfer model, a multi-objective particle swarm algorithm optimization is used obtain the control parameters K_p, K_i of PI controller. Finally, the effectiveness of the proposed method system is confirmed by simulation results.

SunP03-03

Robot arm with micro-hand robust control design using operator-based robust right coprime factorization approach

Aihui Wang (Zhongyuan Univ. of Tech., China)
Hongnian Yu (Bournemouth Univ., UK)
Dongyun Wang (Zhongyuan Univ. of Tech., China)
Mingcong Deng (Tokyo Univ. of Agri. and Tech., Japan)

This work focuses on robust nonlinear control design of a robot arm with micro-hand by using operator-based robust right coprime factorization (RRCF) approach. In detail, to control the precise endpoint position of robot arm and obtain the desired force using micro-hand according to the external environment or task involved, a connected feedback control system based on operator-based RRCF approach is proposed. In first sub-system, to control the angular position of the robot arm, the operator controllers and the tracking controller are designed, and the robust stability and tracking conditions are derived using RRCF approach. The second sub-system is designed to control the micro-hand force, and the robust tracking conditions are also discussed based operator-based RRCF approach. Finally, the effectiveness of the proposed control system is verified by simulation results.

SunP03-04

Complex event processing on uncertain data streams in product manufacturing process

Na Mao and Jie Tan
(Chinese Acad. of Sci., China)

With the development of automatic production, manufacturing factories record tremendous amounts of data with sensor devices deployed in a factory. Because of the inherent inaccuracy of sensor readings, these data are of high level of uncertainty. How to use Complex Event Processing (CEP) to get useful information for quality monitoring of products from a lot of uncertain raw data continually generated from the production lines is becoming a challenging research. Therefore, in this paper, we propose a model of uncertain complex event processing system for real-time monitoring in product manufacturing process. And then we define the probabilistic event model and propose a probabilistic event detection algorithm based on rNFA and its optimization plan by event filtering. At the same time, we introduce Conditional Probability Matrix (CPM) and describe the calculation of probability of complex events with the multiplication theorem of probability. The experimental results show that our proposed method is efficient to detect complex events over probabilistic event streams with better event throughput capabilities and lower time consumption.

SunP03-05

Detecting cracks on a concrete surface using histogram of oriented gradients

Lin Meng, Zhongkui Wang, Yoshiyuki Fujikawa, and Shigeru Oyanagi
(Ritsumeikan Univ., Japan)

With the aging of structures such as bridges, buildings, and tunnels, investigating the cracking of concrete surfaces have become very important. The standard method for investigating cracks has usually been to perform a visual inspection and acoustic diagnosis. However, the inspection results when using these techniques vary depending on the experience of the inspector, causing there are not objectivity and quantifiability enough. Therefore, digital image analysis of concrete cracks is being developed with the aim of providing efficient, automatic, and quantitative inspection. However, in the process of binarization, some of the cracks become fractured or invisible, which have a negative effect on the investigation accuracy. To improve the accuracy when detecting cracks, we propose a method that uses the histogram of oriented gradients (HOG) to detect cracks on the concrete surface. We are also working on the use of unmanned helicopters to take photos of the concrete surfaces to enable automatic investigation.

SunP03-06

Power balance control for switched reluctance generator integrated in DC microgrid

T Wang., D He. (Lanzhou Institute of Physics and National Key Lab. of Vacuum and CryogenicLanzhou Hongrui Aerospace Electromechanical Equipment Co. Ltd, Wuxi Hongrui Aerospace Electromechanical Equipment Co. Ltd., China) Q Wang . (China Univ. of Mining and Tech., China) Y Huo . (Lanzhou Institute of Physics and National Key Lab. of Vacuum and Cryogenic Lanzhou Hongrui Aerospace Electromechanical Equipment Co. Ltd., China) L Lu. and J Li. (China Univ. of Mining and Tech., China)

This paper presents a power balance control (PBC) scheme for switched reluctance generator (SRG) wind power system integrated with DC microgrid. First, a switched reluctance generator wind power system is, which acts as distributed energy source, is integrated with a 24V utility DC microgrid. With proper convertor design and control characteristic for SRG system, output voltage ripple is minimized, which makes it possible for directly connection. Then proposed PBC is achieved on DSP controller for a 3 phase 12/8 SRG system. With proposed control scheme and control system, SRG can change control target dynamically with signals on DC bus. In the end, both simulations and experiments demonstrated proposed PBC well.

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Swarm, Evolutionary, and Memetic Computing

6th International Conference, SEMCCO 2015
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Preface

This LNCS volume contains the papers presented at the 6th Swarm, Evolutionary and Memetic Computing Conference (SEMCCO 2015) held during December 18–19, 2015, at CMR Technical Campus, Hyderabad, India. SEMCCO is regarded as one of the prestigious international conference series that aims at bringing together researchers from academia and industry to report and review the latest progress in cutting-edge research on swarm, evolutionary, memetic computing, and other novel computing techniques like neural and fuzzy computing, to explore new application areas, to design new bio-inspired algorithms for solving specific hard optimization problems, and finally to raise awareness of these domains in a wider audience of practitioners.

SEMCCO 2015 received 150 paper submissions from 12 countries across the globe. After a rigorous peer-review process involving 400 reviews in total, 40 full-length articles were accepted for oral presentation at the conference. This corresponds to an acceptance rate of 27 % and is intended for maintaining the high standards of the conference proceedings. The papers included in this LNCS volume cover a wide range of topics in swarm, evolutionary, memetic, and other intelligent computing algorithms and their real-world applications in problems selected from diverse domains of science and engineering.

The conference featured the following distinguished keynote speakers: Dr. P.N. Suganthan, NTU, Singapore, and Dr. Rammohan Mallipeddi, Kyungpook National University, South Korea.

We take this opportunity to thank the authors of all submitted papers for their hard work, adherence to the deadlines, and patience with the review process. The quality of a refereed volume depends mainly on the expertise and dedication of the reviewers. We are indebted to the Program Committee/Technical Committee members who not only produced excellent reviews but also did so in the short time frames that they were given.

We would also like to thank our sponsors for providing all the logistic support and financial assistance. First, we are indebted to Management and Administrations (faculty colleagues and administrative personnel) of CMR Technical Campus, Hyderabad. We thank Prof. Carlos A. Coello Coello, and Prof Nikhil R. Pal, the General Chairs, for providing valuable guidelines and inspiration to overcome various difficulties in the process of organizing this conference. We would also like to thank the participants of this conference. Finally, we would like to thank all the volunteers for their tireless efforts in meeting the deadlines and arranging every detail to make sure that the conference could run smoothly. We hope the readers of these proceedings and the participants of the conference found the papers and conference inspiring and enjoyable.

December 2015

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Continued Rise of the Cloud

Advances and Trends in Cloud Computing

Springer

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To
Eyaad Imran Rashid Khan:
Happy 1st Birthday

Preface

Overview

Cloud Computing is an attractive paradigm that allows consumers to self-provision cloud-based resources, application services, development platforms, and virtualized infrastructures. The benefits associated with the cloud paradigm are enormous, and although there still are numerous inherent issues, the newness is disappearing and the hype is turning into reality. With time, cloud consumers are becoming more knowledgeable and beginning to dictate what they require. Cloud providers are learning from experiences of the past few years and beginning to provide what consumers actually need. Robust new technologies and methodologies are appearing and existing technologies are becoming mature and useable. Standards organizations are developing the necessary controls and beginning to enforce them for the benefit of all. Other agencies and cloud-related industries are also appearing to provide specialist services to support cloud providers as well as cloud consumers.

Alongside this, researchers and practitioners are coming up with strategies to resolve any issues that previously existed. New areas being investigated include: cloud security, interoperability, service level agreements, identity and access management, cloud governance, big data, data analytics, and cloud applications in other subject areas and different walks of life. New frameworks and methodologies are being developed and further refined for construction, deployment, and delivery of cloud services and environments to ensure that: the software developed is scalable and suitable for virtualized distributed environments; the deployment of platforms is secure and exhibits the in-built characteristic of multi-tenancy; and the new breed of security threats that now exist due to the shared trust boundaries are, at least, minimized.

This book, *Continued Rise of the Cloud: Advances and Trends in Cloud Computing,* aims to capture the state of the art and present discussion and guidance on the current advances and trends in the emerging cloud paradigm. In this text, 36 researchers and practitioners from around the world have presented latest research developments, current trends, state of the art reports, case studies, and suggestions for further development of the cloud computing paradigm.

Objectives

The aim of this text is to present the current research and future trends in the development and use of methodologies, frameworks, and the latest technologies relating to Cloud Computing. The key objectives include:

- Capturing the state of the art in cloud technologies, infrastructures, service delivery and deployment models
- Analyzing the relevant theoretical frameworks, practical approaches and methodologies currently in use
- Discussing the latest advances, current trends and future directions in the cloud computing paradigm
- Providing guidance and best practices for development of cloud-based services and infrastructures
- In general, advancing the understanding of the emerging new methodologies relevant to the cloud paradigm

Organization

There are 15 chapters in *Continued Rise of the Cloud: Advances and Trends in Cloud Computing*. These are organized in five parts, as follows:

- Part I: *Access Control Mechanisms and Cloud Security*. This section has a focus on security and access control mechanisms for cloud environments. There are three chapters. The first chapter looks into the security issues of GPU clouds. The other two contributions present access control strategies focusing on taxonomy, classification, impact and implications of such mechanisms.
- Part II: *Standards, Brokerage Services and Certification*. This comprises three chapters. The first chapter evaluates standards for Open Cloud environment whereas the second contribution analyzes the role of brokerage services in Inter-Cloud environments. The third chapter in this section discusses the role of certification for cloud adoption especially for small-to-medium sized enterprises.
- Part III: *Frameworks for ERP, Big Data and Interoperability*: There are three chapters in this part that focus on frameworks and strategies. The first chapter presents an evaluation of cloud ERP. The second contribution suggests a framework for the implementation of Big Data Science. The final chapter also presents a framework for Cloud Interoperability based on compliance and conformance.
- Part IV: *Management, Governance and Capability Assessment*. This section presents contributions on cloud governance. The first chapter surveys the existing elasticity management solutions. The second chapter presents a discussion on cloud management vs cloud governance. The last contribution of this part presents a framework for the development of a cloud service capability assessment model.
- Part V: *Applications in Education and Other Scenarios*. This is the last section of the book, comprising three chapters. The first two contributions present

cloud applications in higher education: the first chapter focusing on the use of knowledge-as-a-service in the provision of education and the other focusing on cloud-based e-learning for students with disabilities. The final contribution presents application scenarios suitable for cloud adoption.

Target Audiences

The current volume is a reference text aimed to support a number of potential audiences, including the following:

- *Enterprise architects, business analysts and software developers* who wish to adopt the newer approaches to developing and deploying cloud-based services and infrastructures.
- *IT infrastructure managers and business leaders* who need to have a clear understanding and knowledge of the current advances and trends relating to the newer methodologies and frameworks in the context of cloud paradigm.
- *Students and lecturers* of cloud computing who have an interest in further enhancing the knowledge of the cloud related technologies, mechanisms and frameworks.
- *Researchers* in this field who need to have the up to date knowledge of the current practice, mechanisms and frameworks relevant to the cloud paradigm to further develop the same.

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Grateful thanks are also due to the members of my family—Rehana, Zoya, Imran, Hanya and Ozair—for their continued support and encouragement.

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About the Editor

Zaigham Mahmood Professor Zaigham Mahmood is a published author of nine books, four of which are dedicated to Electronic Government and the other five focus on the subject of Cloud Computing including: 1) *Cloud Computing: Concepts, Technology & Architecture;* 2) *Cloud Computing: Methods and Practical Approaches;* 3) *Software Engineering Frameworks for the Cloud Computing Paradigm;* 4) *Cloud Computing for Enterprise Architectures;* and 5) this current volume. Additionally, he is developing three new books to appear later in 2014. He has also published more than 100 articles and book chapters and organized numerous conference tracks and workshops.

Professor Mahmood is the Editor-in-Chief of *Journal of E-Government Studies and Best Practices* as well as the Series Editor-in-Chief of the IGI book series on *E-Government and Digital Divide*. He is a Senior Technology Consultant at Debesis Education UK and Associate Lecturer (Research) at the University of Derby UK. He further holds positions as a Foreign Professor at NUST and IIUI Universities in Islamabad Pakistan and Professor Extraordinaire at the North West University Potchefstroom South Africa. Professor Mahmood is also a certified cloud computing instructor and a regular speaker at international conferences devoted to Cloud Computing and E-Government. His specialized areas of research include distributed computing, project management, and e-government.

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A Framework for Evaluating Cloud Enterprise Resource Planning (ERP) Systems

Continued Rise of the Cloud pp 161-175 | Cite as

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Chapter
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Abstract

Cloud computing is a new paradigm, transforming the information technology (IT) industry, and the commercial sector, that is involved in reshaping the way enterprise services are designed, implemented, and deployed. Rather than using complex software systems, customers are beginning to spotlight on their core business processes while obtaining all required IT functions as cloud services. Enterprise resource planning (ERP) systems attempt to integrate data and processes in organizations. These systems are among the most adopted IT solutions in organizations. This chapter explores the literature available on cloud ERP systems, suggests the factors accounting for cloud ERP, and proposes a framework for evaluating cloud ERP systems. This framework is grounded on software engineering parameters involved in the development of cloud ERP. The validity of the framework is illustrated with the help of a case study.

Keywords

Business process Cloud Customization ERP Evaluation Software engineering

References

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Performance Analysis of Energy Efficiency Improvement Technique for Wireless Sensor Networks

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ABSTRACT

Energy efficiency is the main issue in the Wireless Sensor Networks (WSNs). The concept of cooperative communication is one of the ways to improve its efficiency. The energy consumption is minimized using Cooperative communication technique (CT). To what extent Cooperative technique is energy efficient than Direct communication technique (DT) is analysed for shorter distances in terms of some meters. Finally a discrete optimization algorithm is proposed for energy efficiency maximization based on packet length and modulation level to improve its performance and thus it is extended to a practical scenario. By placing the relay nodes randomly and analyzing its performance for different distance in terms of meters.

General Term

Discrete optimization algorithm

Keywords

WSNs, Cooperative communication, Direct communication, Energy efficiency, packet length, modulation level.

1. INTRODUCTION

Wireless sensor networks (WSNs) are composed of nodes typically powered by batteries, for which replacement or recharging is very difficult. With finite energy, only transmission of a finite amount of information is possible. The concept of sensor networks which has been made viable by the convergence of micro electro-mechanical systems technology, wireless communications and digital electronics. First, the sensing tasks and the potential sensor networks applications are explored, and a review of factors influencing the design of sensor networks is provided. Then, the communication architecture for sensor networks is outlined, and the algorithms and protocols developed for each layer in the literature are explored. Open research issues for the realization of sensor networks are also discussed in [1].Direct communication involves transmission of data packet from source to destination. On the other hand, Cooperative communication involves transmission with help of a relay node. Energy efficiency for Direct and Cooperative communication in WSN are obtained and simulated. From the results, it is observed that, Direct Communication is energy efficient, in the case of shorter distance and Cooperative communication outperforms Direct Communication as distance increases. Then a Discrete optimization algorithm is proposed, which jointly optimizes both Modulation level and packet size in order to maximize the energy efficiency. From the results, it reveals that Optimized Cooperative communication is more energy efficient compared to Cooperative Communication technique without applying optimization which in turn is energy efficient than Direct communication in [2]. As a contribution, the work has been extended to practical scenario with a number of nodes which are located in scattered position with varying distance. Single Source and Destination nodes are considered for transmission and reception and remaining nodes are chosen as relay nodes. Thus energy efficiency is obtained for Direct Communication by performing the data packet transmission between source and sink. On the other hand, energy efficiency is obtained for Cooperative Communication by analyzing each of the remaining relay nodes and the best relay is which is highly efficient is chosen. For each distances in the scenario, different relays performs well. Further to maximize the energy efficiency, the Optimization algorithm is applied to the practical scenario and results are analyzed. The author has analyzed how far cooperative communication can save energy for a successful packet transmission in an energy-constrained WSN. Energy efficiency of Cooperation and Direct transmission schemes in WSN is studied and compared. Therefore, minimizing the energy consumption for data transmission becomes one of the most important design considerations for WSN. Energy consumption in a transmission in WSN is directly proportion to square or forth power of the distance from source to destination node. When the sensor nodes are apart from each other and from sink and there is more energy consumption which is not economical. To overcome this problem the relay nodes may be placed to reduce the energy consumption. Comparing to the sensor nodes, relay nodes are much less costly. Relay nodes are needed to forward readings from each individual sensor in multiple hops to the sink.Relay node works like a repeater that amplifies the signal and forward to sink. Relay node job is only to relay data generated by other sensor nodes, without sensing the environment. Relay node can remove burden from the overloaded nodes. Relay node main task is to communicate with the sensor nodes and with other relay nodes in [3]. In paper [4] the author has presented an analysis of the energy efficiency of best-select relaying, where a single best relay is chosen to relay the source message, and compares its performance with Direct Communication. To improve the energy efficiency further, the optimal constellation size and transmission bandwidth are studied. They show that significant performance gain is possible compared to a Direct Communication scheme. In paper [5] they have considered a cooperative wireless network where a set of nodes cooperate to relay in parallel the information from a source to a destination using a Decode-and-Forward approach. The source broadcasts the data to the relays, some or all of them cooperatively beam form to forward the data to the destination. They generalize the standard approaches to cooperative communications in two key respects.

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Green Space Factor In Modifying The Microclimates In A Neighbourhood: Theory And Guidelines

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ABSTRACT

Cities and rural environments differ substantially in their land surface temperature, which leads to urban heat island effect (UHI). Cities have a dynamic relationship with the microclimate. Landscaping is one of the most effective passive design strategy compared to other passive design strategies in mitigating the UHI effect. The degree of 'greenery' or 'greenness' (Green space factor) is usually defined and measured as the percentage of total urban area that is devoted to open green spaces. The higher the percentage of green cover, the greener that particular city becomes. National forest policy, India states that a 20% to 33% of green cover is considered to be fairly good. The green spaces help to alter the temperature, reduce the urban heat island effect and improve the air quality. In most cities, concentrated vegetation is seen only in parks or recreational spaces. This lowers temperatures on the microclimate of the park but does not have any effect on the microclimate of the neighbouring built environments. By placing vegetation within the built space of the urban fabric, the effect of UHI effect can be reduced where people live, work and spend most of their lives. Such approaches have been investigated in the fields of planning, urban design, landscape architecture, environmental engineering. Selection of right plant in the right place can be based on many aspects such as its thermal performance. It further depends on various plant typologies and their characteristics which will have significant role in urban heat balances by reducing the land surface temperature and reduce energy consumptions in the dense built up areas. It also helps to improve the microclimate performance in the built environment and also create a visually appealing environment compared to other passive techniques. This paper describes the importance of relationship between green space factor and microclimate and implementation of these guidelines in a neighbourhood with various case examples from research papers, literature and theories. The study has been carried out with on site observation and Envimet simulation methods.
Keywords: urban heat island, green space factor, green spaces, Envimet

1. INTRODUCTION

Climate, buildings, and green spaces have been explored worldwide by many researchers due to their interesting interrelationships and significant impacts to the environment. In recent years, urban heat island effects(UHI), induced by urban form, anthropogenic heat from buildings and Air conditioning systems have been studied extensively in cities around the world (1). Since the mid twentieth century, the global surface temperature has increased by 0.7±0.18°C during the 100 years ended in 2005. Thus the increased temperature is connected with increase in UHI through expansion of built up areas and populated area. The heat island during daytime increases rapidly and takes 3-5 hours to reach the

A hybrid test optimization framework using memetic algorithm with cuckoo flocking based search approach

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The testing process of industrial strength applications usually takes more time to ensure that all the components are rigorously tested to have failure-free operation upon delivery. This research work proposed a hybrid optimization approach that combines the population based multi-objective optimization approach namely Memetic Algorithm with Cuckoo Search (MA-CK) to generate optimal number of test cases that achieves the specified test adequacy criteria based on mutation score and branch coverage. Further, GA, HGA and MA based heuristic algorithms are empirically evaluated and it has been shown that the proposed MA with cuckoo search based optimization algorithm provides an optimal solution.

Strengthening of Concrete Filled Steel Tubular Columns using FRP Composites

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Abstract

Over the past few decades, concrete filled steel tubular (CFST) column plays an eminent role in the construction industry owing to its structural behaviour like large deformation and energy absorption capacity. But these members get deteriorated due to the environmental effects like corrosion and ageing. The external strengthening of using fibre reinforced polymer (FRP) material is emerging as a new trend in enhancing the structural performance of CFST members to counteract the drawbacks in using the past rehabilitation work. In this paper, an experimental investigation has been carried out to investigate the behaviour of FRP strengthened slender circular CFST members under compression. The size of the specimens includes 42.4mm diameter, 3.2mm thickness and 1500mm height. In the experimental work, three columns are externally bonded by 200mm width of CFRP strips with the spacing of 60mm and another three columns with 300mm width and 100mm spacing. Experiments are undertaken to examine the interaction of FRP with CFST columns in terms of the failure modes, axial stress-strain and lateral stress-strain behaviour and also the enhancement in load carrying capacity. At the end, the results demonstrated that there is an improvement in the behaviour and the load carrying capacity of CFST columns by strengthening those externally using FRP composites.

Key words: *CFST members, circular, compression, FRP composites, slender, strengthening.*

Introduction

Composite construction incorporates the adverse property of steel which has high tensile strength and ductility with the concrete having high compressive strength, excellent fire resistance and low cost. The composite construction is very often adopted in super high rise building, long span bridges and roof structures owing to its high structural efficiency with large strength to weight ratio as well as large flexural rigidities against instability and serviceability problems. Among the composite members, the composite column is gaining importance because of its wide applications over bridge piers subjected to impact from traffic, column supporting storage tanks, columns in high rise buildings, railway decks, piles and offshore structures (shanmugam & Lakshmi).

Composite column exists in two forms; i) steel encased concrete section ii) concrete filled steel tubular sections. Concrete filled steel tubular (CFST) column is a load bearing member with concrete filled inside bare steel tube. CFST columns are preferred over concrete and steel columns because of its high axial load carrying capacity, better ductile performance, large energy absorption capacity and lower strength degradation (Jianming Liu). During the application of loads, the steel tube provides equal and uniform continuous pressure on the

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Performance Tuning of PCA by CFS-Shapley Ensemble and Its Application to Medical Diagnosis

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Abstract. Selection of optimal features is an important area of research in medical data mining systems. Principal component analysis (PCA) is one among the most popular feature selection methods. Still PCA faces a drawback – i.e., the measurements from all of the original features are used in the projection to the lower dimensional space. Hence this work is aimed to tune the performance of PCA and classify the medical profiles. The proposed method is realized as an ensemble procedure with three steps – (i) feature selection using PCA, (ii) feature ranking with CFS and (iii) dimension reduction using Shapley Values Analysis. The variance coverage parameter of PCA is adjusted so as to yield maximum accuracy which are measured with specificity, sensitivity, precision and recall. This facilitates the selection of a compact set of superior features with uncompromised detection rates, remarkably at a low cost. To appraise the success of the proposed method, experiments were conducted across 6 different medical data sets using J48 decision tree classifier, which showed that the proposed procedure improves the classification efficiency and accuracy compared with individual usage.

Keywords: Data mining, Dimensionality reduction, Feature Extraction, Feature selection, Principal component analysis, Shapley value Analysis, Classification.

1 Introduction

In the classification tasks on the medical datasets, researchers notice that it is common that a considerable number of features are not informative because they are either irrelevant or redundant with respect to the class concept. Ideally, we would like to use the features which have high separability power while ignore or pay less attention to the rest. A suitable feature set can simplify both the pattern representation and the classifiers consequently; the resulting classifier will be more efficient. Identifying the optimal feature subset according to classification performance is referred to as feature selection process.

Feature selection methods are typically divided into two types. The peculiarity is made depending on whether feature subset evaluation is performed using the learning

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Parallel Distributed Arithmetic Based K-Best List Sphere Detection Algorithm for LTE Standard

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Abstract

3GPP Long Term Evolution (LTE) is the upcoming standard for cellular mobile communication. To meet the requirements of high data rate and low latency interactive services, Orthogonal Frequency Division Multiplexing (OFDM) in combination with MIMO is used. From a bit error rate (BER) performance perspective, maximum likelihood (ML) detection is the preferred detection method for multiple input multiple output (MIMO) communication systems. However, for high transmission rates, the K-best algorithm provides close-to-ML bit error rate (BER) performance with its iterative tree search, while its circuit complexity is reduced compared to an exhaustive search. In this paper, Distributed Arithmetic (DA) using parallel architecture based K-best List Sphere Detector (LSD) for a 3GPP LTE receiver is presented. About 50% of the computation time can be decreased and increase in speed with the help of this architecture.

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Keywords: Multiple-Output (MIMO); Orthogonal Frequency Division Multiplexing (OFDM); 3rd Generation Partnership Project (3GPP); Long Term Evolution (LTE); List Sphere Detector (LSD); Distributed Arithmetic(DA).

1. Introduction

The 3rd Generation Partnership Project (3GPP) has recently been drafting the new Long-Term Evolution (LTE) Release 10 (also known as LTE-Advanced) to meet the International Mobile Telecommunications

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Advanced (IMT-A) requirement for the 4th Generation (4 G) wireless network deployment where very high spectrum efficiencies are expected. Equipped with multiple antennas at both the transmitter and the receiver sides, the enhanced multiple-input multiple-output (MIMO) technology is considered to be the key technique in LTE-A to meet the target. MIMO technology is widely recognized as a key enabling technology for future wireless communication systems, and it is becoming an essential part in almost every new wireless standard by Lee [1], and Paulraj [2]. MIMO systems can be used to improve the transmission quality by sending the same data (spatial diversity) or to increase the channel capacity by sending different data (spatial multiplexing). There are several methods by Antikainen [3] to separate parallel data streams for spatially multiplexed MIMO systems.

The maximum-likelihood (ML) algorithm leads to the best error performance, but it requires huge computational complexity. On the other hand, linear detection methods such as the zero-forcing (ZF) algorithm or minimum mean-square-error algorithm are quite simple, but they show very poor performance. Soft-output MIMO detection poses significant challenges to the MIMO receiver design as the computational complexity increases exponentially with the number of antennas. However, the optimal soft-decision detector, the maximum *a posteriori* (MAP) detector, will consume enormous computing power and require tremendous computational resources which make it infeasible to be used in a practical MIMO receiver. As such, researchers are seeking efficient algorithms to reduce the MIMO detection complexity.

The ordered successive interference cancellation (OSIC) algorithm performs better than linear detection methods, but it suffers from the error propagation problem. Recently, there has been a great interest in signal detection methods based on tree search algorithms, which achieve near-ML performance but require significantly less complexity than the optimal ML method. The tree-search algorithms can be often categorized into the depth-first search algorithm and the breadth-first search algorithm. The sphere detection algorithm is a depth-first tree-search algorithm to find the closest lattice point.

However, the sphere detector suffers from non-deterministic complexity and variable-time throughput. The sequential nature of the depth-first tree-search process significantly limits the throughput of the sphere detector especially when the SNR is low. The K-Best algorithm is a fixed-complexity algorithm based on the breadth-first tree-search algorithm. But this algorithm tends to have a high sorting complexity to find and retain the best candidates, which limits the throughput of the detector especially when K is large. There are some other variations of the K-Best algorithms by Juho Antikainen [4], and Wong [5] which require less sorting than the regular K-best algorithm. Distributed Arithmetic algorithm is an efficient realization of K-Best LSD. It is a bit level rearrangement of a multiply accumulate to hide the multiplications by Timmermann [6], and White [7]. It is a powerful technique for reducing the sizes of a parallel hardware multiply accumulate that is well suited to FPGA designs.

2. MIMO Detection

2.1. MIMO System Model

A high-level description of the targeted 2-antenna MIMO OFDM receiver is presented in Figure 1. The input ports are connected to radio-frequency functions of the receiver. The upcoming 3GPP long term evolution (LTE) standard receiver will support data rates up to 100 Mbps by Perttu Salmela [8]. Such a high data rate will be achieved in 20MHz bandwidth by using transmission techniques like Orthogonal Frequency Division Multiplexing (OFDM), Multiple-Input Multiple-Output (MIMO), that is, the use of multiple antennas, and an efficient forward error correction method, the turbo coding by Paulraj [2]. As these techniques are applied, the receiver needs to realize very sophisticated algorithms. The 3GPP LTE standard based on the MIMO-OFDM system provides very high data throughput rate because the technique of the MIMO can increase the data rate by extending an OFDM based system. However, the 3GPP LTE standard also increases the computational and the hardware complexities greatly, compared with the current WLAN standards. The K-best is one of the computational complexity modules in the physical layer of the LTE standard.

The source data passes through modulation, spatial time coding, and inverse fast Fourier transform and cyclic prefix to transmit antennas in the transmitter. The receiver site includes fast Fourier transform and removed cyclic prefix, channel estimation, QRD, spatial multiplex detection, and demodulation to restore the source data.

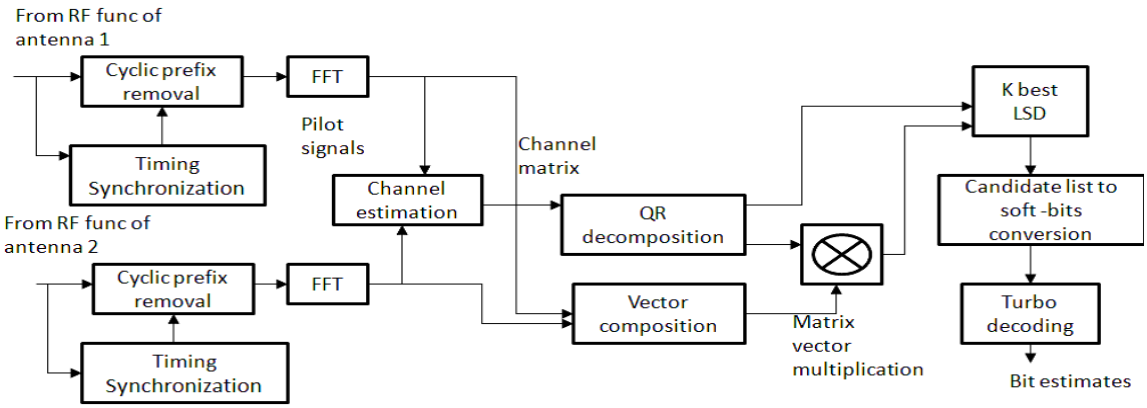


Fig.1. Block diagram of a spatial multiplex MIMO wireless communication system.

The baseband equivalent model can be described in

$$y = Hs + n \tag{1}$$

At each symbol time, a vector **S** with each symbol belonging to the quadrature amplitude modulation (q-QAM) constellation passes through the channel response matrix **H**. The received vector **y** at the receiving antenna for each symbol time is a noisy superimposition of the signals contaminated by additive white Gaussian noise (AWGN) given by **n**

2.2. QRD in ML Detection

The maximum likelihood (ML) detector is the optimum detection algorithm for the MIMO system. It requires finding the signal point **s** from all transmit vector signal sets that minimize the Euclidean distance with respect to the received signal vector **y**. The transmitted symbol **s** can be estimated by solving

$$s = \arg\min \left\| y - Hs \right\|^2 \tag{2}$$

This gives the optimal result. However, solving (2) is intractable with multiple antennas and large constellations. Instead of solving (2), the symbol estimation can be simplified by using QR decomposition of **H**. With this practice, the computational complexity is lowered. The detected vector **s** is computed based on the ML algorithm with QR decomposition as shown

$$s^{'} = \arg\min \left\| y^{'} - Rs \right\|^2 \tag{3}$$

Where $y^{'} = Q^H y$

R is in upper triangular form, approximation of **s** is computationally simpler with the aid of (3). Note that for MIMO-OFDM systems operated in stationary environments, the channel matrix remains almost the same. Thus, QR decomposition of the channel matrix can be done only once to get matrix **R**. The simplified approximation is based on computing the Euclidean distance in (3) by gradually increasing the dimensions of the symbol vector. Basically, there will be partial solutions which are too far away from the received symbols and when such partial solutions are discarded, the search space is efficiently limited. The K-best LSD by Paulraj [2], Myllyla [10] applies the aforementioned principles by maintaining a K-length list of the best partial solutions found so far.

2.3. K-Best LSD Algorithm

The K-Best algorithm has a fixed, implementation dependent computational complexity that depends on the number of transmit antennas MT and on the design parameter *K*, whereby a higher *K* generally results in a better BER performance. However, in practice, *K* must be chosen as a function of the rate in order to maintain close-to ML performance. Hence, complexity also depends on the order of the modulation scheme and tends to grow faster than quadratically in MT. The K-Best detector is a breath first iterative tree-search algorithm. Instead of searching the branches of the tree in a depth first manner, like the sphere decoder, the K-Best detector only calculates the child-nodes of a fixed number of K nodes in one level before it steps to the next level.

The K-best algorithm is a breadth-first search based algorithm, which keeps the nodes which have the smallest accumulated Euclidean distances at each level. If the PED is larger than the squared sphere radius C_0, the corresponding node will not be expanded. We assume no sphere constraint or (C_0 =infinite), but set the value K for instead, as is common with the K–best algorithms Meyer Baese [9], Myllyla [10] and Wenk [11].

The signal detected at the receiver after QR decomposition is given by,

$$s = \arg\min \sum_{i=1}^{M_T} \left| y_i - \sum_{j=1}^{M_T} R_{ij} s_j \right|^2 \tag{4}$$

The above equation was implemented with algorithm given below.

1. $P_M = 0$
2. $K = M - 1$
3. Calculate PED(Partial Euclidean Distances)for all admissible symbols at level k

$$P_k = P_{k+1} + \left\| y_k - \sum R_{k,i} \right\| \tag{5}$$

4. Choose the *K* best symbol vectors with the smallest PEDs. Save the symbol vectors and the corresponding PEDs. If $k = 0$, the solution is found, stop the algorithm; else, $k = k - 1$, go to 3.

The architecture for the algorithm is as shown in Fig 2

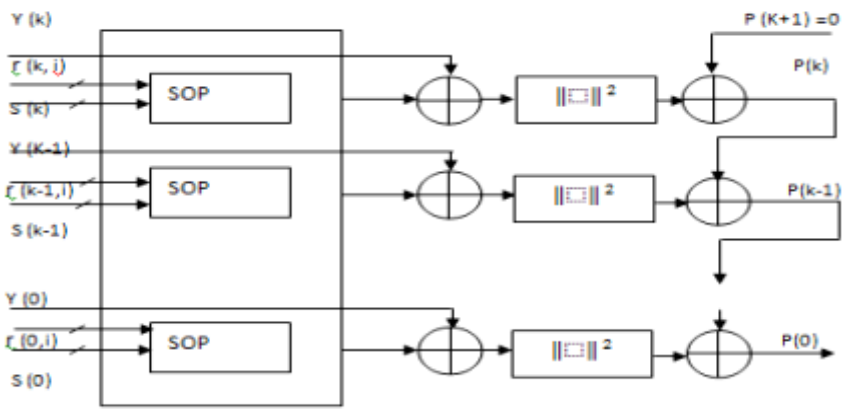


Fig. 2. Architecture for K-Best LSD Algorithm

In this existing architecture as shown in Fig 2, the sum of product term is given by,

$$= \sum_{i=0}^{M-1} r(k,i) * s(i) \quad (6)$$

Where s (i) is an n-bit scaled input and r (k, i) represents upper triangular matrix formed by QR decomposition of channel matrix H. When the above equation is implemented in hardware, the architecture looks as shown in Fig 3.

In this case as shown in Fig 3, 'm' number of parallel scaling accumulators with unique serialized data is fed. Each multiplies that data by a possibly unique constant, and the resulting products are summed in an adder tree. If

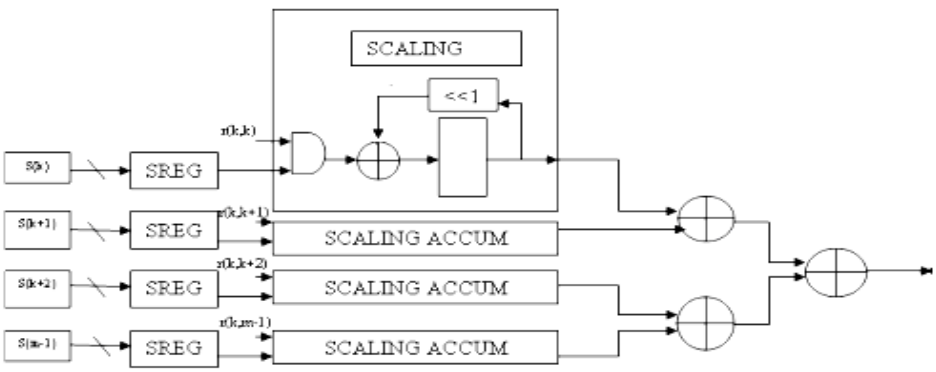


Fig. 3. Existing MAC Architecturein K-Best LSD without Using DA

consider that the scaling accumulator multiplier is really just a sum of vectors, then it becomes obvious that the circuit can be rearranged with use of DA algorithm.

The Sum of Product (SOP) of s and r also takes $m(m+1)/2$ MAC cycles with use of the conventional arithmetic. These numbers of cycles increase the computational complexity, design area and reduce the speed. This appears to be a fundamental problem when this SOP is implemented with use of general purpose multipliers. To overcome these problems, the proposed architecture is implemented with use of DA algorithm explained below.

2.4. Distributed Arithmetic

Real-time signal processing requires fast computation of inner products. Distributed arithmetic is a method of inner product computation that uses table-lookup and addition in place of multiplication. Distributed arithmetic has previously been shown to produce novel and seemingly efficient architectures for a variety of signal processing computations. A partition of the inner product computation at the word and bit level produces a computation consisting of lookups and additions. One of the vector operands is fixed, as in a digital filter; distributed arithmetic preprocesses the stored data to reduce the computational complexity of the inner product calculation

3. Architecture of K-Best LSD Using Parallel DA Algorithm

Distributed Arithmetic (DA) is an important FPGA technology and an efficient technique for calculation of sum of products or vector dot product or inner product or multiplies and accumulates (MAC). The "basic" DA

technique is bit-serial in nature. DA is basically a bit-level rearrangement of the multiply and accumulate operation. DA hides the explicit multiplications by ROM look-ups an efficient technique to implement on Field Programmable Gate Arrays (FPGAs).This DA algorithm is used for the proposed architecture of K-best LSD which is explained below. In K-best algorithm, the main equation to compute the Euclidian distance is given by,

$$P_k = P_{k+1} + \left\| y_k - \sum_{i=k}^{M-1} r(k,i) * s(i) \right\|^2 \tag{7}$$

In this equation, the sum of product term is given by,

$$\sum_{i=0}^{M-1} r(k,i) * s(i) \tag{8}$$

By applying DA algorithm, express s (i) as

$$s(i) = \sum_{b=0}^{n-1} s_b(i) 2^b \tag{9}$$

Where ‘n’ represents the nth bit of the input vector symbol s (i). Sub (i) in equation (8) we obtain

$$= \sum_{i=k}^{M-1} r(k,i) \sum_{b=0}^{n-1} s_b(i) 2^b$$

Rearranging the above equation on a bit level using DA, we obtain

$$= \sum_{i=k}^{M-1} r(k,i) \left[s_0(i)2^0 + s_1(i)2^1 + s_2(i)2^2 + s_3(i)2^3 + ... + s_{n-1}(i)2^{n-1} \right]$$

$$= \sum_{b=0}^{n-1} \sum_{i=k}^{m-1} \left(r(k,i) * s_b(i) \right) 2^n \tag{10}$$

This is the final equation obtained by applying DA algorithm.

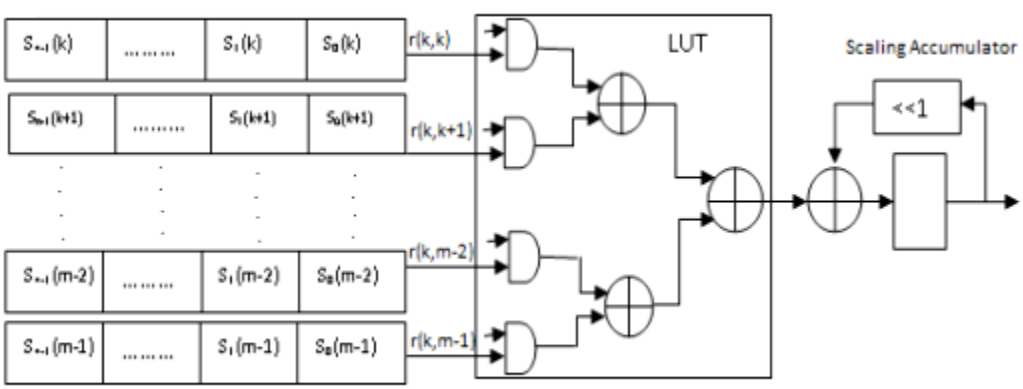


Fig. 4. MAC Architecture in K-Best LSD Using DA

Here as in Fig 4, the adder tree combines the 1 bit partial products before they are accumulated by the scaling accumulator. The order in which the 1xm partial products are summed is rearranged. Now instead of individually

accumulating each partial product and then summing the results, the accumulate function is postponed until after all the 1xm partials are summed at a particular bit time. This simple rearrangement of the order of the adds has effectively replaced ‘m’ multiplies followed by an ‘m’ input add with a series of ‘m’ input adds followed by a multiply. This arithmetic manipulation directly eliminates m-1 Adders in an m product term multiply-accumulate function. Thus number of scaling accumulators used for this proposed architecture gets reduced. If the channel coefficients r (k,i) are known a priori, then the SOP terms r (k,i) and s (i) becomes a multiplication with a constant and this is an important pre requisite for DA implementation.

A basic DA architecture, for a length N^{th} sum-of-product computation, accepts one bit from each of N words. If two bits per word are accepted, then the computational speed can be essentially doubled. The maximum speed can be achieved with the fully pipelined word-parallel architecture shown in Fig. 5. Here, a new result of a length four sum-of-product is computed for 4-bit signed coefficients at each LUT cycle. For maximum speed, we have to provide a separate ROM (with identical content) for each bit vector $s[n]$.

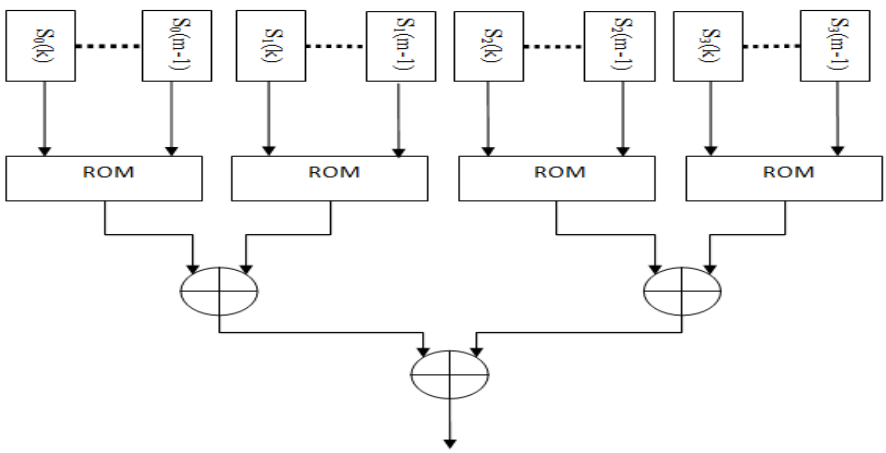


Fig. 5. Parallel DA architecture based K-Best LSD

4. Simulation and Implementation Result

The VHDL coding for PARALLEL K-BEST LSD for MIMO-OFDM is simulated and downloaded into Xilinx *xc3s200-4ft256*. The simulated results and comparison result were given below.

4.1. Simulation Result

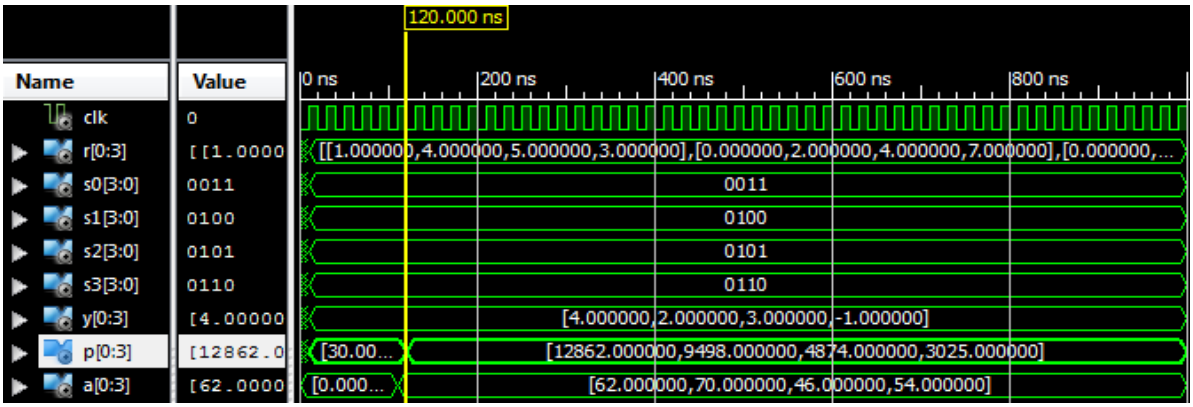


Fig.6. Simulation Result for K-best LSD using DA

For the K-best LSD using DA, taking ‘s’ as input signal vector, ‘y’ as received signal vector, ‘r’ as upper triangular matrix, ‘table_in’ as input to LUT, ‘table_out’ as output from LUT, ‘t’ as output from DA and output ‘p’ as Euclidean distance. In order to compare the simulation result with manual calculation, Inputs given to this algorithm are s = [3 4 5 6] ,y= [4 2 3 -1] and r = [{1 4 5 3 },{0 2 4 7},{0 0 8 1},{0 0 0 9}]. Final output is p = [12862 9498 4874 3025]. The time taken to complete the simulation is 120 ns. This result is same as that of result obtained from manual calculation of K-best LSD using DA algorithm.

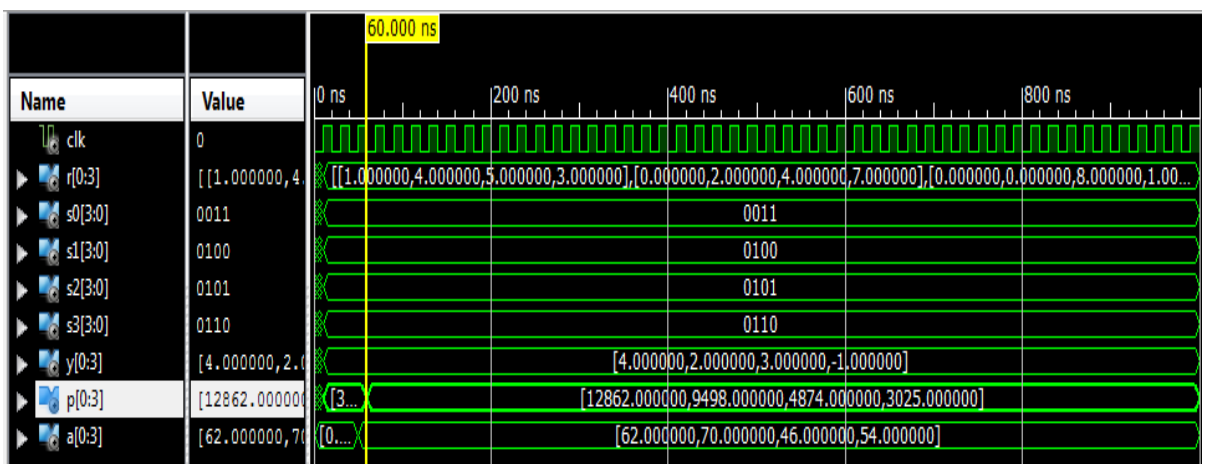
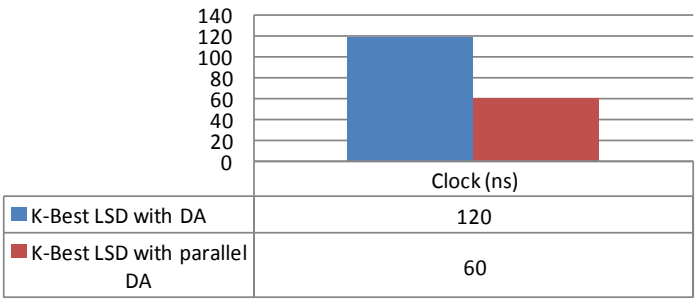


Fig.7. Simulation Result for Parallel K-Best LSD using DA

For the Parallel K-best LSD using DA, taking ‘s’ as input signal vector, ‘y’ as received signal vector, ‘r’ as upper triangular matrix, ‘table_in’ as input to LUT, ‘table_out’ as output from LUT, ‘t’ as output from DA and output ‘p’ as Euclidean distance. In order to compare the simulation result with manual calculation, Inputs given to this algorithm are s = [3 4 5 6] ,y= [4 2 3 -1] and r = [{1 4 5 3 },{0 2 4 7},{0 0 8 1},{0 0 0 9}]. Final output is

p = [12862 9498 4874 3025]. The time taken to complete the simulation is 60 ns. This result is same as that of result obtained from manual calculation of K-best LSD using DA algorithm.



Compared to the previous algorithm it takes only 60 ns to compute an output. This algorithm reduces the clock latency by 60 ns.

5. Conclusion and Future Work

The K-best LSD using parallel architecture of distributed arithmetic (DA) algorithm is simulated with the help of Xilinx ISE tools and also compared with the existing K-best LSD using distributed arithmetic. The simulated result shows that the clock cycle is reduced by 60 ns. Though it uses the parallel architecture, there is possibility of slight increase in hardware. It will be compensated because the proposed work is implemented on FPGA which is an LUT based device. In future, this work will be extended to implement FFT, K-best LSD and turbo decoding of 3GPP LTE receiver on FPGA.

Acknowledgment

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To

Zoya and Imran:
Happy 2nd Anniversary

Chapter 9
Potential Concerns and Common Benefits of Cloud-Based Enterprise Resource Planning (ERP)

S. Parthasarathy

Abstract Enterprise resource planning (ERP) is an industry-driven concept and system that is universally accepted by the industry as a practical solution to achieve integrated enterprise information systems. Enterprises are analyzing the use of cloud provision to carry out their business processes. The shift to the cloud-based business management technology has already started as it leverages the use of abstracted resources. This chapter strives to compare and contrast conventional ERP and cloud ERP systems with respect to three perspectives: organizational, business, and technological. In this chapter, the architecture of conventional ERP and cloud ERP are discussed as well as the business drivers and the deployment options during the implementation of cloud-based ERP system. A case study of a cloud ERP system is carried out, and the findings are presented for the benefit of the ERP implementation teams. The objective of the research study is to help the top management to determine the best deployment options for their organizations. This has been done by means of highlighting the potential benefits an enterprise can reap if they choose to stay with cloud ERP and the concerns they should address to minimize the risks leading to a low-cost and effortless implementation of a complete cloud-based ERP software solution.

Keywords Cloud • Enterprise resource planning • ERP • Software • Risks

9.1 Introduction to ERP and Cloud

Enterprise resource planning (ERP) is a generic term for integrated systems. ERP projects are a subclass of software projects often accompanied by large-scale organizational changes. ERP attempts to integrate all departments and functions across

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Poster Session (Day3, December 18, 09:25 - 10:10)

Green Space Factor In Modifying The Microclimates In A Neighbourhood: Theory And Guidelines

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ABSTRACT

Cities and rural environments differ substantially in their land surface temperature, which leads to urban heat island effect (UHI). Cities have a dynamic relationship with the microclimate. Landscaping is one of the most effective passive design strategy compared to other passive design strategies in mitigating the UHI effect. The degree of 'greenery' or 'greenness' (Green space factor) is usually defined and measured as the percentage of total urban area that is devoted to open green spaces. The higher the percentage of green cover, the greener that particular city becomes. National forest policy, India states that a 20% to 33% of green cover is considered to be fairly good. The green spaces help to alter the temperature, reduce the urban heat island effect and improve the air quality. In most cities, concentrated vegetation is seen only in parks or recreational spaces. This lowers temperatures on the microclimate of the park but does not have any effect on the microclimate of the neighbouring built environments. By placing vegetation within the built space of the urban fabric, the effect of UHI effect can be reduced where people live, work and spend most of their lives. Such approaches have been investigated in the fields of planning, urban design, landscape architecture, environmental engineering. Selection of right plant in the right place can be based on many aspects such as its thermal performance. It further depends on various plant typologies and their characteristics which will have significant role in urban heat balances by reducing the land surface temperature and reduce energy consumptions in the dense built up areas. It also helps to improve the microclimate performance in the built environment and also create a visually appealing environment compared to other passive techniques. This paper describes the importance of relationship between green space factor and microclimate and implementation of these guidelines in a neighbourhood with various case examples from research papers, literature and theories. The study has been carried out with on site observation and Envimet simulation methods.
Keywords: urban heat island, green space factor, green spaces, Envimet

1. INTRODUCTION

Climate, buildings, and green spaces have been explored worldwide by many researchers due to their interesting interrelationships and significant impacts to the environment. In recent years, urban heat island effects(UHI), induced by urban form, anthropogenic heat from buildings and Air conditioning systems have been studied extensively in cities around the world (1). Since the mid twentieth century, the global surface temperature has increased by 0.7±0.18°C during the 100 years ended in 2005. Thus the increased temperature is connected with increase in UHI through expansion of built up areas and populated area. The heat island during daytime increases rapidly and takes 3-5 hours to reach the

Performance Investigation of Dynamic Voltage Restorer using PI and Fuzzy Controller

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***Abstract*— This paper investigates the performance of Dynamic Voltage Restorer for compensating different voltage sag levels with various faults and to reduce the Total Harmonic Distortion during the mitigation process. The DVR is implemented with three phase voltage source inverter and is connected at the point of common coupling in order to regulate the load side voltage. The compensation is based on PI and Mamdani Fuzzy Controller. Extensive simulation studies under different magnitude of sag for faults on load side for balanced and unbalanced conditions are conducted using fault generator. Simulation result analysis reveals that DVR performs perfectly with PI and Fuzzy control approach. In addition, capability and performance of DVR for various energy storage capacities and injection transformer rating are also analyzed. The performance of these controllers are validated with simulation results using Matlab/Simulink .**

Keywords-*Dynamic Voltage Restorer (DVR), Fuzzy Logic Controller (FLC), Total Harmonic Distortion (THD), Voltage Sag*

I. INTRODUCTION

Power quality is most important to industrial and business sectors operating in a highly competitive environment. Voltage sag is the most significant type of power quality disturbance in the low power distribution system. Two important features that characterize the voltage sag are magnitude and duration of the voltage sag. Voltage Sag is a decrease of utility supply voltage magnitude between 0.1 and 0.9 p.u.(per unit) in RMS value at the power frequency for durations of 0.5 cycles to 1 minute. This classification is based on IEEE standard 1159-1995[1]. There are various methods to mitigate voltage sags but the use of a DVR is considered to be the most cost efficient and effective custom power device for the protection of sensitive loads in distribution systems. [2]. DVR is a series connected solid state device between the supply side and sensitive load through the injection transformer. It injects voltage deviation into the system to regulate the load voltage at any magnitude and phase angle. In [3], four varieties of DVR topologies are discussed with energy storage and without energy storage. There are different types of energy storage device are implemented in the DVR such as super magnetic coil, ultra capacitor, battery and flywheels. These types of energy storage are mainly required to supply active and reactive power to DVR. Many solution and problems using DVR are found in literature regarding non-linear controllers [4-7].

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II. MODEL OF THE DVR POWER CIRCUIT

Fig. 1 shows the Block diagram of the power circuit of DVR system which consists of the 3-arm IGBT based inverter and the battery as energy storage system. The source is 22KV fed from distribution substation. 22 KV is then reduced to 415 V by step down transformer before connecting to load. In this study, two types of load, Non Sensitive Load and Sensitive load are considered. The LC filter is introduced to eliminate switching ripples produced by the inverter. A fault generator is introduced intentionally to generate voltage sag at different levels by varying fault resistance value.

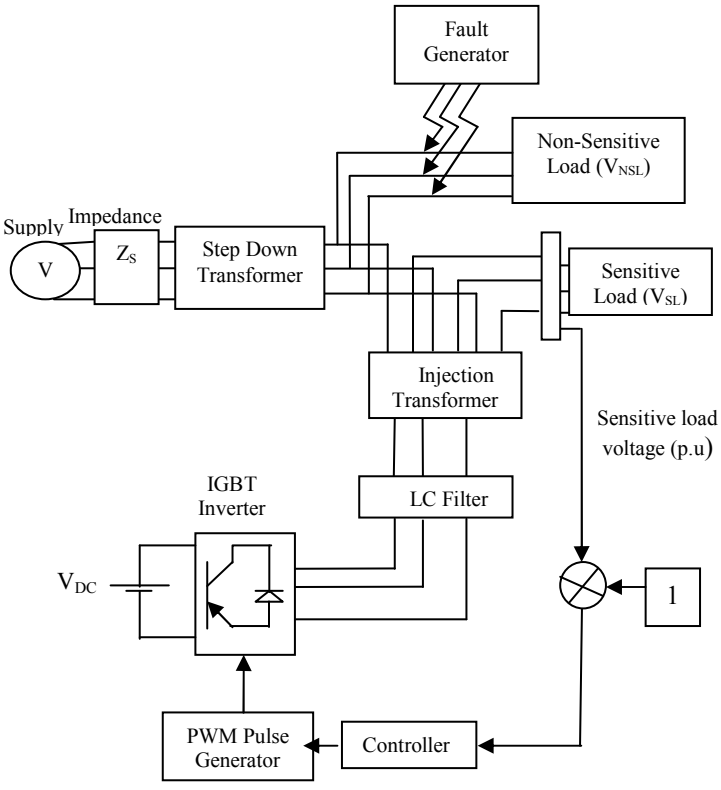

Fig.1 Block Diagram of DVR model

III. CONTROLLER DESIGN

In this work, two control strategies have been investigated which are Proportional Integral (PI) controller and Fuzzy Logic controller (FLC).

A. Conventional Proportional-Integral (PI) controller

The main goal of the controller is to maintain constant voltage magnitude at sensitive load during supply disturbances. This control method is based on comparing source and load voltage. The three phase voltage is transformed to dqo, using park transformation. After converting the voltage is constant with d-voltage is 1 in p.u and q-voltage is 0 in p.u under the normal and balanced condition but varies under abnormal condition. After comparison d-voltage and q-voltage with the desired voltage, the difference in voltage is enhanced by PI controller, after it go through dqo to abc transformation to convert into abc component which is the main signal to generate switching pulses of voltage source PWM inverter. The significant role of controller is to detect the voltage sag, inject voltage deviation and turn off inverter, when voltage sag event in the system is removed. Fig.2 represents the PI controller placed in feed back path [8].

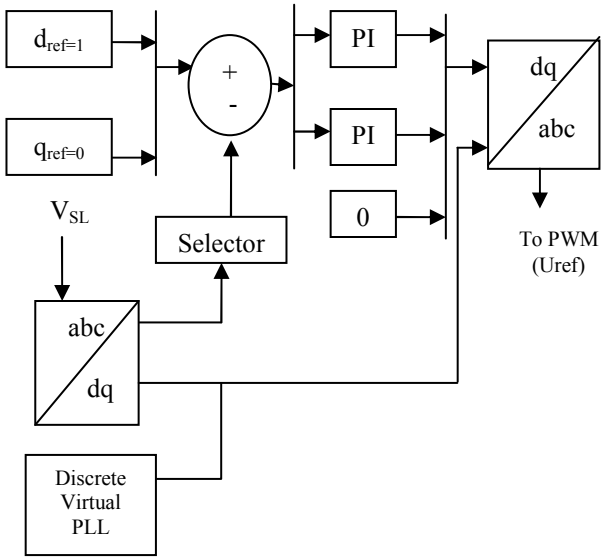

Fig.2 PI controller

The input of the controller come from the Sensitive load voltage, V_{SL} measured by three-phase V-I measurement at Sensitive Load in p.u. V_{SL} is then transformed in dq term. The voltage sag is detected by measuring the error between the dq-voltage and the reference values. Such error is processed by a PI controller. The d-reference is set to rated voltage as unity in p.u while q-reference is set to zero.

B.Fuzzy Logic controller (FLC)

FL controllers are a smart choice when exact mathematical formulations are tedious. The construction of the rules requires a detailed understanding of the system to be controlled. Fig.3. shows the FL controller which can be characterized as follows: 8 linguistic variables for Error, 2 linguistic variables for Derivative Error are two inputs and 13 linguistic variables for output. Triangular and trapezoidal membership functions for Error in terms of voltage, trapezoidal membership functions for Derivative Error in terms of voltage and triangular membership functions for output variables are considered. A rule base of 16 rules is selected to establish the fuzzy controller [9]. With the use of Mamdani's implication and with defuzzification by a centroid method, the FL controller provides the switching function to carry out best control action and each rule expresses an operating condition in the system.

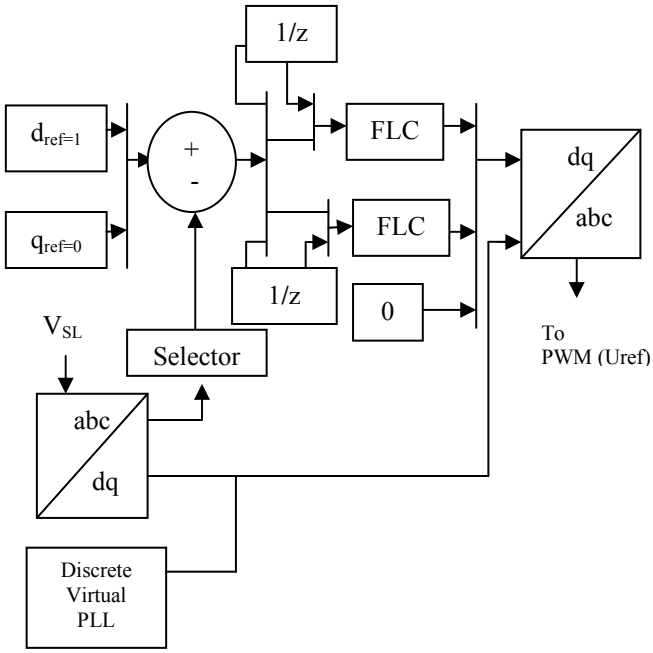

Fig.3 Fuzzy Logic Controller

In this paper, the error in terms of voltage(V_d) and the derivative of error in terms of voltage (ΔV_d) are considered as the inputs of the first FL controller and the the error in terms of voltage (V_q) and the derivative of error in terms of voltage (ΔV_q) as the inputs of the second FL controller. The reference voltages for the voltage regulator are the voltages V_{dref} and $V_{qref.}$ the FL controller consists of 8 linguistic variables from Error which is; Negative (N), Zero (Z), Very Small Positive (VSP), Small Medium Positive (SMP), Medium Positive (MP), Large Medium Positive (LMP), large Positive (LP), and Very large Positive (VLP). For derivative error, there are two linguistic variables, Negative (N) and Positive (P). The membership functions of the inputs are illustrated in Fig 4 and Fig 5.

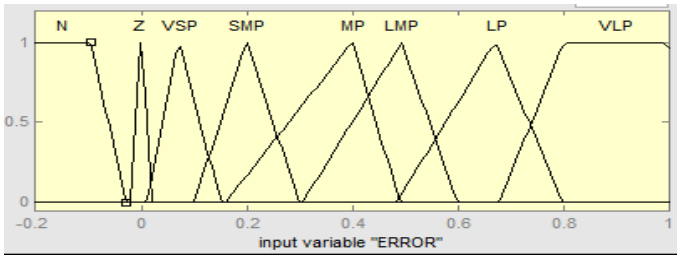

Fig.4 Membership Function of Error

In defuzzyfication process, there are 13 linguistic variables which are Negative (N), Zero (Z), Very Small Positive 1 (VSP1), Very Small Positive 2 (VSP2), Small Medium Positive (SMP1), Small Medium Positive 2 (SMP2), Medium Positive 1 (MP1), Medium Positive 2 (MP2), Large Positive (LP1), Large Positive 2 (LP2) , Very large Positive 1 (VLP1), Very large Positive 2 (VLP2) and Very large Positive3 (VLP3). Fig. 6. shows each parameter for output signal.

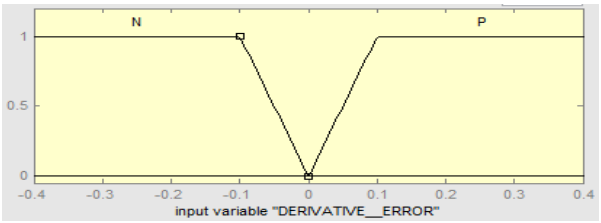

Fig.5 Membership Function of derivative error

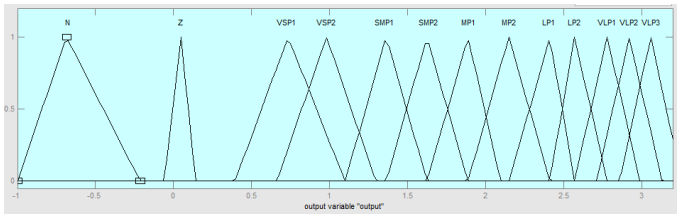

Fig.6 Membership Function of output

IV. RESULTS AND DISCUSSION

The comprehensive simulations are performed on the DVR test system using Matlab/Simulink. Due to page limitation simulink model is not presented. It is assumed that the magnitude of the load voltage is maintained at 1 p.u and the DVR is modeled to inject the voltage to the test system during phenomenon of voltage sag. System performance is analyzed for compensating voltage sag with various types of faults, various DC storage capacities and injection transformer rating. These test cases were conducted with PI and FL controller to determine how it deals with all types of faults and which controller gives superior performance. These various cases are discussed below.

A .Unbalanced Fault

In this case, the DVR against unbalanced voltage sag is applied. To simulate a voltage sag condition at non sensitive load, an unbalanced three phase to ground and double line to ground fault are created using fault generator. The simulation result of the DVR response in terms of the phase voltages for PI and FLC are shown in Table I. Fig. 7 shows the waveform of source voltage, injected voltage and load voltage for unbalanced three phase to ground for PI control and similarly Fig .8 shows waveform corresponding to FLC.

TABLE I. UNBALANCED FAULT

UNBALANCED THREE PHASE TO GROUND FAULT								
Before injection (p.u)			After injection (p.u) (FLC)			After injection (p.u) (PI)		
A	B	C	A	B	C	A	B	C
0.28	0.49	0.80	1.00	1.00	1.01	0.99	0.98	0.99
UNBALANCED DOUBLE LINE TO GROUND FAULT								
0.28	0.98	0.80	1.00	1.01	1.00	0.99	0.98	0.99

It is observed that during normal operation the DVR is in off state. It quickly injects necessary voltage components to compensate the load voltage upon detecting voltage sag.

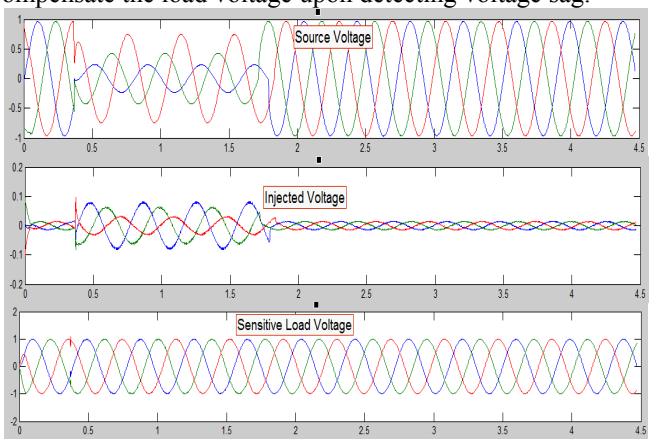

Fig.7 Unbalanced three-phase to ground fault (PI CONTROL)

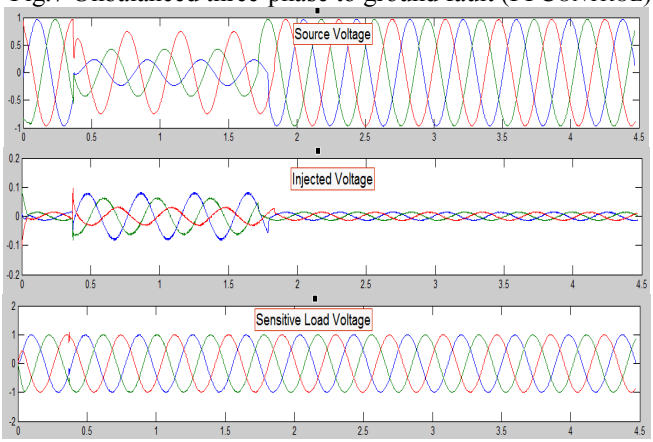

Fig.8 Unbalanced three-phase to ground fault (FLC)

B. Balanced Fault

In this case, the DVR against balanced voltage sag is applied. The performance of DVR is observed to be satisfactory for both controllers. Various types of fault is created at non sensitive load using fault generator to produce sag which are three phase fault, single-line-to-ground fault, double-line-to-ground fault, three phase to ground fault and line to line fault. There are different levels of voltage generated to sensitive load for every fault (0.4 to 1.8 seconds duration) which are 25%, 50%, 75% and 90% and nearly 100% of voltage sags .The sensitive load voltage V_{SL} is maintained at the desirable level with the compensation of DVR and re-establishes to the pre-sag status. The sudden voltage sag and harmonics are compensated and the power quality is improved by DVR. Several types of fault have been simulated and the result can be seen in Table II. The Table shows that DVR can compensate the various levels of voltage sag before mitigation and after mitigation by using PI and FL controllers.

Most common faults are single line to ground fault (SLGF). In this case, the SLGF occurs on phase C of supply voltage resulting in 50% decrease from nominal value between the period 0.4 sec and 1.8 sec. Fig. 9 shows the supply voltage, sensitive load voltage, injected voltage(low-voltage side of the transformer) for PI control and similarly Fig .10 shows waveform corresponding to FLC. Fig.11 and Fig.12 shows the waveform corresponding to balanced three phase fault for both the controllers. Initially there is no voltage injection and power flow from DVR to the system because no voltage sag is sensed. As soon as the sag starts, DVR compensates the dip in voltage so that the voltage sag does not affect the sensitive load.

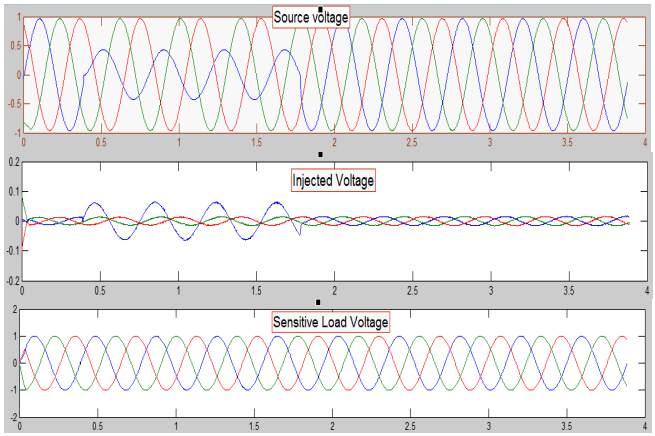

Fig.9 Single-line-to-ground fault with 50% sag (PI Control)

TABLE II. PERFORMANCE OF PI AND FLC FOR LOAD SIDE FAULT

Sag %	Before injection (p.u)			After injection (p.u) (FLC)			After injection (p.u) (PI)		
	A	B	C	A	B	C	A	B	C
SINGLE LINE TO GROUND FAULT									
25	0.96	0.96	0.74	1.00	1.00	1.00	0.99	0.99	0.99
50	0.96	0.965	0.511	1.00	1.00	1.00	0.99	0.99	0.99
75	0.96	0.96	0.26	1.00	1.00	1.00	0.99	0.99	0.99
90	0.96	0.96	0.105	1.00	1.00	1.00	0.99	1.00	1.00
nearly 100	0.96	0.96	0.02	1.00	0.99	1.00	0.99	1.00	1.00
DOUBLE LINE TO GROUND FAULT									
25	0.74	0.96	0.74	1.00	1.00	1.00	0.99	0.98	0.99
50	0.50	0.96	0.51	1.00	1.00	1.01	1.00	0.99	1.00
75	0.26	0.96	0.26	1.00	1.00	1.01	1.00	0.99	1.00
90	0.10	0.96	0.10	1.00	1.00	1.00	1.00	1.00	1.00
nearly 100	0.09	0.96	0.01	1.01	1.00	1.01	1.00	0.99	1.01
THREE PHASE TO GROUND FAULT									
25	0.74	0.74	0.74	1.00	1.00	1.00	0.99	1.00	0.99
50	0.50	0.50	0.50	1.01	1.01	1.01	1.00	1.00	1.00
75	0.25	0.25	0.25	1.01	1.01	1.00	1.00	1.01	1.00
90	0.09	0.09	0.09	1.01	1.01	1.01	1.00	1.00	1.00
nearly 100	0.01	0.01	0.01	1.01	1.01	1.01	1.00	1.00	1.00
LINE TO LINE FAULT									
25	0.75	0.98	0.88	1.00	1.00	1.00	0.99	0.99	0.99
50	0.54	0.98	0.73	1.00	1.00	1.00	1.00	0.99	1.00
75	0.27	0.97	0.28	1.00	1.00	1.01	0.99	0.99	1.00
90	0.12	0.98	0.15	1.00	1.00	1.00	0.99	0.99	1.00
nearly 100	0.03	0.96	0.01	1.01	1.00	1.01	1.00	0.98	1.01
THREE PHASE FAULT									
25	0.75	0.76	0.75	1.00	1.00	1.00	1.00	0.99	0.99
50	0.48	0.48	0.49	1.00	1.00	1.01	1.00	1.00	1.00
75	0.25	0.25	0.25	1.00	0.99	1.00	1.00	1.00	1.00
90	0.10	0.11	0.11	1.00	1.00	1.00	0.99	1.00	1.00
nearly 100	0.01	0.01	0.01	1.01	1.01	1.01	1.00	1.00	1.00

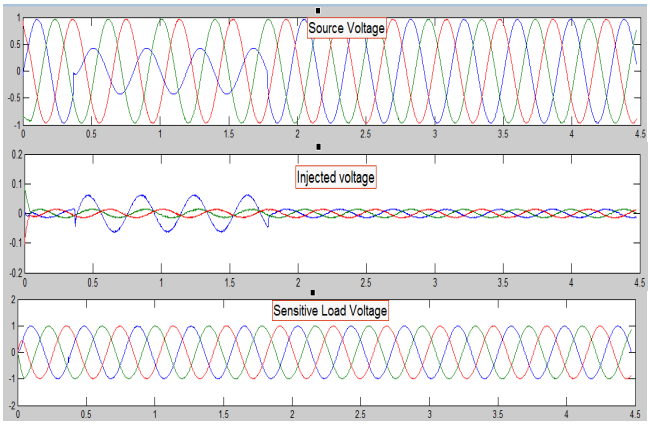

Fig.10 Single-line-to-ground fault with 50% sag (FLC)

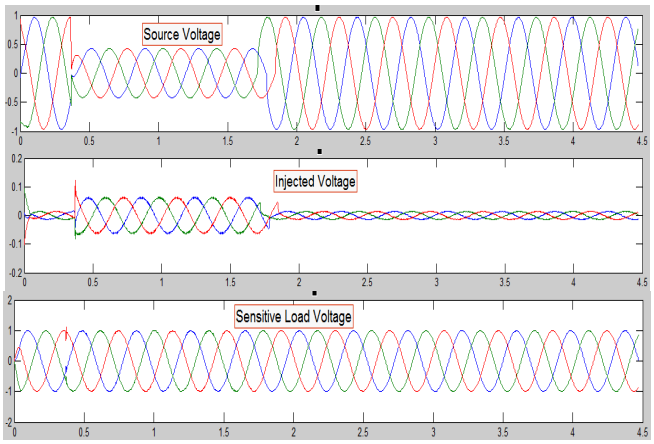

Fig.11 Balanced three-phase fault with 50% sag (PI CONTROL)

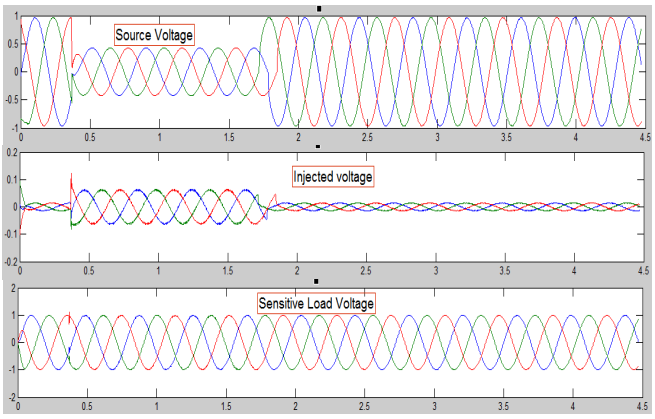

Fig.12 Balanced three-phase fault with 50% sag (FLC)

PI Controller generates higher total harmonic distortion (THD), 0.59% as compared to FL Controller, 0.48%. It can be seen that both controllers gave an optimum performance and have the ability to improve the source voltage back to 1 p.u before deliver it to the load in balanced and unbalanced fault condition. Fig.13 and Fig.14. Shows even for worst case, balanced three phase fault with nearly 100% of voltage sag, DVR controlled by PI and FL controller can work successfully.

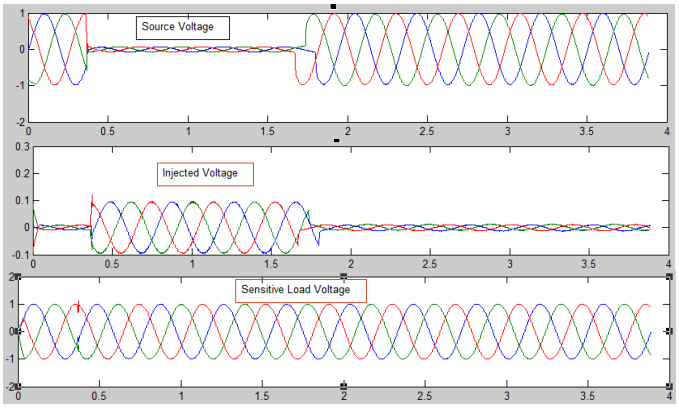

Fig.13 Three Phase fault with nearly 100% sag (PI)

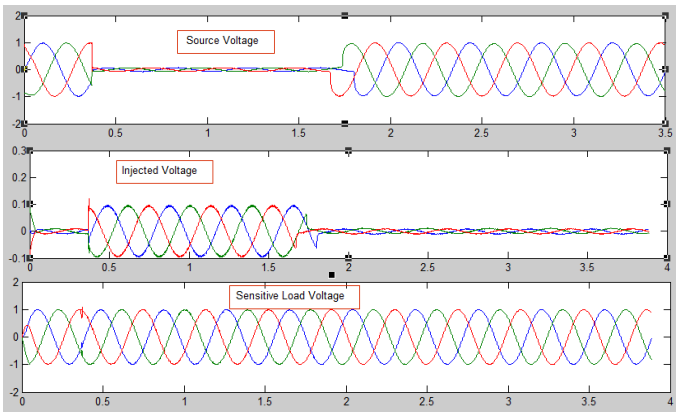

Fig.14 Three Phase fault with nearly 100% sag (FLC)

C. Compensation capability of DC storage

Initially a constant value of DC source voltage is fixed and the changes in load rms voltage due to voltage sag changes are recorded. Then it is repeated for a number of other dc voltage values. The results simulated are summarized in Table III. The first column shows that the variation of DC source. The second column records the values of sensitive load voltage before compensation. The third and fourth column indicates the values of sensitive load voltage after compensation for both FLC and PI according to the DC source variation. And it is clearly show that 200 V_{dc} is the suitable voltage that capable to compensate voltage drop of 0.55 p.u, below which the mitigation process be deficient in accuracy.

TABLE III.OVER ALL DC STORAGE PERFORMANCE

Energy Storage (V_{dc})	V_{SL} Before Mitigation (p.u)	V_{SL} After Mitigation (p.u)	
		FLC	PI
200	**0.459**	**1.014**	**1.007**
150	04573	0.9873	0.9702
100	0.4613	0.7605	0.7284

D Quality Performance of Transformer Ratings

Total Harmonic Distortion (THD) is an important index to reveal the harmonic components included in the voltage. Table IV shows the THD analysis of DVR with different injection transformer ratings. Using the Fast Fourier Transform (FFT) analysis to analyze the Total harmonic distortion (THD) for the voltage signal .On considering 3.5KVA for analysis, before mitigation the THD is 11.89%, whereas after mitigation, the THD made to 0.42 for FLC and 0.46 for PI controller. It shows that increase in KVA rating reduce the THD level.

TABLE IV EFFECTS OF THD WITH DIFFERENT KVA RATING OF INJECTION TRANSFORMER

KVA	THD Before Mitigation (%)	THD After Mitigation (%)	
		FLC	PI
1.5	11.89	0.48	0.59
2.5	11.89	0.43	0.50
3.5	**11.89**	**0.42**	**0.46**

V CONCLUSION

The DVR handles both balanced and unbalanced conditions effectively and injects the deviated voltage component under supply disturbances to keep the load voltage balanced and constant at the nominal value. Thus the proposed DVR has the ability to mitigate various levels of voltage sag and different types of faults. Simulation results in MATLAB/SIMULINK prove that the control scheme provides an accurate tracking of the voltage reference and a very fast transient response. Both the controllers exhibits good performance and minimize the THD level. It is found that FLC gives better performance with THD of 0.42% where as PI gives 0.46% THD. The increase in KVA rating of injection transformer and DC storage value effectively compensates the voltage sag and reduce the THD level.However, higher value of DC storage and transformer rating makes it more expensive. The efficacy of a DVR system mainly depends upon the rating of DC storage capacity, injection transformer rating and the load. From the simulation, it clearly shows the importance of these factors and how it affects the performance of DVR is analyzed.

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