

Lecture Notes in Networks and Systems 241

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A TSV Constrained Algorithm for Designing Balanced Wrapper Chains in 3D SoC



Sabyasachee Banerjee , Soumendu Ghorui, and Subhashis Majumder 

Abstract Three-dimensional integrated circuit (3D-IC) has emerged as a saviour of failing Moore's law, where the reduced length of interconnects is guaranteed with some added advantages like heterogeneous integration, higher computation per volume, etc. These benefits are also exhibited in 3D SoCs (3D System on Chips) to use the already built cores. However, testing these large complex SoCs in lesser time has become a challenge. In this paper, we propose a simulated annealing based wrapper chain design algorithm that will balance the length of the wrapper chain. The number of TSVs (Through Silicon Vias) are also kept as a constraint so that the number of TSVs could also be reduced. Rigorous experiments were being conducted on several ITC'02 SoC benchmarks and the results when compared with a recent work showed that our proposed approach recorded better test lengths in more than 90% cases with an average reduction of 9.65% in test length. Our algorithms also used less number of TSVs in approximately 85% of the cases with an average reduction of 17.94% in number of TSVs, in comparable CPU time.

Keywords 3D SoC · Wrapper design · TAM · TSV · Entropy

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Advances in Oil-Water Separation

**A Complete Guide for Physical,
Chemical, and Biochemical Processes**

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An overview of oil pollution and oil-spilling incidents

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1.1 Introduction

The risk of accidental oil spill is associated with the transportation of crude petroleum or petroleum derived oil from production sources to consumption locations. Spilled oil causes severe damage to terrestrial as well as marine ecosystems and also loss to human society. Though the occurrences of major oil spills are occasional, these lead to obvious environmental damage and hence receive considerable public attention.

The most significant variables those affect the dispersal and residence time of the contaminants following oil spillage in marine environment are the prevailing hydrodynamic conditions and location of spillage. The wave exposure and prevailing tides and currents during spillage affect the dispersal of oil spilt. With increasing wave exposure, the availability of mechanical mixing energy required for natural dispersal of oil increases. Increased wave exposure also increases the effectiveness of chemical dispersants (Carls et al., 2001; Owens, Robson, & Foget, 1987).

Lecture Notes in Mechanical Engineering

D. Maity · P. K. Patra · M. S. Afzal ·
R. Ghoshal · C. S. Mistry · P. Jana ·
D. K. Maiti *Editors*

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First Ply Failure Behaviour of Corner Point Supported Laminated Composite Skew Plate



Dona Chatterjee , Arghya Ghosh, and Dipankar Chakravorty

1 Introduction

Till the year 1960, almost all papers related to material research were about isotropic materials. It was during the year 1961; the first paper on orthotropic material was published. Then onwards, researchers started and continued exploring the behaviour of layered materials over 50–55 years. Turvey [1] investigated and reported the initial failure load and centre deflection of a symmetric cross ply simply supported rectangular plate under flexure. In this investigation, both glass and carbon fibre-reinforced plastic materials were used. Kam et al. [2] predicted the linear and nonlinear first ply failure loads of partially clamped centrally loaded rectangular laminated composite plate. It was stated that the finite element model for forecasting initial ply and ultimate ply failure strengths had been successfully experimentally validated. First ply failure loads of stiffened rectangular plates with I, hat and blade-shaped stiffeners were investigated for uniformly distributed and sinusoidal loadings by Sathish Kumar and Srivastava [3]. Kumar and Chakrabarty [4] studied the first ply failure of angle ply and cross ply clamped and simply supported laminated composite plates for the first time with skew configuration.

A review of the literature shows a good volume of publications on first ply failure (FPF) analysis of laminated composite rectangular plates but only one such paper [4] contains information about skew plates. The authors' aims to expedite the FPF behaviour of a corner point supported laminated composite skew plate under transverse distributed pressure.

Roofs of car parking plaza, aircraft hangers, theatres, halls, etc. have functional requirements of a large column and beam free open spaces. This necessitates that roof cladding structural elements to be corner point supported on columns. As a result, the focus of this article is on FPF behaviour study of corner point supported skew

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Dielectrically modulated source side cavited SOI FET-Based Bio-sensor

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Abstract— In this paper, we have designed and analyzed the application of fully depleted SOI MOSFET as bio-sensor by developing a source sided cavity below the gate electrode. Device design and simulation is done using Silvaco TCAD simulator. The performance analyses of the proposed biosensor is studied using threshold voltage sensitivity and ON state drain current sensitivity for cavity length of 40nm, 50nm, 60nm, 70nm. Considering the threshold voltage as sensing parameter, 50nm cavity length is observed to exhibits better sensitivity compared to others. While considering the ON state drain current as the sensing parameters, 70nm cavity length showed higher sensitivity. Further the sensitivity of the proposed bio-sensor is studied for different fill factor (50%, 75% and 100%), as expected the sensitivity for fully filled cavited device exhibited higher sensitivity.

Keywords—SOI-MOSFET, Bio-Sensor, dielectrically modulated cavity, Threshold voltage sensitivity, Drain current sensitivity, bio-molecule.

I. INTRODUCTION

The present scenario of advancement is seeking the pacing of bio-medical diagnosis with fast growing digital technology. In this concern, research for development of fast and cheap bio-sensor with high sensitivity and reliability are utmost importance. FET based biosensor was first proposed by Bergveld, which he termed as ion sensitive field effect transistor (ISFET) as the gate metal electrode was ion-sensitive film with a reference electrode and an electrolyte solution and recorded the pH of the sample [1]. Currently researchers are more drawn towards the transistor-based biosensor and two types of bio-sensors seems more feasible which labeled Bio-sensor and label free biosensor. Considering the key features of any FET such as high I_{ON} to I_{OFF} ratio, lower threshold voltage, scalability and lower sub-threshold swing lower power consumption initially and then considering the device structure with higher surface area to volume they are chosen for designing of bio-sensor FET. Considering the abovementioned characteristics, there is wide range of transistors such as Vertical TFET, diagonal TFET, dielectrically modulated TFET, dielectrically modulated multi-gated MOSFET, dielectrically modulated JLTFET, HEMT, FinFET, NCFET etc. [2][3][4][5][6] and many more. Considering the high performance of Silicon-

On-Insulator (SOI) MOSFET such as higher I_{ON} to I_{OFF} and higher gate controllability [7], it is favorable to be used for designing of dielectrically modulated sensor.

In this paper, fully depleted SOI MOSFET with Source-sided cavity based dielectrically modulated Bio-sensor is designed and its sensitivity is studied.

II. DEVICE DESIGN AND STRUCTURE

The device architecture of SC-SOI MOSFET based biosensor is shown in Fig.1 The gate length of the proposed SOI MOSFET device is 100nm. For the insertion of bio-molecules, a nanogap cavity of 4nm thickness is formed at the gate region by itching the SiO_2 layer adjacent to the source end. The length of the cavity is varied in the study to obtain better sensitivity. A thin SiO_2 layer is given below the cavity region of 1nm adjacent to the channel region which works as an adhesive layer for the biomolecule. The work function of the gate material is taken as 4.6 eV in this work. The source and the drain doping concentration are chosen as 10^{20} cm^{-3} . The doping concentration of the channel is taken 10^{18} cm^{-3} in this work.

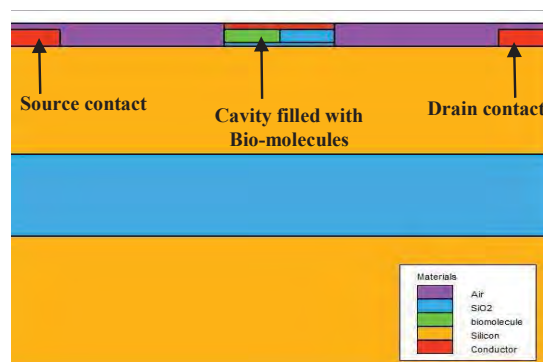


Fig. 1: Device structure of SOI MOSFET based Bio-sensor having Source sided Cavity.

III. SIMULATION AND METHODOLOGY

The Silvaco TCAD simulator [8] was utilized in this study for simulation purposes. FLDMOB model for field-dependent mobility, Shockley–Read–Hall (SRH) model with AUGER

Dielectrically Modulated both-side caviated SOI-MOSFET based Bio-sensor highly sensitive for glucose oxidase

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Abstract— We propose an SOI-MOSFET-based bio-sensor with cavities on both sides, i.e., source and drain, in this paper. The sensitivity of a bio-sensor is evaluated by looking at the change in threshold voltage and drain current that occurs when bio-molecules are introduced. The cavities etched under the gate oxide are of one symmetrical and two asymmetrical types. The asymmetrical topology having 50nm source side and 20nm drain side cavity exhibits higher threshold voltage and drain current sensitivity for glucose oxidase. Glucose oxidase is an enzyme which is synthesized by interaction of species like fungi and micro insects. It helps in detection of glucose and could also be used for detection of diabetes and Alzheimer disease. The sensitivity of this device is also tested for different filled factors such 50%, 75% and 100% and it is observed the sensitivity for fill factor below 100% is very low. The device design and simulation results for different variations are obtained by using Silvaco TCAD simulator.

Keywords—Bio-sensor, bio-molecules, SOI-MOSFET, glucose oxidase, dielectrically modulated cavity, threshold voltage sensitivity, drain current sensitivity.

I. INTRODUCTION

Bio-sensor is the electronic devices which could detect or sense the presence of bio-molecules /bio-chemical. The principle of detection of biomolecules or bio-chemical by bio-sensor are of various type and the physicists and engineers are more drawn towards the transistor-based biosensor and in these two types of bio-sensors are seems more feasible which labeled Bio-sensor and label free biosensor. Dielectrically modulated FET based biosensors are where gate oxide layer is etched to form nanogaps also called as cavities or pockets, these nanogaps are filled with bio-molecules to be detected. Due to short channel effects (SCE), conventional MOSFET are not preferred for development of biosensor. However, various new FET design such TFET, JLTFET, DGMOSFET, DGTFTFET,

HTFET, gate recessed channel MOSFET [1],[2],[3],[4],[5],[6],[7] are studied and which shows better performance compared to conventional MOSFET and have lower SCE with higher I_{on}/I_{off} ratio. Similarly, Silicon-On-Insulator MOSFET has admirable performance such as higher I_{on}/I_{off} ratio, lower gate leakage current and lower DIBL.

In this paper, considering the fringing effect due to cavity under gate electrode, we created symmetrical and asymmetrical cavities on both sides to investigate their sensitivity to biomolecules such as silica-binding proteins/avian influenza ($k=1.9$), 3-aminopropyltriethoxysilan ($k=3.57$), streptavidin ($k=2.1$), cholesterol oxidase ($k=3.28$), and glucose oxidase ($k=3.64$). Silvaco TCAD Atlas was used to design and simulate the proposed device.

Among the all detectable, Glucose oxidase is an enzyme which is synthesized by pathogens like fungus and micro insects whose detection with higher sensitivity could be used for detection of diabetes and Alzheimer disease [8]

II. DESIGNING OF DEVICE STRUCTURE

Figure 1 depicts the device architecture of a BSC-SOI MOSFET-based biosensor. The suggested SOI MOSFET device has a gate length of 100nm. For the insertion of biomolecule, two nanogap cavities of 4nm thickness are formed at the gate region by etching the SiO_2 layer adjacent to the source and drain end. The lengths of the two cavities are varied in the study to obtain the better sensitivity. In the cavity areas of 1nm adjacent to the channel region, a thin SiO_2 layer is applied as an adhesive layer for the biomolecule. In the work, the work function of the gate material is taken to be 4.6eV. 10^{20} cm^{-3} is used as the source and drain doping concentrations. In this study, the doping concentration of the channel is taken to be 10^{18} cm^{-3} .

Metaheuristic-based tuning and analysis of different algorithms of Fractional-order integral Differential (FOPID) controller for non-integer Order systems

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Abstract—This paper consists of meta-heuristic-based tuning methods of Fractional order proportional integral differentiation (F.O.PID) controller for a non-integer-order system has been discussed and analyzed. The main objective is to get a solution a set of non-linear equations carrying inequalities unlike that of an integer-order proportional integral differential (I.O.PID) controller which only contains fewer parameters that need to be tuned. The main contents consist of designing, simulation, and the Model reduction of FOPID controllers for a non-integer-order system. Following the proposed schemes, the Fractional-order Proportion integral (F.O.PI) controller and F.O.PID controller perform effectively. Moreover, the design of FOPID using meta-heuristic algorithms clearly defeats the FOPI controller. To verify this fact and validate the proposed tuning schemes, simulation results are shown.

Fractional-order system, robustness, Fractional order Proportional Integral Differentiation Controller, Meta-heuristic, model-based-reduction, filter approximation, Particle Swarm Optimization, Differential Evolution, Genetic Algorithm, Artificial Bee Colony Optimization, Teaching Learning Based Optimization.

I. INTRODUCTION

With the evolution of Control Systems and its implementations, there is a massive development in the modern control technique. New control theories have emerged too; to obtain optimized output, while considering both precision, feasibility, and cost. Even though unified feedback control, predictive approach control, fuzzy logic control, neural network strategy control, etc. have been proved to be successful and effective control techniques, but most used control technique in many industrial applications is PID control; for its robustness and simple structure. In general notion, the Fractional-order methods, show up integral order structure in frequency domain analysis, and its tuning, therefore, is referred to as Tuning of Integral Order

PID Controller (I.O.PID Controller). But recently, there is an emergence of Fractional order calculus. Among researchers, it has been able to develop huge attention. The use of Fractional-order controllers has the ability to not only improve control performance but also system robustness and other important parameters as well. Fractional Calculus has become a topic of research interest in the control domain area [16] [13] [21] [19]. They have well proven their worth both for non-integer order and integer-order systems [34] [29] [35]. In the paper here, a FOP.I.D controller is designed and tuned using different meta-heuristic algorithms to improve performance characteristics along with the fact that it is going to make sure the robustness of a Fractional-order system that can be modeled as many real systems related to bioengineering [14].

II. FRACTIONAL ORDER CALCULUS

A. Definition of Fractional Order Calculus

Nowadays, Fractional-ordered calculus has gained so much popularity in the domain of control systems. We go back in time and see the definitions first.

The Differintegral operator, represented by aD_t^r , is a combination of integration and derivative operator which is mainly used in the fractional calculus. This operator denotes a notation considering the fractional order derivative along with the fractional order integral in one single equation which is defined by [32]

$$aD_t^j f(t) = \begin{cases} \frac{d^j}{dt^j} R(j) > 0 \\ 1 & R(j) = 0 \\ \int_a^t (d_j)^{-j} R(j) < 0 \end{cases} \quad (1)$$

A Model for Optimal Assignment of Non-Uniquely Mapped NGS Reads in DNA Regions of Duplications or Deletions

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Cite This

PDF

Rituparna Sinha ; Rajat K. Pal ; Rajat K. De [All Authors](#)

13
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Abstract

Document Sections

- I. Introduction
- II. Methodology
- III. Result
- IV. Conclusion

Abstract:

Massively parallel sequencers have enabled genome sequences to be available at a very low cost and price, which opened huge scope on analyzing human genome sequences from different perspectives, thereby the association of diseases with genetic alterations gets further enlightened. However, the sequencing process and alignment of NGS technology based short reads suffer from various sequencing biases which needs to be addressed. In this work, the mappability bias occurring with respect to repeat rich regions of the DNA have been addressed in a novel approach. A model has been designed which considers all non-uniquely mapped reads and performs a pipeline of computations to allocate the reads to an optimal location, due to which the precise detection of breakpoints in the region of duplications and deletions are obtained. In addition, the application of this model for mappability bias correction, prior to the detection of structurally altered regions of

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Patient Adaptive Heart Beat Classification System Using Kernel Based Feature Extraction Method

Santanu Ghorai, Pradip Saha, Udit Dev Roy, Diptarup Mukherjee, Akash Mondal and Aniket Bhaumik

Abstract—*Arrhythmia is the most fatal for human being among all cardiovascular diseases. Early detection of arrhythmia beats, from long term ECG record, is helpful to start treatment and saving life of patients. In this work, we presented a patient- adaptive scheme to discriminate normal and three classes of arrhythmia beats from ECG signal. Instead of conventional features, the proposed method uses a kernel based modeling technique of the ECG beats and the model coefficients are used as the features to characterize different types of beats. In this semi automatic scheme, a global training set is combined with a local learning set to form a patient adaptive training set to develop a patient specific classifier*

model. The results are validated on MIT-BIH arrhythmia database and the performance of the proposed technique is validated by three classifiers namely, support vector machine (SVM), vector valued regularized kernel function approximation (VVRKFA) technique and k-nearest neighbour (KNN) classifiers. Experimental results indicate that the proposed patient adaptive classification scheme increases the global accuracy by 12 to 16% than that of the accuracy obtained without using patient specific beats to global training set. The highest average accuracy obtained using this method is 96.63%, which is comparable and even better than most of the works available in the literature.

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CHAPTER 7

Sustainable membranes with FNMs for biomedical applications

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7.1 Introduction

Membrane science and technology has been one of the most coveted technologies for several decades, which has proven easy to implement in different application areas like air purification, water treatment, pharmaceutical manufacturing, food processing, biomedical applications, etc. Eco-friendliness and energy efficiency are the two major factors for which membrane technology has drawn attention from worldwide researchers. Nowadays, biomedical applications are one of the important areas, where membrane science has been introduced with enough opportunity in the development of advanced healthcare systems. An example is hemodialysis that involves the purification of blood at the time of erroneous kidney functioning [1]. However, one of the complexities in making the dialysis process less efficient is the fouling of the membrane, which results in a deviation in the permeation rate from the normal glomerular filtration rate (GFR). Secondly, biofilm growth over the membrane might pose an additional issue to the application of membrane technology in hemodialysis and several other biomedical applications. Nowadays, such issues have been resolved through fabricating the membrane after casting polymer mixed with other materials such as nanoparticles on the support. Such a mixed system helps to modulate the membrane property in several ways with a solution to the key issues related to the membrane; for example, in case with the silver-lined membrane, where silver is doped with the basic polymer in order to inhibit the growth of the biofilm over the membrane and also to increase the hydrophilicity of the membrane. Among several such technologies associated with the mixed matrix, doping of functionalized nanomaterials is one of the emerging techniques, where the property of the nanomaterials is also being modulated according to the applications. Nanosized materials

Detection and Mitigation of Blackhole Attack Effect in Opportunistic Networks

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Abstract - Blackhole attack is one of the major security concerns in mobile ad-hoc networks that are hard to detect. In this type of attack, the malicious node attracts message packets by advertising itself as a cooperating node but eventually drops them, thus heavily degrading the network performance. This attack becomes a more serious threat in Opportunistic Networks due to the absence of any predefined path of trustworthy nodes between source and destination. In this paper, we have proposed a technique to identify the potential Blackhole nodes present in the network. With the knowledge of such a list and minor modification of the traditional Spray-and-Wait Routing protocol, we were able to mitigate the effect of Blackhole attack on the network performance. Simulation results show improvement in the network performance in terms of delivery ratio and the number of dropped messages, even in the presence of Blackhole nodes. It has also been observed that traditional routing protocols like Epidemic, Prophet and Spray-and-Wait routing, perform better if the paths containing the suspected nodes detected by our proposed method are avoided.

Index Terms - Opportunistic Networks, Trust, Black Hole attack., Trust-based protocols, Security.

I. INTRODUCTION

Due to the absence of any predefined infrastructure, mobile ad hoc networks or MANETs suffer from different security issues. One of the most common and significant issues is the Blackhole attack. In this type of attack, one or more malicious node(s) uses the existing routing protocol to claim itself as the shortest hop to the destination and tries to route the packets towards it [1]. Once it receives the packets, they are either dropped or consumed, thus preventing them from reaching the destination and hence significantly compromising the network efficiency.

Opportunistic Networks or OppNets are a type of MANET in which there are no predefined paths between the source and the destination nodes. The mobile nodes carry the messages and wait for the opportunities to forward them to the next hops when they come in close proximity, i.e., they follow the store, carry and forward paradigm [2]. Though OppNets have significant utility in areas where connectivity is intermittent and delivery delays are tolerable, ensuring the reliability and trustworthiness of the intermediate nodes in routing the packets to the final destination remains a challenge. Just like MANETs, OppNets are also vulnerable to Blackhole attacks. The blackhole nodes may act as reliable intermediate nodes and lead to loss of packets.

Due to the inherent properties of OppNets, reliable routing is a challenge. It is difficult to predict when a node will get the opportunity to forward its packet to the next reliable node. Also, as the OppNets are highly dynamic in nature, it is not possible for the nodes to know the network topology beforehand [3]. Even if a relevant routing protocol is being used, guaranteeing the reliability of the intermediate nodes is not easy, thus making it difficult to differentiate a malicious blackhole node from an honest node. In addition, OppNets are delay-tolerant and hence TTLs often expire, leading to packet drops. Also, some packets may get dropped due to buffer overflow. So, it is important to determine whether the packet drops are due to blackhole attack or some other non-malicious reasons. Thus, it is evident that it is a tough task to identify malicious nodes in OppNets and the methodologies applicable to MANETs may not always be suitable for OppNets.

In this paper, we have proposed a technique to deal with Blackhole attacks. Our proposed method attempts to detect the set of potential blackhole nodes in the network and then tries to avoid those paths that contain these marked nodes. Our method is applied with three standard routing protocols – Spray-and-Wait [4], Epidemic [5], and Prophet [6] routing algorithms. Simulation results show that avoiding these potential adversary nodes indeed improves the network performance, thus helping in mitigating the effect of blackhole attack on the network.

The rest of the paper has been organized as follows: Section 2 describes some related works in this area. In Section 3, our proposed method is explained in detail. Section 4 contains the simulation results and analysis and finally, section 5 concludes our work.

II. RELATED WORKS

As discussed above, Opportunistic networks suffer from a number of security issues. To ensure a secure transmission, the reliability of the intermediate nodes is required, i.e., they must cooperate to forward the packets towards the destination. This magnitude of cooperation is measured in terms of the ‘trustworthiness’ of the node. The more the trust value of a node, the more reliable it is in forwarding a packet honestly. There have been some trust-based security protocols proposed for MANETS and OppNets.

Comparative Analysis of Multi-objective Algorithms for Imbalanced Biomedical Data Classification with Tuned Classifier

Publisher: IEEE

Cite This

PDF

Prativa Agarwalla ; Sumitra Mukhopadhyay All Authors



Abstract

Abstract:

Classification of cancer with microarray data is a challenging task because of the high dimensionality and imbalanced characteristics of the dataset. Selection of few contributing relevant feature genes and classification of biomedical data with an optimally tuned classifier enhances the accuracy of disease detection. Generally, choice of parameters of the classifier is done by trial method and a value is kept fixed for the classification. But in this study during the search process, the best parameters of the classifier are adapted. Five well established and robust algorithms in the multi-objective domain are chosen for the feature selection and for the tuning of parameters of the support vector machine (SVM). We have performed experiments on 12 microarray datasets (both binary class and multi-class). Not only the effect of classifier tuning is studied but also a thorough comparison is performed amongst different multi-objective algorithms. The comparative study can be helpful to make an informed choice for selection of an appropriate algorithm in the field of multi-objective feature selection. The experiments show that MODE provides promising results for highly imbalance data having higher number of classes. For binary and multiclass data with imbalance ratio within the range of 2-5, NSGA-II is performing better. For the dataset having low imbalance ratio, the performance of the multi-objective algorithms are quite competitive.

Document Sections

I. Introduction

II. Background

III. Methodology

IV. Experimental Results

V. Conclusion

Authors

Figures

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Keywords

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Investigation of Deep Learning Model Based Intrusion Detection in Traditional and Ad Hoc Networks

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Abstract— Evolution and proliferation of the state-of-the-art technologies enable a human life marked by convenience and ease of access. Due to this technological advancement, difficulties are also created which are observed across various segments. Security issues in the field of networking are no exceptions to this. Networking also experiences lots of troubles produced by diffident types of complex intrusions. As a countermeasure to these troubles, a sophisticated and well-organized system, defined as network intrusion detection system (NIDS), has been introduced. It is aimed not only at the improvement of detecting accuracy but also at the correct identification of unspecified attacks. Over the last few decades, several technologies are introduced for developing NIDS to ensure a high degree of privacy and reliability. With the progression of modern deep learning technologies, NIDS performs wonders in the field of information security. In this paper, a number of deep learning based NIDSs are reviewed in a wide range of network oriented infrastructures, viz., traditional and ad hoc networks. This paper mainly discusses about the applications, limitations and methodologies of various NIDSs to provide a complete and transparent overview of network security to the readers.

Keywords— *Traditional Networks, Ad Hoc Networks, Deep Learning, Network Intrusion Detection System.*

I. INTRODUCTION

In present era, people are extremely accustomed with several applications through which they can easily share their personal or confidential information to outer world and then, censorious cyber-attacks are taken place where cybercriminals use these confidential data to execute crime activities [1]. The overall infrastructure of network system experiences with different kinds of cyber threats such as teardrop attacks, scan attacks etc. due to the rapid growth of internet along with digital medium. Many systems and applications like firewall, antivirus etc. are developed for the safeguard of network system but these technologies are not enough capable for proper protection. Hence, an advanced and well defined system, network intrusion detection system (NIDS) is introduced and implemented to secure the network. IDSs are an upgrade over the firewall in the sense that it can monitor and analyze the complete network's traffic. IDSs are also

enabled to generate alarms and alert system administrators or information security experts in the event of an abnormal situation within the network system. However, that is not all. Owing to their ability to store all network traffic, IDSs can also inform the system expert, cyber security expert or network forensic specialist about the situation in case of a cyber-incident or crime. Given that the information relayed by the IDS is processed and developed correctly, it also has the potential to be used as evidence in court [2]. Usually, two types of detection approaches have been used in NIDS. The known intrusions can be easily detected using signature oriented NIDS but this system is not able to identify the unspecified attacks. The second approach, named as anomaly based NIDS, encloses the deficiencies by correctly detecting new or unknown intrusions with the help of learning algorithms. Nowadays, this second approach is widely accepted throughout the world due to its efficient and dynamic characteristics.

Developments in the field of Neural Network (NN) algorithms have given birth to the concept of Deep Learning (DL). The need for DL arose when the experts had to look to do away with the limitation of having only a single hidden layer in the NNs. DL is a hierarchically cascaded algorithm with multiple hidden layers. These layers are connected through neurons, which represent the mathematical computation of the learning processes. Deep learning methods have shown their adequacy in the areas of dimensionality reduction and classification assignments. With regards to a deep learning-based IDS, deep networks gain from recorded traffic information, which is comprised of both typical and atypical traffic. Deep organizations can naturally decrease the organization traffic intricacy to discover the relationships among information without the need for human mediation. Besides, deep learning is all the more impressive in recognizing zero-day attacks and refined attack designs by learning from a huge number of training samples to build the detection model. Fig. 1 shows various intrusions which are included in well known benchmark KDD'99 dataset.

Development of New Univariate Process Capability Index for Multistage Wheel Manufacturing System

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Abstract - Process capability indices (PCI) are widely appreciated nowadays to measure the performance of a process. They are used to evaluate single or multiple quality characteristics of the process output such as a product or service according to their specifications. Univariate process capability indices are used to analyse a single quality characteristic of a product. Cp, Cpk, Cpm and Cpmk are widely used univariate process capability indices that required significant statistical knowledge to analyse. In this paper, a new univariate process capability index [Ca, A_{dev}, AI] is developed to measure the performance of a multiple-stage locomotive wheel manufacturing system. This index is based on a simple geometric formula and using a process performance monitoring chart. It is less complicated, user friendly and quite suitable for products with one-sided specification limits.

Keywords - univariate process capability index, multistage wheel manufacturing system

I. INTRODUCTION

Nowadays all manufacturers are aiming for “defect-free” (zero defect) products. Making the product within a specified range of quality characteristics at the beginning reduces the failure cost and increase customer satisfaction. Quality serves as an important factor in the success of any business or engineering enterprise. Researchers have developed several sampling techniques, control charts, statistical quality control techniques to achieve the goal of zero defect manufacturing (ZDM)[1,2]. Approaches of ZDM are applied from household products to industries like automation, transport, multistage manufacturing [3-5].

Process capability indices (PCI) are vastly used in the industry to provide quantitative measures on process performance by evaluating the conformation of products to their specifications and achieve zero defect manufacturing. There are two major categories of PCI. Univariate process capability indices (UPCI) deal with a single quality characteristic of the product, whereas multivariate process capability indices (MPCI) analyse multiple quality characteristics at a time. In the year of 1974, Juran [6] introduced the concept of capability ratio. Kane [7] developed two widely used univariate process capability indices Cp and Cpk expressed in “Eq. 1” and “Eq. 2” respectively.

$$C_p = \frac{USL - LSL}{6\sigma} \quad (1)$$

$$C_{pk} = \min\left\{\frac{USL - \mu}{3\sigma}, \frac{\mu - LSL}{3\sigma}\right\} \quad (2)$$

In the “Eq. 1” and “Eq. 2”, “σ” is the process standard deviation, USL represents “upper specification limit” and LSL is “lower specification limit”. The limitation of Cp is that it measures process capability by process spread without considering the actual location or mean of the process (μ). Cpk considers process location into account but does not consider whether it diverges from the target value (T) or not. Cpk gives no clear idea between on or off-target process and direction of the “off-target” process. Assuming the target in the middle of the specification limit Cpm was introduced by Chan et al. [8] as “Eq. 3”.

$$C_{pm} = \frac{USL - LSL}{6\sqrt{\sigma^2 + (\mu - T)^2}} \quad (3)$$

Here T represents the target value of a quality characteristic. The process parameters μ and σ² have been estimated from the sample mean and sample variance. Cpk and Cpm is combined in Cpmk [9] expressed as “Eq. 4”

$$C_{pmk} = \min\left\{\frac{USL - \mu}{3\sqrt{\sigma^2 + (\mu - T)^2}}, \frac{\mu - LSL}{3\sqrt{\sigma^2 + (\mu - T)^2}}\right\} \quad (4)$$

When the process mean μ departs from the target value T, the reduction in the value of Cpmk is rapid than the decrease in Cp, Cpk, and Cpm. PCI is an emerging field of research for statisticians, researchers and quality engineers. Abdolshah et al [10] estimated Cpk as the most suitable capability index among Cp, Cpk, Cpm, Cpmk based on randomly generated data by Monte Carlo simulation and Taguchi loss function. PCI is used for Cascade property analysis for multistage manufacturing [11] and product life cycle analysis considering pre-on-post production [12]. The authors have done process capability analysis on the multi-stage manufacturing process.[13,14]

II. CASE STUDY

R34 grade steel (C: 0.61%, Mn: 0.76%, P: 0.020%, S: 0.016%, Si 0.21%, Al: 0.018%) is used as raw material to manufacture locomotive wheel. Wheel ingot of a



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Robust Optimized Structural Feature-Based Transformation Parameter Estimation for Image Registration

Authors [Authors and affiliations](#)

Joydev Hazra, Aditi Roy Chowdhury, Kousik Dasgupta, Paramartha Dutta

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A MAP-Based Hybrid Cryptography Algorithm for Low-Cost Secret Communication

Authors [Authors and affiliations](#)

S. K. Ghosh, Joydey Hazra, Satarupa Biswas, Sachin Rana, Anushikha

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Abstract

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Preface

The title of the book is *Smart Technologies for Energy and Environmental Sustainability*, which is published under the book series “Green Energy and Technologies”.

Green energy is a type of energy that is generated from natural resources that do not harm the environment by producing greenhouse gases and, therefore, reduce the impact on global warming. Greenhouse gases consist mainly of ozone, carbon dioxide, methane, nitrogen oxide, etc. CO₂, methane, and nitrogen oxide are not efficient enough to stop the solar radiation from entering into the atmosphere; they cannot absorb all these radiations. The rapid rise of carbon footprint, due to several reasons, is a leading factor of increasing levels of carbon dioxide in the environment which, in turn, increases the atmospheric temperature.

With technological advancements, we have acknowledged a series of benefits, but we have also noticed the succession of disasters and catastrophes because of the misuse or selfish use of these technical advancements. Smart technologies are being developed and used to reduce greenhouse gas emission. Smart IoT-based services are producing green benefits. Construction of buildings with net zero carbon emissions and efficient energy usage are on rise. Technologies related to smart agriculture are also helping to make the environment more sustainable.

The entire world is on the verge of a major energy crisis. We are witnessing an era in the global energy environment where global measures using smart and intelligent technologies for the environment have already geared up. This book examines the trends and analyses factors that impact the environment by focusing on efficient energy consumption, storage, and management. Efficient energy management techniques using computation models and techniques in domains like transportation, green buildings, smart homes, and smart cities are much needed. The potentials of IoT and other smart technologies can provide solutions for the same where smart algorithms and techniques can be proposed. This book focuses on exploring these techniques to enhance the performance of energy systems. Methods/models/architectures/algorithms and their results to improve the consumption of energy and using alternative sources of energy for protecting the environment are the prime focus of

the book. A well-illustrated book with case studies that support the theory is an important feature of the book.

Book Contents

This book *comprises 15 chapters*, designed to capture the core ideas of Smart Technologies for Energy and Environmental Sustainability, and is organized as follows:

Chapter 1: Organic Semiconductors: Technology and Environment

Organic semiconductors are based on carbon materials, whereas inorganic semiconductors are composed of non-carbon-based materials such as silicon. These materials are popularly used in compact (in weight and size) and power-efficient light-emitting devices like small digital display units used in many electronic gadgets. In this chapter various aspects related to organic semiconductors have been discussed such as their operation, types, applications, and limitations. This chapter also reviews the conduction mechanisms of organic thin-film transistor and issues associated with it.

Chapter 2: Defining and Visualizing Energy and Environment Related Smart Technologies

Climate change and global warming are global issues. Scientists, experts, and academicians are much concerned over this issue. They are making policies and strategies to minimize its impact on the environment. This chapter sheds light on the need for smart technologies in the area of energy and environment to make our environment safe and smart.

Chapter 3: Energy Minimization in a Sustainably Developed Environment Using Cloud Computing

In a cloud computing environment, data centres are used for processing and storing the data which may cause carbon footprint issues to the environment. Through the concept of green technologies, this issue may be addressed by how to get a sustainable cloud computing system by using various techniques like software optimization, network optimization, and hardware optimization.

Chapter 4: Sensing, Communication with Efficient and Sustainable Energy: An IoT Framework for Smart Cities

Smart cities refer to a network of physical objects connected through sensors. They communicate among themselves to accomplish specific tasks. The basic issue is how to reduce the power consumption of each sensor node. In this chapter, an optimal IoT framework is discussed for a better energy management system to make the entire system more sustainable. Here, for simulating the energy consumption of IoT framework, a simulator named Cooja is used for analysing the energy consumption data.

Chapter 5: Existing Green Computing Techniques: An Insight

Green computing means eco-friendly usage of computing resources and facilities. It is directly or indirectly related to the environment. This chapter aims at green design and manufacturing techniques for reducing the ecological footprints. Green disposal is equally important because of the growing e-waste problem related to health and the environment.

Chapter 6: Smart Home for Efficient Energy Management

One of the aspects of a smart home is to manage the consumption of electrical energy most efficiently. Through intelligent energy management techniques and scheduling techniques for devices, energy consumption may be reduced that will eventually reduce the electricity bill. A metaheuristic algorithm is used for the optimization of energy consumption and to maintain optimal energy consumption with reduced energy cost without compromising supply and quality.

Chapter 7: Solar Energy Radiation Forecasting Method

Among many alternative energy sources, solar energy is the most powerful source. In this chapter, a forecasting methodology known as solar irradiance is discussed considering all important parameters. Combined forecasting methods are also used for the prediction purpose.

Chapter 8: Electric Vehicles for Environmental Sustainability

Transport vehicles, powered by traditional sources of energy, are one of the prominent sources of pollution in the environment. Electric vehicles may reduce this pollution level. This chapter discusses the short, medium, and long-term role of electric vehicles within urban and rural areas. It also discusses the potential market for it.

Chapter 9: Smart Grid: A Survey

Traditional power grid has not been relevant to meet the current demands and challenges efficiently. To solve such problems, different techniques are being used to make the power grid much smarter. This chapter explains about high power converter, advanced transmission system, and automated control system. This chapter also deals with how to minimize its impact on the environment.

Chapter 10: Green Building: Future Ahead

Green building is not to preserve the environment but to restore it. The utilization of solar energy, smart home appliances, cool roof technique, etc. makes the building a zero energy building, which consumes less energy. In this chapter how the concept of green building is related to the concepts of renewable energy, e-waste, minimizing toxicity in indoor air, etc. is shown.

Chapter 11: Reliable and Cost-Effective Smart Water Governing Framework for Industries and Households

Issues related to water leakages during transmission, its consumption tracking, its overflow from water tanks, and water quality check in industries and households are discussed in this chapter. An Internet of Things-based sustainable smart water governing framework is also proposed. Relevant data is collected, analysed, and visualized using analytics tools to make an effective decision.

Chapter 12: Adaptation of Smart Technologies and E-Waste: Risks and Environmental Impact

E-waste is a growing environmental issue. It is mainly due to mercury and lead which are toxic to human beings, air, water, and soil. In this chapter, various problems are discussed related to e-waste and also how to manage it using smart technologies. A model is also proposed for handling e-waste.

Chapter 13: A Comprehensive Study on the Arsenic Contamination in the Groundwater of Assam and West Bengal with a Focus on Normalization of Arsenic-Filled Sludge from Arsenic Filters

The presence of arsenic in consumable water, a poisonous chemical element, is dangerous and harmful to health. It is accumulated in the food chain and thus has cascading effects on each stakeholder of this chain. This chapter proposes technical solutions for providing arsenic-free water for consumption; it also discusses safe deposition and utilization of arsenic-enriched sludge.

Chapter 14: Sustainable Approach for Cloud-Based Framework Using IoT in Healthcare

Technologies in the healthcare domain are an emerging and important area of research to address the issues related to healthcare, particularly in developing countries. In this chapter, two technologies, IoT and cloud services, have been discussed so as to bring better health services even to remote areas of the countries. The concerned technologies with their merits and demerits are also discussed.

Chapter 15: A Case Study on Evaluation of Energy Management System by Implication of Advanced Technology in a Typical Cement Factory in Tamil Nadu, India

Cement factories are considered to be one of the most polluting agents. So, their energy assessments and audits help in the analysis and plan of energy use, specifically for the industrial production process. Several reports and documents are verified pertaining to energy aspects, and the auditor prepares a hierarchical report which helps factory managers to update and make changes and follow the

procedures that lead to better environment-friendly alternatives. This chapter carries out extensive research on the same and presents a case study on a typical cement factory located in Tamil Nadu, India.

We hope that you delve deeper into the varied aspects of the book and enjoy reading and learning about various smart technologies that focus on optimal energy usage for a better future.

We dedicate this book to our family members without whose support this would not be possible. The authors form an integral part of this volume. We express our gratitude to the contributors and are also obliged to the reviewers for their comments that helped to improve the quality of the book. Last but not least, thanks to God, for showing us the light to start this project and blessing us to complete it.

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Gjøvik, Norway

Parul Agarwal

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A Comprehensive Study on the Arsenic Contamination in the Groundwater of Assam and West Bengal with a Focus on Normalization of Arsenic-Filled Sludge from Arsenic Filters

[Subhashis Chowdhury](#), [Rajashree Lodh](#) & [Souvik Chakraborty](#)

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Abstract

Arsenic is a very dangerous chemical element to human being if it is present in groundwater, that is used as a potable drinking water in many regions of India. A large number of populations in Assam and West Bengal depend upon the groundwater for their daily basic needs, but the problem is that the groundwater of these two states is very much contaminated with Arsenic, so the effects of arsenic contamination is a very much relevant topic to be reviewed and discussed. The arsenic present in consumable water and the status of arsenic contamination is explained here. The present study presented allowable standards of Arsenic in potable water. The worst contamination of arsenic is observed on people in terms of their health as it accumulates in the food chain of human being if they consume potable water contaminated with arsenic. The harmful effects of arsenic contaminated water used for irrigation and agricultural purposes are also explained here. The paper also explored

Sustainable Textiles: Production, Processing,
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Subramanian Senthilkannan Muthu
Ali Khadir *Editors*

Dye Biodegradation, Mechanisms and Techniques

Recent Advances

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Bioremediation of Dye Using Mesophilic Bacteria: Mechanism and Parametric Influence



Souptik Bhattacharya, Ankita Mazumder, Dwaipayan Sen,
and Chiranjib Bhattacharjee

Abstract For centuries, dyes have been utilized in the tannery, textile, food, paper, cosmetic, and plastic industries. As a consequence of the fast urbanization and industrialization, the uncontrolled release of dyeing agents in the effluent is increasing. Such a release causes toxicity and pollution to the whole environment. These concerns become more critical due to the biomagnification phenomenon through various trophic levels resulting in severe toxicity in higher animals and plants including aquatic flora and fauna. Mitigation of this nuisance can be achieved by the economic application of biotechnology using safe biological agents to decolorize and degrade the dye in water bodies.

In this chapter, we reviewed the toxicity and harmful effects of various dyes along with different mechanisms and strategies of dye decolorization and degradation by biological agents while giving ampule emphasis on the mesophilic type bacteria. Further, the effect of different physicochemical parameters on dye removal efficacy was explicitly discussed. Moreover, various techniques to investigate the harmful toxic effects of the produced post degradation metabolites were also enlightened. Thus, this present chapter will deliver a quintessential perception on the feasibility of the bioremediation technique using mesophilic bacterial strains to treat dye contaminated waste streams.

Keywords Mesophilic bacteria · Biodegradation · Wastewater · Dye · Aerobic bacteria · Anaerobic bacteria, · Biomagnification · Bioreactor · Biosorption · Enzymatic degradation

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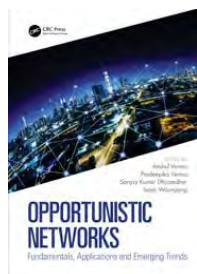
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Opportunistic Networks

Fundamentals, Applications and Emerging Trends

Edited By Anshul Verma, Pradeepika Verma, Sanjay Kumar Dhurandher, Isaac Woungang

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ABSTRACT

The opportunistic network is an emerging and recent area of research. To make this research area more adaptable for practical and industrial use, there is a need to further investigate several research challenges in all aspects of opportunistic networks. Therefore, **Opportunistic Networks: Fundamentals, Applications and Emerging Trends** provides theoretical, algorithmic, simulation, and implementation-based research developments related to fundamentals, applications, and emerging research trends in opportunistic networks.

The book follows a theoretical approach to describe fundamentals to beginners and incorporates a practical approach depicting the implementation of real-life applications to intermediate and advanced readers. This book is beneficial for academicians, researchers, developers, and engineers who work in or are interested in the fields related to opportunistic networks, delay tolerant networks, and intermittently connected ad hoc networks. This book also serves as a reference book for graduate and postgraduate courses in computer science, computer engineering, and information technology streams.

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ABSTRACT

Performance of cooperation-based networks, like delay tolerant networks (DTNs), are severely affected by selfish nodes that are not willing to participate in message forwarding due to resource constraints. Thus, nodes must receive satisfactory incentives to compensate their resource depletion for cooperation. The available incentive schemes for DTNs either rely on hypothetical central trusted authorities or do not use explicit digital currency that is provably secure. Blockchain, a decentralized and secure digital ledger of immutable transactions, is an attractive approach for addressing the incentive challenges in DTNs that lack central trusted authorities. Ethereum, the blockchain-based cryptocurrency, makes it possible to devise practical credit-based incentive schemes for such networks. However, the usage of blockchain is restricted by the availability of end-to-end internet connectivity, which restricts the use of blockchain in intermittently connected networks like DTNs and has prompted exploration of new mechanisms for using blockchain in such networks. This chapter first proposes a mechanism, based on the Ethereum platform using smart contracts in Solidity, for integrating blockchain technology with DTNs, towards exploiting the immutability and availability of blockchains in DTNs. It then develops BlockCent, a blockchain-based node incentivizing scheme for DTNs that runs on the blockchain-DTN integrated environment. The scheme uses a novel reward strategy to bring rationality to the incentivizing process. To add logic to the incentivizing method, the scheme uses a novel incentive strategy. The proposed incentivizing scheme is applied to the disaster management use case for fast transmission of relief shelter needs to the emergency operation center, thus leading to efficient disaster relief. Extensive security analysis justifies security of the proposed scheme. Exhaustive experiments conducted on the UHL simulator and the Ethereum platform substantiate the efficiency of the scheme in terms of design parameters like selfishness reduction and reward fairness, and network parameters like delivery ratio, average delay, and overhear ratio, while not compromising blockchain performance parameters like processing time and gas consumption.