

**VIETNAM NATIONAL UNIVERSITY, HANOI
UNIVERSITY OF ENGINEERING AND TECHNOLOGY**

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ANNUAL SCIENTIFIC REPORT

HANOI 2016

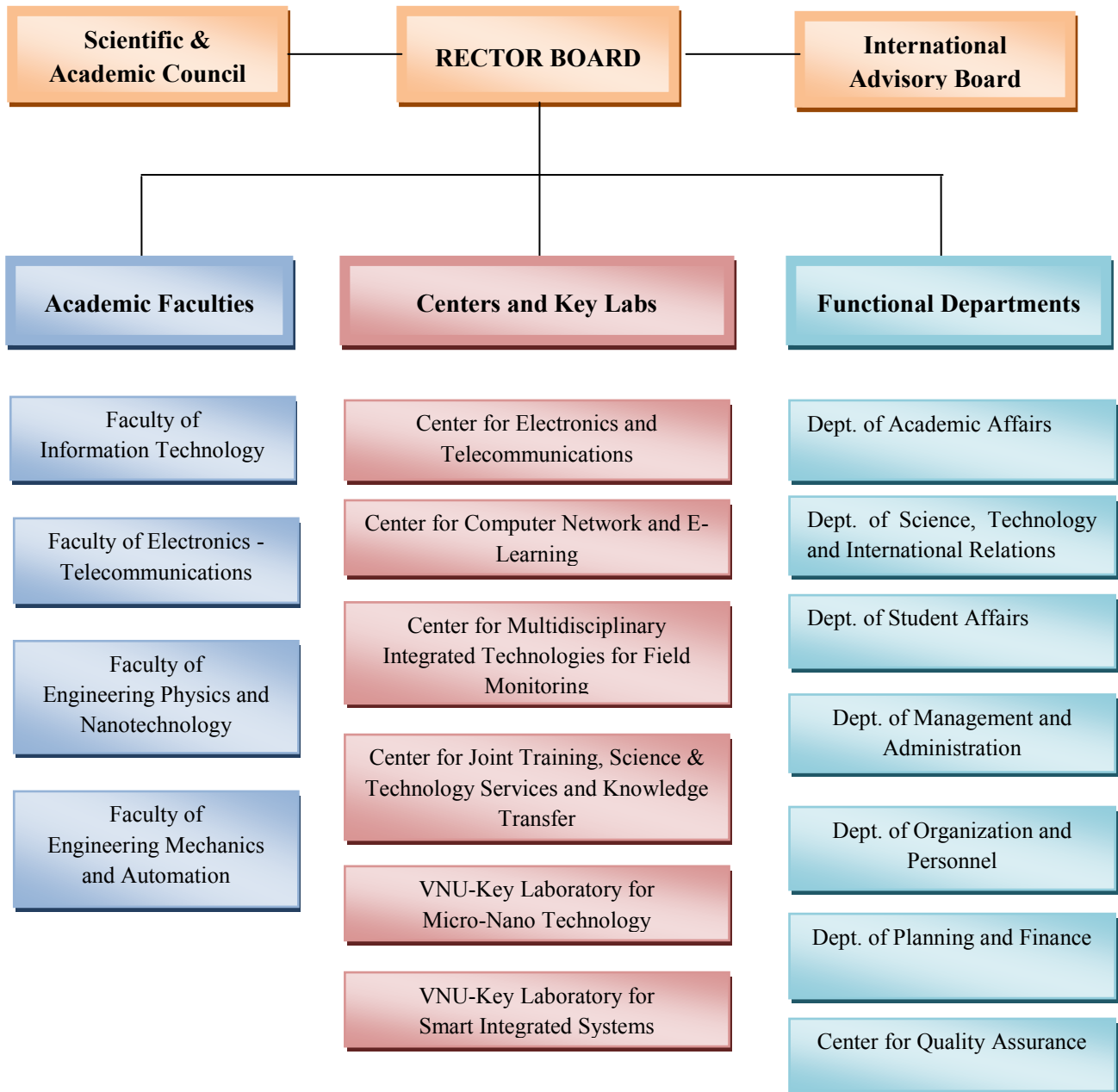
PREFACE

The University of Engineering and Technology (UET) was founded in 2004 as a member university of Vietnam National University, Hanoi (VNU).

The last only five years have seen immense progresses in the development of our university in various aspects of its activities thanks to the great efforts put in by the government with strong financial supports, by the VNU with steering leadership and administration, by the national and international educational institutions and corporations in fruitful collaborations and advices, and by all the staff and students of the UET with determination, hard work and patience.

Today, our university has built up a solid foundation for a sustainable and dynamic development in coming years. This solid foundation consists of a completed system of well-designed programs at both undergraduate and graduate levels, renovated teaching and learning facilities, a just limited but strong and advanced research infrastructure with state-of-the-art and completed equipment systems, a sustainable and fruitful collaboration with leading research and educational institutions in the country, and a bright, young, well-educated and welltrained faculty who are eager to take on advanced research and studies. All these have made our university a prestigious institution and firmly established its education and research capabilities. This is proved by the facts that only in the last four years our university has established close and solid ties and cooperation with prestigious foreign universities, just to name a few, the University Paris-Sud 11 (France), Japan Advanced Institute of Science and Technology, the National University of Singapore, Nanyang Technological University (Singapore), University of New South Wales and with famous international industrial and technological corporations such as Samsung, Toshiba, NEC, Mitani, Human Resocia, IBM, and other well-known institutions in the region and around the world. This is also proved in a convincing way by the facts that only in the last two years, our university has been granted several significant research projects from various national research programs. Our university has become an attractive destination for talented students at all training levels. We are proud that our university is the only Vietnamese higher-education institution that has one among the 100 best student's teams all over the world participating the World Final of the ACM International Collegiate Programming Contest (rank #29 in 2015). We are also proud that in this year, our faculty has won an award in the National Contest in Information Technology entitled "Vietnamese Talent Award" and three awards in the VNU Science & Technology Award for the period of 2011-2015. In the coming period, we shall put our great efforts to solidify our strength and prestige. We shall widen our training scope while paying significant attention to further improvement on the education quality. We shall strongly enhance our concentrated research activity by exploring efficiently and effectively our well established foundation for a further dynamic development and, thus, contributing our crucial part to the socio-economic development of our nation and fulfilling our great missions clearly assigned by the government in the decision on the establishment of our university. To do that, innovative thinking and acting by all faculty, administrative staff and students are of deciding role and of crucial importance.

ORGANIZATION



UNIVERSITY'S RESEARCH CENTERS/LABORATORIES

Research Centers & Key Laboratories

- Center for Multidisciplinary Integrated Technologies for Field Monitoring
- Center for Electronics and Telecommunications Research
- VNU Key Laboratory for Smart Integrated Systems (SISLAB)
- VNU Key Laboratory for Micro-Nano Technology
- Laboratory for Engineering Mechanics and Automations

Research Laboratories and Departments

- Department of Computer Science
- Department of Computer Networks and Communications
- Department of Software Engineering
- Department of Information Systems
- Department of Computational Science and Engineering
- Natural Languages Laboratory
- Bio-informatics Laboratory
- Information Security Laboratory
- Embedded Systems Laboratory
- UET-Toshiba Cooperation Laboratory for Software Engineering
- Knowledge Engineering Laboratory
- Human-Machine Interaction Laboratory
- Department of Electronics and Computer Engineering
- Department of Micro Electro-Mechanical Systems and Microsystems
- Department of Wireless Communications
- Department of Networks and Communications Systems
- Signals and Systems Laboratory
- Automation and Robotics Laboratory
- Department of Marine and Environment Engineering
- Electromechatronic and Industrial Fluids-Mechanics Laboratory
- Distributed Controls Laboratory
- Advanced Materials and Structures Laboratory
- Department of Nano-Magnetic Materials and Devices
- Department of Nano-Biotechnologies

- Department of Nano-Semiconductor Materials and Devices
- Hybrid Materials and Devices Laboratory
- Electro-Optical Laboratory
- Energy Engineering Laboratory

Practical Laboratories

- Center for Computer Network and E-Learning
- Computer Labs
- Fundamental Electronics and Communications Practical Laboratory
- Advanced Electronics and Communications Laboratory

RESEARCH ACHIEVEMENTS

Research achievements are divided into four main areas as follows:

- ❖ **Computer Sciences**
- ❖ **Electronics and Communications**
- ❖ **Engineering Mechanics and Automations**
- ❖ **Engineering Physics and Nanotechnology**

**RESEARCH ACHIEVEMENTS
IN
COMPUTER SCIENCES**

Air Pollution Management (APOM) system using Satellite Image

Research topics: air pollution, satellite image, ground station, WebGIS

Thanh TN Nguyen, Hung Q Bui, Ke C Luong, Hung V Luu, Ha V Pham, Chuc D Man, Bang H Pham, Thanh V Phan, Tu V Do, Thanh X Le, Ha T Le, Hoang N Nguyen, Chau H Nguyen, Thuy T Nguyen

ABSTRACT: Particulate Matter pollution is one of the most important air quality concerns in Vietnam. In this work, we integrate ground-based measurements, meteorological and satellite data to map PM concentrations at 6x6 km and 10x10 km grid for the entire Vietnam, 60x60 m grid for the Hanoi city. We specifically used Aqua/Terra MODIS, VIIRS, SPOT4/LandSat 8 data and developed PM concentration maps which later converted to Air Quality Index maps following QCVN-2013 and US-EPA standards. An Air Pollution Management system, connected to MODIS/VIIRS/JPSS ground station at VNU-UET, provides services for daily MODIS/VIIRS PM_{2.5} monitoring over Vietnam, search & download, report, and registration for daily alerts via email or sms.

Vietnam is facing air quality problems as a result of the rapid growth of traffic, construction, industries, biomass burning, crafts villages and domestic activities ... out of efficient waste treatments. As the result, the amount of Vietnamese citizens getting respiratory problems is always a significant contributor to the total of human diseases. The Center for Environmental Monitoring (CEM) at the Vietnam Environment Administration provides updated pollution information on the website for six cities: Phu Tho, Ha Noi, Hue, Da Nang, Ha Long and Khanh Hoa. Air pollution measurements through ground based stations have high level of accuracy and frequency but limited geographic coverage in Vietnam.

The objectives of our research are to: (i) estimate Particulate Matter (PM) concentration maps over Vietnamese regions using satellite images at different temporal spatial scales and (ii) develop a system based on research results to provide air pollution services such as daily monitoring, search and download, reports, and alerts via email and SMS.

We proposed the approach for PM estimation at different spatial scales using different optical satellite images such as Landsat 8, SPOT, VIIRS and MODIS. PM maps at 60x60m was extracted from SPOT4 (or LandSat8) and ground truths as required. The methodology is based on application of Least Square Fitting using high resolution aerosol optical depth (AOD) derived from SPOT 4 image to estimate the Particulate Matter concentration (PM₁₀) tested over Hanoi, Vietnam. These results provide confidence that the AOD models can make an accurate prediction of the PM concentration [1]. The daily VIIRS and MODIS PM_{2.5} at 6x6 and 10x10 km were provided in two hours since satellite images recorded by the ground station at VNU-UET. Ground-based measurements, meteorological and satellite

data are used to map PM concentrations at a 10x10km and 6x6km grid for the entire Vietnam. We specifically used MODIS Aqua/Terra, VIIRS data and developed statistically-significant regression models to map and extend the ground-based PM concentrations. We validated our models over diverse geographic provinces i.e., North East, Red River Delta, North Central Coast and South Central Coast in Vietnam. Our modeled PM_{2.5} maps were able to replicate seasonal and spatial trends of ground-based measurements in four different regions, which highlight the potential use of MODIS datasets for PM estimation at a regional scale in Vietnam [2].

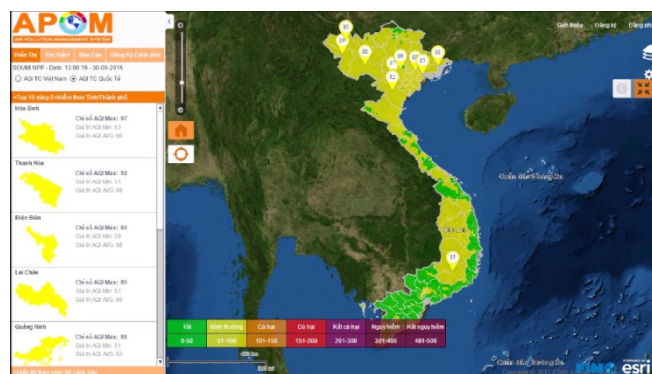


Figure 2. The main interface of APOM system

The APOM system utilizing research results supports four types of users including citizen, researcher, manager and system/data administration. The APOM system is a WebGIS application based on server-client architecture, processed online data from MODIS/VIIRS ground station at UET automatically and provided near-real time services. It provides user interface for system/data administration, data processing and services (i.e. monitoring, search & download, report and alerts). The APOM is online at <http://apom.edu.vn:8080/apom/web/>.

- [1] Hung V Luu, Chuc D Man, Ke C Luong, Hung Q Bui, Thanh TN Nguyen, 2016. Air pollution mapping from high spatial resolution satellite images: A case study in Hanoi. *Proc. of International Joint Conference on Convergence, Hanoi, Vietnam, Jan. 2016*.
- [2] Thanh T.N. Nguyen, Hung Q. Bui, Ha V. Pham, Hung V. Luu, Chuc D. Man, Bang H. Pham, Hai N. Pham, Ha T. Le and Thuy T. Nguyen, 2015. Particulate Matter Concentration Mapping from MODIS Satellite Data: A Vietnamese Case Study. *Environmental Research Letter*.

OPINION MINING AND SENTIMENT ANALYSIS

Research topics: Natural Language Processing and Data Mining

Le Anh Cuong and Students (Faculty of Information Technology)

ABSTRACT: This report briefly introduces the problem of Opinion Mining and Sentiments Analysis (OMSA) and some our related works. Firstly we describe it as the most attracting issue in the recent decades in the field of natural language processing and data mining. We then present a general framework for building an OMSA system and its components' missions. Finally, some results from our work are introduced.

Building a service for media social monitoring is now becoming a new development direction for many software companies as well as an big inspiration for some startup groups. You can easily search using Google for seeing systems of this kind. The figure 1 below describes a general framework of systems for mining opinion and analyzing sentiments.

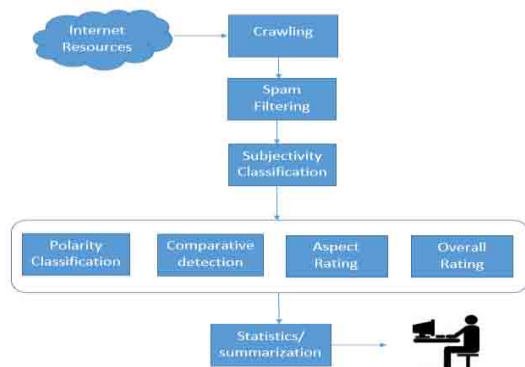


Fig 1. A general framework for OMSA systems

The major components and their functionalities are described as below:

- First, the first component, a crawler, will crawl raw data from Internet resources such as forums, blogs, and social networks.
- Second, we need a spam classifier for filtering spam comments.
- Third, a subjectivity classification is invoked to keep just the posts which contain opinions or sentiments. We do not care about factual posts/comments.
- And then, depending on different purpose, the systems need one or more analyzed modules among the following: (i) polarity classification aims to classify one post/comment into the positive class, negative class, or neutral class; (ii) comparative detection means to

comparative information which is important for some purposes; (iii) overall rating is the task of rating a post/comment depending on the degree of positive sentiments from customers; (iv) sometimes we need the analysis on particular aspects, and it is the task of aspect-based analysis like aspect rating.

- Finally, we may need a summarization module to make statistics or summary over separate results of comments. Note that there are some studies focusing on modeling the whole data (i.e. combining all posts/comments) to derive overall analysis.

Our research focuses on three subtasks:

The first subtask is about standardizing informal texts. As you know, people usually use free grammars, abbreviations, and make spell mistakes. Therefore, when applying normal NLP tools such as Word Segmentation, Part-Of-Speech tagging to these informal texts we will get low accuracies. In our research [3] we have proposed a method to improving these basic NLP tools by using some spelling techniques for standardizing the texts before training and testing.

The second subtask is subjectivity classification. In the paper [2, 4] we first investigated various grammatical phenomena which accurately reflect sentiment of writers. And then we proposed to use grammatical patterns as new features for machine learning methods. Obtained results are much better previous studies (92% in comparison with 86%).

For the third subtask we addressed the problem of aspect rating. In [1] we have proposed a new method based on Neural Network. Besides obtaining the overall rating for each aspect we consequently could determine the importance of each aspect based their weights learned from the model.

- [1] Pham Duc Hong, Le Anh Cuong, Le Thi Kim Chung., A Least Square based Model for Rating Aspects and Identifying Important Aspects on Review Text Data, NICS 2015
- [2] Tran-Thai Dang, Nguyen Thi Xuan Huong, Anh-Cuong Le, Van-Nam Huynh. Automatically Learning Patterns in Subjectivity Classification for Vietnamese. KSE 2014: 629-640.
- [3] Thi Xuan Huong Nguyen, Tran Thai Dang, Anh Cuong Le (2014) Adapting Vietnamese Word Segmentation for Microblogs-Style Data. In: 2014: The Third Asian Conference on Information Systems (ACIS 2014)
- [4] Huong Nguyen Thi Xuan, Anh-Cuong Le, Minh Le Nguyen: Linguistic Features for Subjectivity Classification. IALP 2012: 17-20

On The Design and Development of VAV: A Mobile Virtual Assistant for Vietnamese

Research topics: Vietnamese spoken text processing, Mobile virtual assistant

X.-H. Phan and the students in MDN-Team (Faculty of Information Technology)

ABSTRACT: This report briefly describes the design and implementation of VAV, a mobile virtual assistant for Vietnamese. VAV allows mobile users to perform a variety of tasks (e.g., adding an event to the calendar, setting alarm, finding direction, surfing the web, calling/texting someone, asking for weather information, playing a song, etc.) on their smartphones via natural spoken language commands. In order to do that, VAV needs to understand both the intent and the arguments in each user input sentence. The remainder of this report will give an overview of the core machine learning methods and NLP technologies that make VAV accurate, fast, and robust.

VAV is an intelligent mobile virtual assistant application that allows users to interact with their smartphones via natural spoken commands in Vietnamese. Using VAV, users can easily set up a wake-up alarm, add an entry to calendar, change the phone settings, call or text someone, call taxi, open an application already installed on the phone, surf the web, find a direction on the map, seek nearby ATM machines, look up dictionary, search Wikipedia and the web, or simply playing a favorite song, etc.

Designed and developed with artificial intelligence, machine learning, and natural language processing techniques, VAV can analyze input sentences and understand the user intent even though they express their requests in many different ways. In addition, VAV can interact with various applications and services like calendar, map, online news, financial sites, weather news, Wikipedia, ... in order to provide useful and interesting features/information to mobile users.

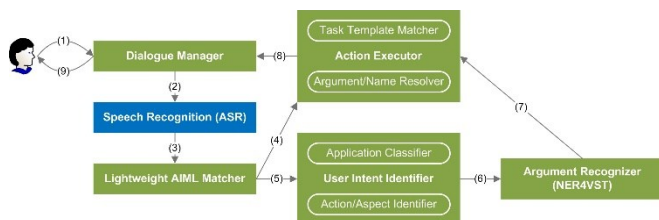


Figure 1: Architecture of Mobile Virtual Assistant for Vietnamese.

There are at least three major reasons why we attempted to develop VAV. Firstly, with the recent major advances in speech recognition technology, voice-based communication and interaction care becoming increasingly popular. We can easily see this shift via the application of speech-to-speech translation (Microsoft Skype and AT&T Speech Translator), the growing adoption of in-car voice control, call-center automation, and especially the quick emergence of mobile virtual assistants like Apple Siri, Google Now, and Microsoft Cortana. Secondly, most virtual assistants (Siri, Cortana, etc.) have been designed and optimized for English and European languages. It is still very hard for Vietnamese users to use these virtual assistants since Siri, Cortana, and Now cannot really understand Vietnamese. Lastly, we can freely integrate into VAV any features that are useful for

Vietnamese users. This is cannot be done with foreign virtual assistants like Siri, Now, or Cortana.

Figure 1 shows the general architecture of VAV. In order to understand and execute a user's spoken command, VAV first records the user voice command and converts to a spoken text sentence using an ASR (automatic speech recognition) service (e.g., Google Voice). The spoken text command is then analyzed to capture the intent that the user meant to do as well as to extract any necessary parameters for execution. Given a command like "tim đường từ 144 Xuân Thủy đến Hồ Gươm" (find direction from 144 Xuan Thuy to Hoan Kiem Lake), VAV needs to determine its proper intent as <map, find-direction> (meaning that open the map application and find direction from one point to another on the map). In addition, finding a direction requires a source and a destination as arguments. Therefore, VAV will ask the argument recognizer (see Figure 1) to recognize the source "144 Xuân Thủy" and the destination "Hồ Gươm" in the command. The resulting intent and arguments are finally sent to the action executor (see Figure 1) for execution.

Technically, a user intent of a spoken text command c , denoted $I(c)$, is defined as a pair of a domain d and an action f associated with d .

$$I(c) = \langle d, f \rangle$$

For the second version of VAV, we deal with more than 20 applications or domains (Alarm, Reminder, Calendar, Photo, Video, Phone, Contact, SMS, Email, Note, Map, Weather, Search, Music, Browser, Finance, Facebook, Language, Calculator, Settings, OtherApp, Lottery, Wikipedia, Taxi, etc.) and various actions associated with those domains.

To build VAV, we propose a lightweight machine learning and matching approach to perform (1) domain identification as a classification problem, (2) action identification as a conjunction matching problem, and (3) command argument recognition as a sequential labeling problem. These classification, labeling, and matching models are very accurate, fast, and compact in order that we can store and execute them right on mobile devices. See [1] and [2] for more technical insights of VAV application.

- [1] T.-L. Ngo, V.-H. Nguyen, T.-H.-Y. Vuong, T.-T. Nguyen, T.-T. Nguyen, B.-S. Pham, and X.-H. Phan. Identifying User Intents in Vietnamese Spoken Language Commands and Its Application in Smart Mobile Voice Interaction, The 8th Asian Conference on Intelligent Information and Database Systems (ACIIDS), March, 2016.
- [2] P.-N. Tran, V.-D. Ta, Q.-T. Truong, Q.-V. Duong, T.-T. Nguyen, and X.-H. Phan. Named Entity Recognition for Vietnamese Spoken Texts and Its Application in Smart Mobile Voice Interaction, The 8th Asian Conference on Intelligent Information and Database Systems (ACIIDS), March 2016.

Scalable Multi-attribute Queries on Distributed Hash Table Networks

Research topics: Peer-to-peer, multiple-attribute query, Distributed hash table (DHT)

Hoai Son Nguyen (VNU), Yasuo TAN, Yoichi SHINODA (JAIST)

ABSTRACT: In this study, we propose a search system, which is built on top of a ring-based DHT and supports efficient scalable multi-attribute queries of information resources in a distributed manner. Our system utilizes a descriptive naming scheme, which names each resource using an attribute-value (AV) tree, and resource names are mapped to DHT key space in order to distribute the resource information to responsible nodes based on a DHT routing algorithm. Our proposed mapping scheme ensures that in our system both efficiency and a good degree of load balancing can be achieved even when the distribution of AV pairs in the resource names is skewed.

The unprecedented growth of information and network technology means that users can now access various types of information resources, which can be found everywhere. These resources can be provided by Web services, sensors, networked devices, etc. However, one problem that has emerged is how to search and exploit these information resources in an efficient and flexible manner with high scalability. We believe that the development of a search system that can describe resources precisely using sets of attribute value (AV) pairs and that supports multi-attribute queries in a distributed manner is a viable solution to this problem. A vast number of distributed applications could benefit from this type of search system, such as service discovery systems, file sharing systems, and ubiquitous computing systems.

In our research, we focus on a descriptive naming scheme, which names resources using AV trees in order to allow resource providers to describe precisely what they provide and to allow users to easily describe what they require. A search system that supports multi-attribute queries will distribute resource information to its nodes based on the resource names and perform queries on its nodes to return information of resources, whose name is a superset of a query AV tree, as search results. The information of a resource may be a full description of the resource, or the address of the server or device that provides the resource or the resource itself. The challenge of our research is determining how to implement a highly efficient and scalable search system that supports multi-attribute queries when vast numbers of information resources are distributed in the system.

In this study, we propose a novel search system called D-AVTree, which implements multi-attribute queries of information resources on top of a ring-based DHT such as Chord or Pastry. An information resource is named an AV tree and resource information is distributed to the nodes responsible for the keys created from the resource name, which are called distribution keys. In contrast to conventional approaches, our system creates a distribution key from each AV branch of an AV tree, which is defined as a sequence of AV pairs on the path from a root node to a leaf node of an AV tree. We propose a novel mapping scheme between AV branches and distribution keys where AV branches that share a subsequence of AV pairs beginning from a root node are mapped to a continuous portion of the DHT key space (Fig. 1). Therefore, when searching for resources whose names are supersets of a query AV tree, the system only needs to query a number of nodes, which are responsible for a continuous portion of the DHT key space. Furthermore, if a query AV branch is long,

the size of the portion in the key space is small, which means that only small number of nodes need to be queried.

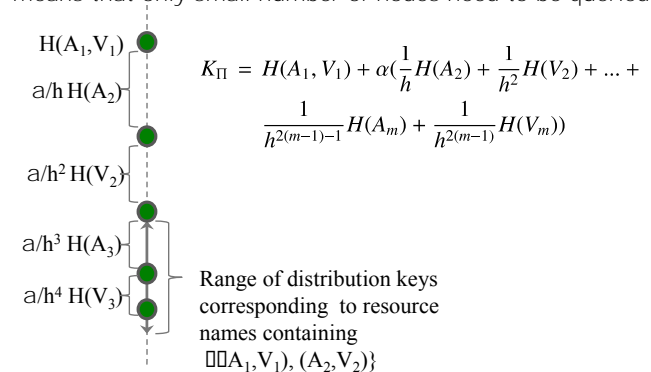


Figure 1: The range of distribution keys that correspond to resource names containing an AV branch $\{(A_1, V_1)(A_2, V_2)\}$

Our search system has several advantages, as follows.

- Low information distribution overheads: The number of replications of resource information is equal to the number of leaf nodes in the AV tree, which is low compared with conventional methods.
- Good degree of load balancing: The distribution keys are created from each AV branch of the resource names, which means that a low number of resource names create the same distribution key. Therefore, our system can benefit from the natural load balancing characteristic of DHT-based algorithms.
- Efficient search: If the number of AV pairs in an AV branch of a query AV tree is sufficiently large, the system needs to query only a small number of nodes.

We conducted simulations to evaluate the performance of our proposed system. In our simulation, the maximum number of resources distributed to a node is only 3.7% of the total number of distribution resources, whereas in the case of INS/Twine, a conventional search system, one node stores 16.5% of the total resources. If the length of a query AV branch is 2, the number of queried nodes is only 2.5. Compared with the Content Discovery System (CDS), which uses a load balancing mechanism, our D-AVTree can achieve almost the same degree of load balancing but with lower distribution costs and less query latency. The application of a simple load balancing mechanism to our D-AVTree provides even better performance in terms of the query hit ratio and query overheads compared with CDS when the system workload is high.

More information on our proposed system can be found in [1].

Fingerprint Matching on GPU for a Large Scale Identification System

Research topics: Fingerprint matching, large scale identification system, GPU computing

H-H. Le, N-H. Nguyen, T-T. Nguyen

ABSTRACT: The need for processing speed for databases with millions fingerprints are very demanding. GPU devices are used widely in parallel computing tasks for their efficiency and low-cost. Most approaches make use of GPU for the filtering process in a multi-stage matching system. We propose a complete fingerprint matching algorithm on GPU that fits well with the architecture of GPU. The result tested with GTX- 680 device shows that the proposed algorithm can perform 1.8 millions matches per second, making it applicable for real time identification systems with databases of millions fingerprints.

Although state-of-the-art algorithms are very accurate, but the need for processing speed for databases with millions fingerprints are very demanding (*Minutia Cylinder-Code, a state-of-the-art matching algorithm, takes 3 milliseconds to perform a matching on CPU. So it takes 3 seconds to identify a fingerprint in a database of 1000 fingerprints*)

Graphic Processing Unit (GPU) has been proven to be a very useful tool to accelerate the processing speed of computationally intensive algorithms. But not all fingerprint algorithms can be implemented on GPU to easily. CUDA-enabled GPU consists of a set of Streaming Multiprocessors (SM). Figure 1 shows the computing architecture of GPU. Each SM schedules and executes threads in groups of 32 parallel threads. If threads take different paths (due to flow control instructions), they have to wait for each other.

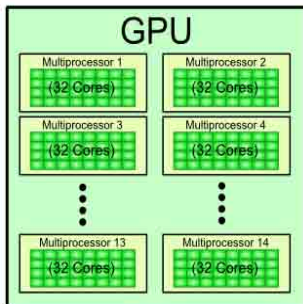


Figure 1: GPU architecture.

Most approaches make use of GPU for the filtering process. After that, more accurate matching algorithms on CPU for remaining fingerprint candidates are used.

Our approach is based on the fact that using 32 minutiae for each fingerprint is enough for the matching process. From statistics of FVC 2002 fingerprint databases, the average number of minutiae of each fingerprint is 30. The average number of matches for a genuine matching is 6. We use one block for matching a fingerprint pair, each block has 32 threads. Each thread of the block is used to calculate a column in the similarity matrix of MCC algorithm and to find the maximum value in that column. Figure 2 presents steps of our fingerprint process on GPU. The proposed fingerprint matching process fits well with the architecture of GPU.

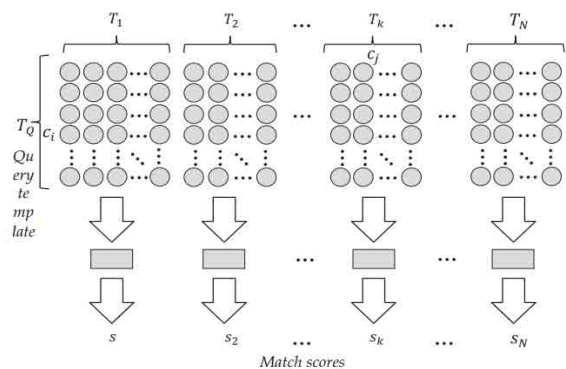


Figure 2: Our fingerprint matching process on GPU.

For evaluating the speed of the proposed algorithm, we carried out all the experiments on an NVIDIA GeForce GTX 680 with 1536 CUDA cores, Kepler Architecture and 2GB of memory. FVC 2002 DB was scaled to different database sizes. Some experimental results are presented in Table 1.

Table 1: Implementation results of the proposed design

DB size	Time (ms)	Throughput (KMPS)
100000	567	1763
200000	1105	1809

At larger DB sizes, throughput of the proposed algorithm is stable at 1.8 million matches per second, no scalability issues were found. It is higher than the result reported for previously published GPU algorithm which gains 55.7 KMPS on a single GPU device, which is the same as our device.

We propose a simple approach of adapting MCC to GPU. Using all minutiae for calculating cylinders, then choosing 32 minutiae for matching, the approach actually fits well with the GPU computing architecture and can be easily implemented. The proposed method does not affect to the accuracy of the original algorithm. The proposed approach can be easily scaled-up. Thus, it is possible to implement a large-scale fingerprint identification system on inexpensive hardware.

More information on our proposal can be found in [2].

[1] H-H. Le, N-H. Nguyen, T-T. Nguyen. Exploiting GPU for Large Scale Fingerprint Identification, 8th Asian Conference on Intelligent Information and Database Systems International, 2016.
 [2] H-H. Le, N-H. Nguyen, T-T. Nguyen. A complete fingerprint matching algorithm on GPU for a large scale identification system, 7th International Conference on Information Science and Application, 2016.

Whole genome analysis of a Vietnamese trio

Research topics: Human genome, Vietnamese human genome

Dang Thanh Hai, Nguyen Dai Thanh, Pham Thi Minh Trang, Le Si Quang, Phan Thi Thu Hang, Dang Cao Cuong, Hoang Kim Phuc, Nguyen Huu Duc, Do Duc Dong, Bui Quang Minh, Son Bao Pham, Le Sy Vinh

ABSTRACT: We here present the first whole genome analysis of an anonymous Kinh Vietnamese (KHV) trio whose genomes were deeply sequenced to 30-fold average coverage. The resulting short reads covered 99.91% of the human reference genome. We identified 4,719,412 SNPs and 827,385 short indels that satisfied the Mendelian inheritance law. Among them, 109,914 (2.3%) SNPs and 59,119 (7.1%) short indels were novel. We also detected 30,171 structural variants of which 27,604 (91.5%) were large indels. There were 6,681 large indels in the range 0.1–100 kbp occurring in the child genome that were also confirmed in either the father or mother genome. We compared these large indels against the DGV database and found that 1,499 (22.44%) were KHV specific. The novel variants identified from our study demonstrated the necessity of conducting more genome-wide studies not only for Kinh but also for other ethnic groups in Vietnam.

Today a human genome can be sequenced within a week for a cost of around 1,000 USD. A number of large-scale sequencing projects have been conducted, such as the 1000 Genomes Project. For the first time we comprehensively analysed whole genomes of a Kinh Vietnamese (KHV) trio (father, mother and son). The genomes were sequenced to 30-fold average coverage by the Illumina HiSeq 2000 machine. We obtained 578 million (562 million and 493 million) clean paired-end reads of 100 base pair length from the son genome (father genome and mother genome, respectively).

We used state-of-the-art methods, software and pipelines to analyse the sequenced genomes. We identified 4,823,475 single nucleotide polymorphism (SNPs) in KHV trio genomes (Figure 1) of which 109,914 (2.3%) are novel or KHV-specific SNPs, i.e. those that were not present in either dbSNP or the 1000 Genomes Project database.

We identified 974,100 short indels (length \leq 100bp) in the KHV trio genomes consisting of 465,609 insertions and 508,491 deletions. We compared the Mendelian-compatible indels with the 1000 Genomes Project database and found that 59,119 (7.15%) indels are novel or KHV specific.

All mapped reads with quality greater than or equal to 20 were used to identify large structural variants (length \geq 100bp). There were 6,681 Mendelian supported large indels in the range of 0.1–100 kbp consisting of 2,855 insertions and 3,826 deletions. Most of these large indels have length ranging between 100 to 500 bp and there are no insertions longer than 500 bp.

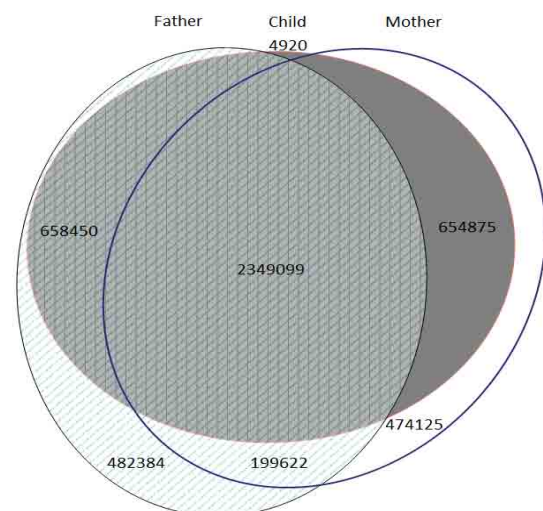


Figure 1: SNP distribution in child, father and mother genomes.

To the best of our knowledge, this is the first Vietnamese whole genome-wide study at a high coverage level. We believe that this study will be an important reference for further genomic studies of Vietnamese and Southeast Asian populations. Finally, the novel variants identified from the KHV trio genomes demonstrated the necessity of conducting more genome-wide studies for Vietnamese and other populations to complete the picture of human genome variations.

- [1] Dang Thanh Hai, Nguyen Dai Thanh, Pham Thi Minh Trang, Le Si Quang, Phan Thi Thu Hang, Dang Cao Cuong, Hoang Kim Phuc, Nguyen Huu Duc, Do Duc Dong, Bui Quang Minh, Son Bao Pham, Le Sy Vinh, (2015), Whole Genome Analysis of a Vietnamese trio, *Journal of Bioscience*, 40(1) 114-123.
- [2] Nguyen Dai Thanh, Pham Thi Minh Trang, Dang Thanh Hai, Nguyen Ha Anh Tuan, Le Si Quang, Bui Quang Minh, Dao Quang Minh, Pham Bao Son, Le Sy Vinh, Building population-specific reference genomes: A case study of Vietnamese reference genome, 2015 Seventh International Conference on Knowledge and Systems Engineering, 97-102.
- [3] Dang Thanh Hai, Nguyen Dai Thanh, Pham Thi Minh Trang, Dang Cao Cuong, Hoang Kim Phuc, Son Bao Pham, Le Sy Vinh, Le Si Quang, Phan Thi Thu Hang, Preliminary Results on the Whole Genome Analysis of a Vietnamese Individual, *VNU Journal of Science: Com. Science & Com. Eng.*, Vol. 30, No. 3 (2014) 31-35.

Automated Conversion between Formal Specifications and Application for Software Verification

Pham Ngoc Hung (VNU-UET)

ABSTRACT: The assume-guarantee tool has been built for verifying component-based systems in order to solve the state space explosion problem in model checking. This tool is potential to be applied in practice. However, the tool works in command-line interface and uses a simple input/output format so that it is difficult to be used. In order to improve the tool for better using in practice, we implement a graphical user interface tool with many more features. The implemented tool supports multiple input/output formats so it can interact with other model checker tools (i.e., Labeled Transition System Analyzer). By these new features, the tool can reuse the existed models of these model checkers without converting. The assumptions generated by this tool can be saved for future uses in order to recheck systems effectively, specially in the context of software evolution. With these improvements, we hope that the tool will become popularly and will be applied in practice.

The assumption generation tool has been implemented to support the assume-guarantee verification method proposed in [1]. It has an important role in our researches. Many experiments in our researches are done by this tool to compare the proposed methods with that in [2]. We hope that this tool will be useful in software community in the near future where researches related to the assume-guarantee approach.

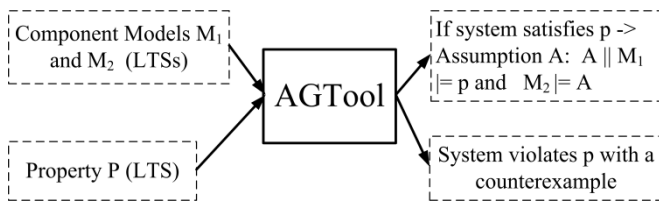


Figure 1: Function of AGTool.

The function of AGTool is described in Fig. 1. The inputs of this tool are two models M_1 , M_2 and a required property p which are all represented by Labeled Transition Systems (LTSS). The tool returns either an assumption A if the system satisfies the property p or a counterexample to identify a violation. The output of AGTool is represented in the listing form (LF) format and simply displayed in console interface. Not only difficult to understand, this output also cannot be saved for future uses. In order to reuse this output, it must be saved and manually converted to LTS before reused.

In order to solve the above issues, this research proposes two techniques for converting between the LF and Finite State Process (FSP) formats. The technique for converting the FSP format to LF format allows the tool to accept the FSP format as another input format while the LF to FSP technique provides a mechanism to store the generated assumptions for future uses.

The FSP to LF technique includes two following steps: parsing an FSP file in order to obtain FSP data and converting the obtained FSP data to a corresponding LF representation. In order to obtain an FSP data from an input file, we create a context-free grammar to describe FSP and use the OCaml parser module to analyze this file. The grammar includes Identifier to denote names of state and ActionLabel to denote labels of transitions. The both denotations are made of combining from letters and digits. After using the grammar to parse the input file, the

obtained FSP data will be converted to the LF format. For the purpose in converting LF to FSP, the technique loops through the list of transitions. If two transitions have the same starting and finishing states then their labels are combined together to make a new FSP process. If two transitions have the same starting states but different finishing states then they are two child processes of an FSP process.

The inputs of the proposed techniques contain a list of finite states and transitions. Moreover, these techniques simply have a counted loop structure thus they always terminate. It means the proposed algorithms stop when all transitions and states are all visited. However, the grammar used in this language only describes a subset of the FSP grammar. As a result, these algorithms only convert LTSS in a subset of FSP. Even though, this grammar is enough to represent LTSS in FSP format and can be reused by other tools.

We have implemented a graphical user interface tool for assume-guarantee verification called GUI-AGTool presented in Fig. 2. The proposed techniques for converting between FSP and LF are also integrated to the GUI-AGTool. Thus, the GUI-AGTool can provide three ways to read inputs about component models and required properties: (i) reading an input file in LF, (ii) reading an input file in FSP and converting this FSP data into the LF format before given to AGTool, (iii) allows users to draw input LTSS in a graphical interface then converts these drawing models into the LF format. Furthermore, the generated assumptions of this tool are visualized and displayed in a panel for easier understanding and can be saved for future uses in FSP format.

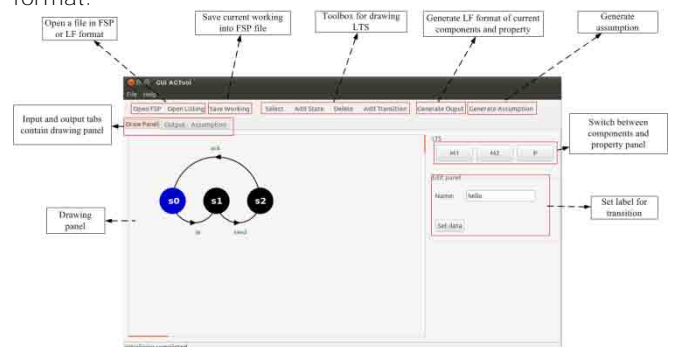


Figure 2: Functions of GUI-AGTool.

[1] J. M. Cobleigh, D. Giannakopoulou, and C. S. Pășăreanu. Learning assumptions for compositional verification. In Proc. of the 9th Inter. Conf. on Tools and algorithms for the construction and analysis of systems, TACAS'03, pages 331–346. Berlin, Heidelberg, 2003.

[2] P. N. Hung, V.-H. Nguyen, T. Aoki, and T. Katayama. Assume-guarantee tools for component-based software verification. In Proc. of the 2010 2nd Inter. Conf. on Knowledge and Systems Engineering, KSE'10, pages 172–177, Washington, DC, USA, 2010.

**RESEARCH ACHIEVEMENTS
IN
ELECTRONICS AND COMMUNICATIONS**

Improvement of Step tracking Algorithm Used For mobile Receiver System Via Satellite

Research topics: Auto-tracking system, Discrete-time controller, Fuzzy PID controller, Satellite communication, Step-tracking algorithm

Tran Van Hoi, Nguyen Xuan Truong, Bach Gia Duong (VNU-UET)

ABSTRACT: In the mobile communication via satellite, received systems are mounted on the mobile device such as ship, train, car or airplane. In order to receive continuous signals, received antenna system must be steered in both the azimuthal and elevation angle to track a satellite. This paper proposes the improved step-tracking algorithm using for mobile receiver system via satellite Vinasat 1. This paper also presents the results of study, design and manufacture of the discrete-time controller system for the fast tracking of a satellite by applying an improved step tracking algorithm with fuzzy proportional integral derivative controller. Simulated and experimental results indicate that the system performances obtain from applying the improved step tracking algorithm and the fuzzy controller was better than traditional control systems.

In the communication ways, satellite communication is known such as a means of providing not only fixed broadband and internet services but also provides mobile communication services and services of a new generation networks. The satellite received system shown in Figure 1, which consists of a satellite antenna, a low-noise block-down converter (LNB), a set-top box tuner, antenna control unit (ACU) and mechanical system.

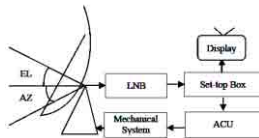


Figure 1

In order to receive signal efficiently from the satellite, particularly, on a mobile satellite communication system, a satellite antenna must be controlled to track a target satellite accurately. Tracking capabilities depend on many parts, for example tracking algorithm, the beam width of the antennas, the speed of mobile motions and the response time of motor controller. One of the traditional tracking algorithm is used a step tracking algorithm [1]. However, algorithm was mainly applied for system, which has stable signal and not fading such as ship board system, fixed receiver system. Many antenna tracking system using step tracking algorithm have been implemented [2]. But tracking time is limited.

This paper proposes improved step tracking algorithm by combining traditional step tracking algorithm with opened-loop algorithm, which use global positioning system (GPS) receiver and angle sensor in order to decrease tracking time of controller. Moreover, in the proportional integral derivative (PID) control system, due to the effects of noise and measurement errors as well as non-linear nature of the engine, leading to the calibration parameters of the PID controller is difficult to achieve good values, specially the response time is not optimal. Therefore, control system is performed by using a fuzzy controller to decrease response time. To demonstrate the effectiveness of the system, the paper describes the design and fabrication of a control system, which has been capable of searching and satellite auto-tracking used for Vinasat-1. The architecture of the tracking control system is shown in Figure 2.

Center microcontroller receives signals from inputs such as keyboard, GPS receiver, AGC, angle sensors, encoder. After that, microcontroller implements control process using the combined tracking algorithm with fuzzy PID controller.

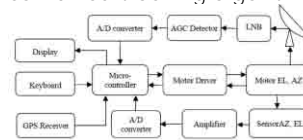


Figure 2



Figure 3

The electronic scheme and tracking control system are shown in Figure 3. Motor driving circuit uses power transistors. System uses microcontroller Atmega-128 that is 8 bit micro controller. The system performs searching mode in the time from 0 to 5 seconds, then moves to tracking mode and turn to stable mode. When the receiver system moves, the received antenna would be disoriented, so the system switches to tracking mode and the time to track and return stable state takes about 2-4s when using step-tracking algorithm and about 0.5-0.7s when using opened-loop algorithm or improved step tracking algorithm. We can see that when using the combined tracking algorithm the tracking time is shortened time equivalent when using opened-loop algorithm, but the quality of signal is more stable due to combining step-tracking algorithm to tune the antenna position more accurately.

This paper proposed improved step tracking algorithm by combining step tracking and opened-loop algorithm to decrease tracking time. The paper also presented the study, design and fabrication of the searching and satellite auto-tracking system used for mobile satellite receiver. In order to decrease response time, the system also applied fuzzy control method to design self-tuning fuzzy PID controller. The result shows that the system applies improved tracking algorithm with fuzzy PID controller has a better performance in response time, tracking time.

More information on our design can be found in [3].

The research has been sponsored by Vietnam Academy of Science and Technology and carried out at University of Engineering and Technology, VNU.

[1]Chang-Ho C., Sang-Hyo L., Tae-Yong K., and Cheol L. "Antenna Control System Using Step Tracking Algorithm with H ∞ Controller". *International Journal of Control, Automation and System*. Vol 1, No. 1, pp 83-92, 2003.
 [2] Weimin Jia, Luyao Hao, Kai Du. "Step tracking algorithm based on finite difference stochastic approximation for SATCOM on-the-move". *International Conference on Electric Information and Control Engineering*. pp. 2632 –2635, 2011.
 [3]Tran Van Hoi, Nguyen Xuan Truong, Bach Gia Duong, "Improvement of Step tracking Algorithm Used For mobile Receiver System Via Satellite", *International Journal of Electrical and Computer Engineering (IJECE)*, Vol. 5, No. 2, April 2015, pp. 280–288

Investigation of Rectifier Circuit Configurations for Microwave Power Transmission System Operating at S Band

Research topics: Conversion efficiency HSMS2820. Microwave power transmission Rectifier, Wireless power transmission.

Doan Huu Chuc (Hai Phong Private University), Bach Gia Duong (VNU-UET)

ABSTRACT: The purpose of this work is to propose rectifier circuit topologies for microwave power transmission system operating at ISM band. This paper particularly presents in detail the proposed rectifier circuit configurations including series diode half wave rectifier and voltage double rectifier. The maximum conversion efficiency of rectifier using series diode half wave rectifier is 40.17 % with 220 Ω load resistance whereas it is 70.06 % with 330 Ω load resistance for voltage double rectifier. Compared to the series rectifier circuit, it is significant to note that the voltage double rectifier circuit has higher efficiency. The circuits presented are tuned for a center frequency of 2.45 GHz. The rectifiers were fabricated using microstrip technology. The design, fabrication and measurement results were obtained using a well-known professional design software for microwave engineering, Advanced Design System 2009 (ADS 2009). All design and measurement results will be reported.

Microwave power transmission (MPT) is one of the hot topics in microwave and millimeter wave devices, circuit, and systems. Microwave power transmission has had a long history before the more recent movement toward wireless power transmission (WPT). MPT research has been driven primarily by the desire to remotely power unmanned aerial vehicles (UAVs) and by the concept of space solar power (SPS) first by Dr. Peter Glaser of the Arthur D. Little Company in 1968. MPT can be applied not only to beam type point to point WPT but also to an energy harvesting system fed from distributed or broadcasting radio waves. A rectifying antenna (Rectenna), which is used to convert the microwave power to the direct current (DC) power, is one of the key components of the MPT system. A rectenna is a passive element with rectifying diodes that operates without an internal power source. It can receive and rectify microwave power to DC power [1], [2]. A general block diagram of a conventional rectenna is shown in Figure 1. Rectenna consists of a receiving antenna, low pass filter, rectifying circuit (rectifier) and output filter (DC filter). The output voltage of rectenna is fed to load resistance.

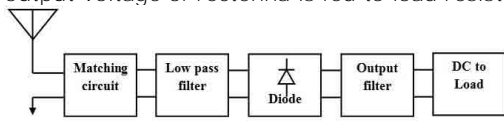


Figure 1

In this paper, we are presenting the design, simulation and fabrication of two rectifier circuit topologies for microwave power transmission operating at S band. The first part of this paper presents several design challenges of rectifier circuit. Fabrication and measurement of the proposed rectifier models are presented in the subsequent parts. The printed circuit board (PCB) technology is used to minimize the circuit size and losses. Finally, conclusions and future work of this research are discussed.

1. Series Diode Half Wave Rectifier

With the series diode half wave rectifier, it has been found in the experiment that this rectifying circuit has the DC voltage of 5.7 V at 2.45 GHz with the load resistance of 220 Ω when input power level is 26 dBm. The output voltage and the measured RF-DC conversion efficiency of the series rectifier are shown in Figure 2.

The highest conversion efficiency reaches 40.17 % with the load resistance of 220Ω at the input power of 24 dBm.

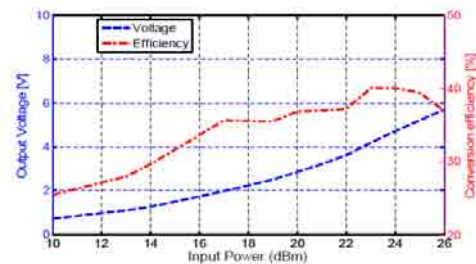


Figure 2

2. Voltage Double Rectifier

The voltage double rectifier (VDR) is an amplitude amplifying circuit that uses dual diodes.

Figure 3 Series diodes half wave and voltage double rectifier circuit configurations have been researched, designed and measured for different load resistances. Good performances have been obtained in terms of microwave to-DC conversion efficiency. The measured conversion efficiency of voltage double rectifier is over 70 %. The measured efficiency values are plotted in figure 3.

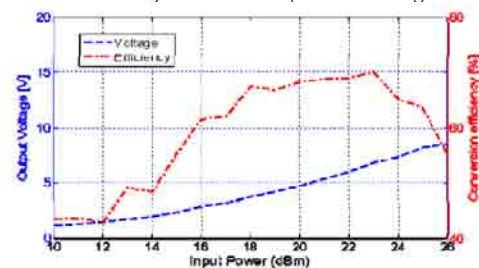


Figure 3.

The proposed rectifier circuits can be used for microwave power transmission systems applications. For future work, the objective is to increase the rectifier performance in term of microwave – to – DC conversion efficiency.

More information on our design can be found in [3].

This work has been sponsored by Vietnam National University, Hanoi (VNU), under Project No.QG.15.27.

[1] N. Shinohara, "Rectennas for microwave power transmission", *IEICE Electronics Express*, vol. 10, No. 21,

[2] Mohamed Louzazni, El Hassan Aroudam, Hanane Yatimi, "Modeling and Simulation of A Solar Power Source for a Clean Energy without Pollution", *International Journal of Electrical and Computer Engineering (IJECE)*, Vol.3, No. 4, August 2013.

[3] Doan Huu Chuc, Bach Gia Duong, "Investigation of Rectifier Circuit Configurations for Microwave Power Transmission System Operating at S Band", *International Journal of Electrical and Computer Engineering (IJECE)*, Vol. 5, No. 5, October 2015, pp. 967~974

Improved time and frequency synchronization in presence of imperfect channel state information

Research topic: OFDM synchronization, IEEE 802.11a wireless communication systems

Cong Luong Nguyen, Anissa Mokraoui, Pierre Duhamel, Nguyen Linh-Trung (VNU-UET)

ABSTRACT: This paper addresses altogether time and frequency synchronization in IEEE 802.11a OFDM wireless communication systems. We propose a joint MAP time and frequency synchronization algorithm novel algorithm which makes use of the additional source of information available at the SIGNAL field of the IEEE 802.11a physical layer, on top of the usual ones typically adopted for synchronization such as training sequences. The time synchronization is also fine tuned by means of a specific metric in the frequency domain that allows us to minimize the expectation of the transmission error function over all channel estimate errors. Simulation results for both indoor and outdoor environments show that the algorithm drastically improves the performance in terms of synchronization failure probability and bit error rate.

Due to its flexibility and efficiency in coping with interference channels, orthogonal frequency division multiplexing (OFDM) has been adopted by many recent standards, among which is the IEEE 802.11a standard. However, the main disadvantage of this technique is the sensitivity to intersymbol interference (ISI) and intercarrier interference (ICI) caused by time and

frequency synchronization errors. Therefore, accurate time and frequency synchronization is absolutely required at the receiver.

The physical packet structure of the IEEE 802.11a wireless communication system is shown in Figure 1. It consists of three main fields: PREAMBLE, SIGNAL, and DATA. The PREAMBLE field helps the mobile receiver to synchronize with the mobile transmitter. The SIGNAL field provides information about the transmission rate (in Mbits/s) and the length of field DATA field (in octets).

Before being transmitted, the IEEE 802.11a physical packet must follow the various processing steps summarized in Figure 2.

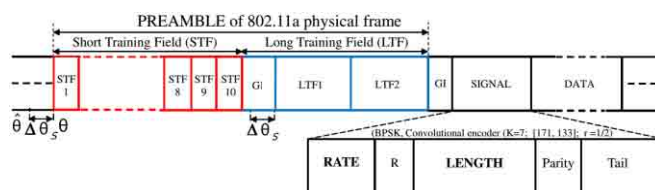


Figure 1: IEEE 802.11a physical packet.

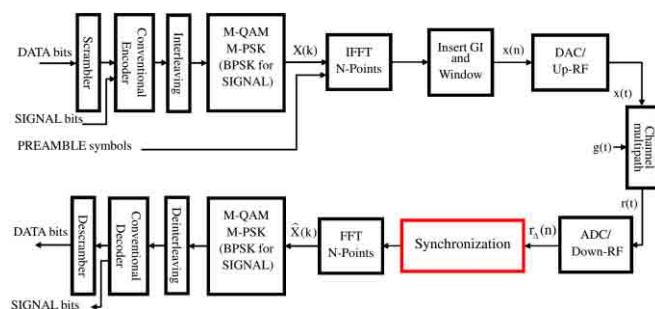


Figure 2: Wireless system using OFDM

At the receiver, the discrete baseband received signal is expressed as

$$r_{\Delta}(n) = \sum_{i=1}^{L-1} h(i)x(n-i-\theta)e^{j2\pi\epsilon(n-\theta)/N} + g(n),$$

where $h(i)$ is the slowly time-varying discrete complex channel impulse response, L is the number of the channel taps, $g(n)$ is the complex AWGN samples with variance σ_g^2 , θ is the symbol timing, and ϵ is the normalized Carrier Frequency Offset (CFO). Estimating θ and ϵ is the objective of OFDM synchronization.

The proposed multistage synchronization algorithm is composed of an initialization stage followed by three main stages as summarized in Figure 3. Its performance under the COST-207 channel is shown in Figure 4.

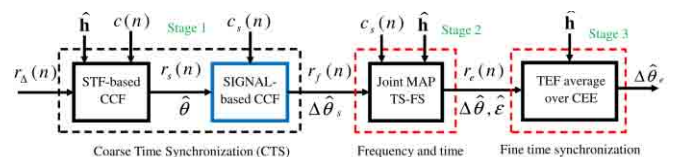


Figure 3: Proposed time and frequency synchronization algorithm.

Initialization: extract new information source to be exploited at physical layer packet

Stage 1: perform coarse symbol timing estimation using the known STF and improve this estimation using the predicted SIGNAL field;

Stage 2: perform a joint maximum a priori probability (MAP) time and frequency synchronization;

Stage 3: perform a frequency domain based fine timing estimation.

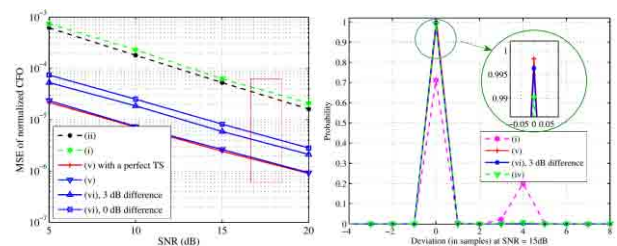


Figure 4: Performance of the proposed algorithm (v and v_i) under the COST207-RA channel: (a) MSE of normalized CFO, (b) Deviation with respect to the true time position of a physical packet.

More information on our design can be found in [2].

- [1] C. L. Nguyen, A. Mokraoui, P. Duhamel, N. Linh-Trung, "Improved time and frequency synchronization in presence of imperfect channel state information", *EURASIP Journal on Wireless Communications and Networking*, 2015(42):1-17, Feb. 2015.
- [2] C. L. Nguyen, A. Mokraoui, P. Duhamel, N. Linh-Trung, "Improved Time and Frequency Synchronization Algorithm for 802.11a Wireless Standard based on the SIGNAL Field", *REV Journal on Electronics and Communications*, 3(1-2):40-49, Jan.-June, 2013.

Radio Resource Allocation and Mobility Management in Cognitive Cellular-Femtocell Mobile Communications Networks

Research topics: Mobile networks, channel allocation, mobility management

Kien D. Nguyen, Toan V. Nguyen, Bac X. Nguyen, Dong N. Hoang and Nam-Hoang Nguyen (VNU)

ABSTRACT: Cognitive radio and femtocell are promising technologies which can satisfy the requirements of future mobile communications in terms of dynamic spectrum sharing and high user density. In the research project QG.13.06 sponsored by Vietnam National University Hanoi, we proposed mechanisms of channel allocation and femtocell selection schemes. We also designed a simulation tool for radio resource management and mobility management for cognitive cellular-femtocell mobile communications networks.

The evolution of wireless communication technologies and mobile devices leads to the fast growth of the number of mobile users and the amount of data delivered in mobile networks. Cognitive radio and femtocell are considered as the key technologies which are expecting to build cognitive femtocell mobile networks for the future 5th generation (5G) mobile communications [1].

The system model of cognitive cellular-femtocell network is described in Fig 1. We assume that Femtocell Management System (FMS) and Mobile RAN Management System (MRMS) have periodical information exchange. The interaction between these two entities is for supporting mobility management and radio resource management. Using this model, we have designed uplink/downlink channel allocations schemes, femtocell selection schemes for femtocell handover and a simulation tool used for performance evaluation of the proposed schemes.

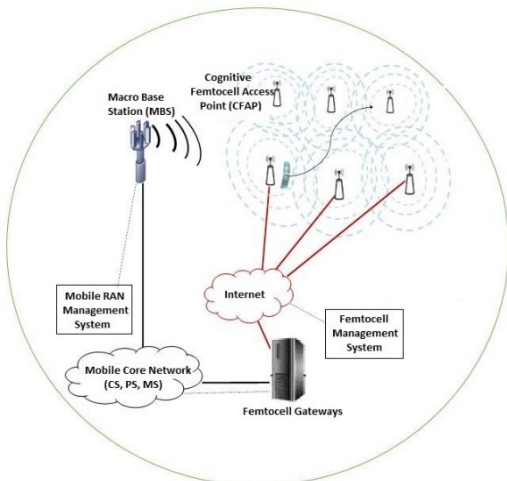


Figure 1. Cognitive cellular-femtocell network model

The downlink transmission quality of femtocell users (FU) can be degraded because of downlink interference caused by Macro Base Stations (MBS) and Cognitive Femtocell Access Points (FAP). When a FU is assigned a downlink channel, the channel might be being suffered high interference. In [1], we proposed a cooperative channel monitoring mechanism and a downlink channel allocation

scheme which can support to eliminate bad channels and allocate a low interference downlink channel to FU.

For uplink transmission, FU's connections can cause strong interference to uplink transmission of macro users (MUs) and vice versa. Uplink channel allocation schemes presented in [2] show that when allocating uplink channels to FUs, the system should give higher priority to choose a channel of MBS which has the lowest interference.

When a femtocell user (FU) moves between femtocells, femtocell-to-femtocell handover is a very important and difficult task when considering the scenario that CFAPs are deployed with a high density. In [3], we have proposed two femtocell selection schemes in which one scheme selects the target CFAP of handover based on the prediction of user movement in order to reduce the number of unnecessary handover. Another scheme selects the target CFAP based on its available capacity. A combination of these schemes is considering as the best solution of femtocell selection.

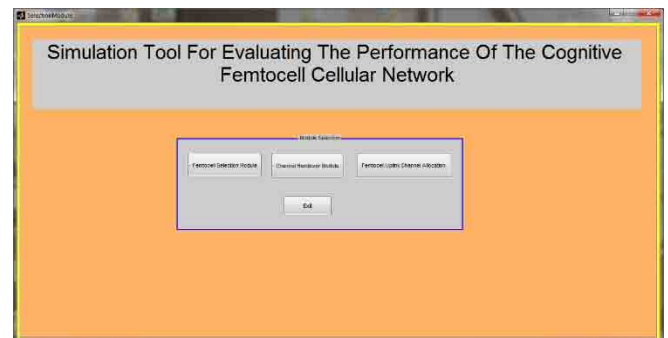


Figure 2. GUI of Simulation tool

To evaluate the performance of the proposed channel allocation and femtocell selection schemes, we designed a simulation tool which is easy to use, modify and develop [4]. The simulation tool has been used by undergraduate and graduate students for doing research in radio resource management and mobility management of cognitive cellular-femtocell mobile communications networks.

Our future works are going to focus on the investigation of mechanisms for power allocation considering real-world mobility scenarios in 5G mobile communications.

- [1] Van-Toan Nguyen, Hoang Nam Nguyen et al., Downlink Channel Allocation Scheme deploying Cooperative Channel Monitoring for Cognitive Cellular-Femtocell Networks, *Journal of Networks*, Vol 10, No 6 (2015), pp.: 338-343, June 2015
- [2] Duc-Kien Nguyen, Nam-Hoang Nguyen et al., Scheme and QoS Management Mechanism for Cognitive Cellular-Femtocell Networks*, *International Journal of Communication Networks and Information Security (IJCNIS)*, Vol 6, No 1, 2014, April 2014
- [3] Nhu-Dong Hoang, Nam-Hoang Nguyen et al., Cell Selection Schemes for Femtocell-to-Femtocell Handover deploying Mobility Prediction and Downlink Capacity Monitoring in Cognitive Femtocell Networks, *TENCON2014*, 22-25 Oct. 2014, Bangkok, Thailand
- [4] Xuan-Bac Nguyen, Nam-Hoang Nguyen et al., Cognitive Cellular Femtocell Network Modeling and Simulation for Performance Comparison of Uplink Channel Allocation Schemes, *IEEE TENSYP* 2014, Kuala Lumpur Malaysia, on 14-16 April 2014

On the Reuse of Shadowed CRs as AF Diversity Relays in Cooperative Spectrum Sensing in Correlated Suzuki Fading Channels

Research topics: Cognitive Radio, cooperative spectrum sensing, cooperative relay, Suzuki fading.

Thai-Mai Dinh Thi (VNU), Quoc-Tuan Nguyen (VNU), Dinh-Thong Nguyen(UTS, Australia)

ABSTRACT: Most recent work on cooperative spectrum sensing using cognitive radios has focused on issues involving the sensing channels and seemed to ignore those involving the reporting channels. Furthermore, no research has treated the effect of correlated composite Rayleigh-lognormal fading, also known as Suzuki fading, in cognitive radio. This paper proposes a technique for reuse of shadowed CRs, discarded during the sensing phase, as amplified-and-forward (AF) diversity relays for other surviving CRs to mitigate the effects of such fading in reporting channels. A thorough analysis of and a closed-form expression for the outage probability of the resulting cooperative AF diversity network in correlated composite Rayleigh-lognormal fading channels are presented in this paper. In particular, an efficient solution to the "PDF of sum-of-powers" of correlated Suzuki-distributed random variables using moment generating function (MGF) is proposed.

Cooperative spectrum sensing using cognitive radio (CR) has proved to be a reliable technique for combating deep fading during the sensing a primary user. The sensing is carried out in two phases: in the sensing phase, the CRs independently measure and process the signal from the primary user, and in the reporting phase the CRs independently report the processed information to a fusion center (FC) which is usually a cognitive base station and which will make the final global sensing decision as to whether the primary user is present or absent. In many standard fusion rules, it is easy to see that the inclusion of deeply faded CRs, i.e. with low SNRs, in the decision fusion at the FC diminishes the reliability of the cooperative detection of the primary user. Thus by discarding the detection contribution from shadowed CR sensors, the detection probability of the cooperative sensing network can be improved.

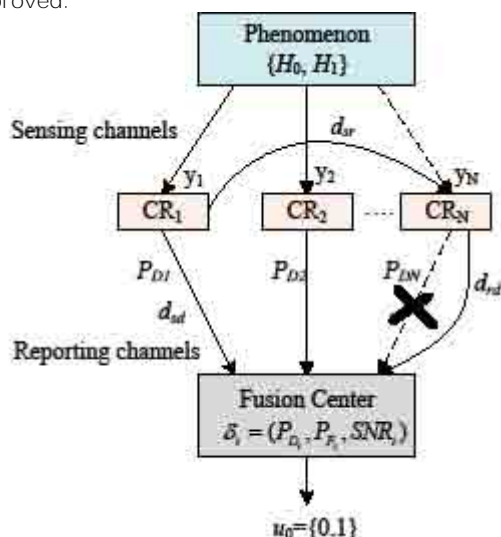


Figure 1: A model of cooperative spectrum sensing in Cognitive Radio in a deep fading environment

In reality, when the distances between CRs and the FC are of significant in suburban macrocells or under shadowing in urban microcells, loss and fading is a significant issue. As one of solutions, cooperative diversity relaying may be used to improve the performance of the reporting wireless channels. The cooperative diversity relay can process the information that it receives from the source and forward the

information to the destination using either amplify-and-forward (AF) or decode-and-forward (DF) protocols.

In an earlier paper [1], we proposed an innovative re-use of those CRs under deep fading of the sensing channels by re-assigning them to act as diversity relays to their more healthy peers in the reporting channels, thus improving the global detection reliability of the fusion center. However, in [1], the fading mechanism in the reporting channels is assumed to be uncorrelated Rayleigh-lognormal distributed, also known as the Suzuki fading channel. The proposed pairing algorithm which selects surviving-rejected CR pairs to form cooperative diversity relaying networks, involves searching for pairs that produce lowest outage probabilities of the resulting networks.

In this paper, we would like to consider a more complicated and more realistic context, cooperative relay over correlated Suzuki faded reporting channels. We present a new idea to derive a closed-form expression for the sum of two correlated Suzuki distributed RVs, hence for derivation of a closed-form and accurate expression for the probability of outage probability P_{out} of the resulting three-terminal cooperative diversity AF relaying network under such correlated fading. While the main motivation of our paper is clearly to re-use the shadowed sensing CRs which otherwise will be wasted, its main contribution is more towards the mathematical and computational advance for cooperative diversity relaying using AF protocol.

In particular, an efficient solution is proposed to the fundamental problem of "PDF of sum-of-powers" of correlated Suzuki-distributed random variables using Gauss-Hermite polynomial approximation to their moment generating function (MGF). This expression allows us to calculate the effective probability of detection P_D and to greatly speed up the execution of the proposed re-use algorithm, giving us the incentive to research a more sophisticated and efficient algorithm. The effectiveness of the strategy was judged on the basis of resulting global ROC curves, i.e. global probability of detection, Q_D , versus global probability of false alarm, Q_F . The benefit of the proposed re-use of shadowed sensing CRs as diversity relays is also proved.

More information on our proposals can be found in [2].

- [1] Thi Thai Mai Dinh, Quoc Tuan Nguyen, Cong Lam Sinh and Dinh-Thong Nguyen, "Algorithm for Reuse of Shadowed CRs as Relays for Improving Cooperative Sensing Performance", Proceedings of IEEE International Conference TENCON 2012, pp. 1-6, 2012.
- [2] Thai-Mai Dinh Thi, Quoc-Tuan Nguyen, Dinh-Thong Nguyen, "On the Reuse of Shadowed CRs as AF Diversity Relays in Cooperative Spectrum Sensing in Correlated Suzuki Fading Channels", IEICE Transaction on Communication, Vol. E98-B, no. 1, pp. 55-68, 2015.

Differential C⁴D Sensor for Conductive and Non-conductive Fluidic Channel

Research topics: Capacitive sensor, microfluidic sensor

Nguyen Dac Hai, Vu Quoc Tuan, Do Quang Loc, Nguyen Hoang Hai, Chu Duc Trinh

ABSTRACT: This work designs and fabrications of a novel design of a differential C⁴D (DC⁴D) sensor based on three electrodes for both conductive and non-conductive fluidic channel. This structure consists of two single C⁴D with an applied carrier sinusoidal signal to the center electrode as the excitation electrode. The electrodes are directly bonded on the PCB with built-in differential amplifier and signal processing circuit in order to reduce the parasitic component and common noise. In the non-conductive fluidic channel, the output voltage and capacitance changes 214.39 mV and 14 fF, respectively when a 3.83 μ l tin particle crosses an oil channel. In conductive fluidic channel, the output voltage and admittance change up to 300 mV and 0.07 μ S for the movement of a 4.88 μ l plastic particle through channel. Moreover, the voltage change of this sensor is linear relation with the volume of investigated particle. This sensor also allows measuring velocity of particle inside fluidic channel and resistivity of the conductive fluidic.

Figure 1 shows a block diagram design of the DC⁴D fluidic sensor based on three electrodes for detecting particles inside both conductive and non-conductive liquid channel. This structure consists of two single C⁴D with an applied carrier sinusoidal signal to the center electrode as the excitation electrode. The differential signal between the top and bottom electrodes is then amplified and demodulated for removing the carrier components. The output signal indicates the different response between two single C⁴D structures. This proposed sensor could detect a particle like plastic particle, air bubble, metal particle and so on inside channel when it passes the electrodes.

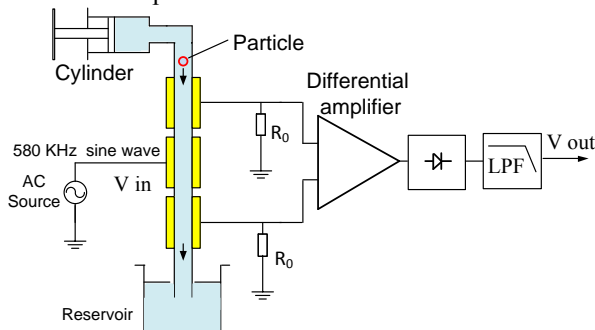


Figure 1: Block diagram design of the DC⁴D fluidic sensor.

In this work, a DC⁴D consists of three electrodes is presented. In this design, there are two pick up electrodes, which are outside electrodes. The center electrode is excited electrode (see Figure 2). The differential signal between the two pick up electrodes indicates changing inside the fluidic channel.

Figure 3 shows output voltage of the DC⁴D sensor when a plastic particle cross electrodes in salt solution and water channel as the investigated conductive fluidic. The output voltage consists of both negative and positive peaks thank to the differential circuit. The output voltage magnitude changes up to 300 mV and 50 mV when a 4.88 μ l plastic particle cross electrodes in water channel and plastic particle cross electrode in salt solution channel, respectively.

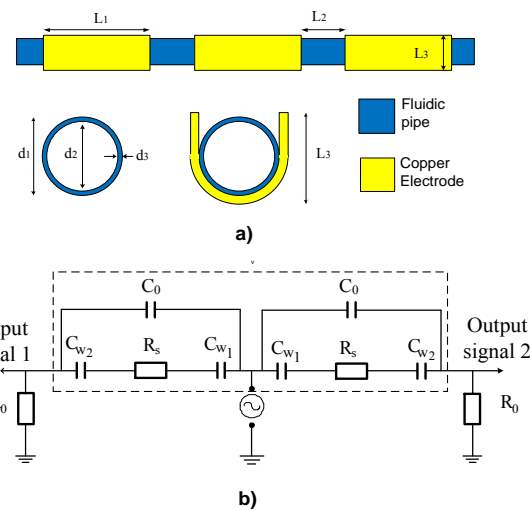


Figure 2: (a) The DC⁴D based on three-electrode configuration; (b) The equivalent circuit

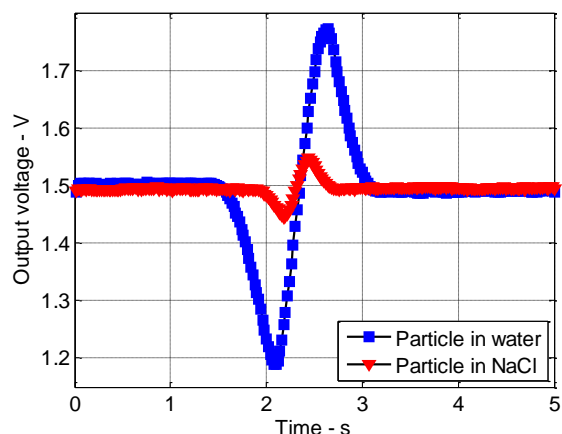


Figure 3: The DC⁴D output voltage response when a plastic particle crosses electrodes: (a) water channel; and (b) salt solution channel

Successive Pilot Contamination Elimination in Multi-antenna Multi-cell Networks

Research topics: Channel estimation, Pilot contamination, Massive MIMO systems.

Thang.X. Vu, Trinh Anh Vu (VNU-UET), and Tony Q.S. Quek

ABSTRACT— Channel estimation is an important problem in Massive MIMO systems, one in the direction of development of the current 5th generation. The performance of such systems are usually bounded by a bottleneck resulted from pilot contamination. We propose two channel estimation schemes that completely remove pilot contamination. The exact closed-form expression for average Mean Square Error (MSE) of the proposed estimators are derived. More importantly, our proposed estimators do not need to know the second-order statistics of neither desired user channels nor interfering user channels. Finally, simulated results confirms gains over existing channel estimation schemes.

In recent years the Massive MIMO systems, a type of MIMO technique applied to cellular mobile networks, has made breakthroughs in mobile communications with high performance of both energy and spectrum

The Massive MIMO systems have the following main features: Number of antennas at the base station is much bigger the mobile number with single antenna. Channels are considered reversible with time division duplex (TDD) and channel estimation techniques use the uplink-pilot from the mobile users

However, the full reuse of frequency at neighboring cells can cause estimated Channel State Information (CSI) in one cell to be contaminated by pilot training in other cells, since the orthogonal property in general is not held among pilot sequences across different cells. Pilot contamination constitutes a performance bottleneck that impairs the advantage of MIMO system in cellular networks and especially in Massive MIMO system

In this report, we propose a novel pilot contamination elimination scheme for Multi antenna multi-cell cellular networks that completely eliminate pilot contamination. Exact closed-form expression for average MSE is provided. More importantly, the proposed estimators does not rely on the assumption that each BS knows the second-order statistics of desired and/or interfering user channels.

Two estimators are proposed to completely remove pilot contamination:

A. The proposed estimator 1

The idea behind this proposed estimator is to promote the BS to run channel estimation as soon as it receives interference. It is realized that all interference in every cell received in 2 phases be subtracted for each other: In the first phase all mobile in all cell transmit the pilots, in the second phase only mobile in this cell does not play. We obtain, for example at cell 1:

$$\tilde{\mathbf{Y}}_1 = \mathbf{Y}(0) - \mathbf{Y}(1) = \mathbf{X}\mathbf{H}_{1,1} + \tilde{\mathbf{Z}}_1,$$

Where $\tilde{\mathbf{Z}}_1 = \mathbf{Z}(0) - \mathbf{Z}(1)$

Applying the LS estimation

$$\hat{\mathbf{H}}_{CE-1} = (\mathbf{X}^H \mathbf{X})^{-1} \mathbf{X}^H \tilde{\mathbf{Y}}_1 = \mathbf{H}_{1,1} + \frac{1}{K} \mathbf{X}^H \tilde{\mathbf{Z}}_1.$$

It is observed that the pilot contamination is completely eliminated

B. The proposed estimator 2

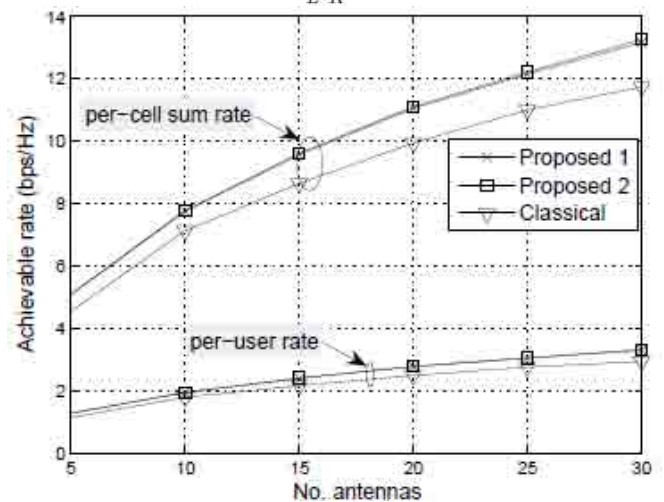
The proposed estimator 2 aims to exploit all L+1 channel observations in order to improve the channel estimation accuracy. During L - 1 phases $2 \leq l \leq L$, Y(l) does not

contain interference from users in the l-th cell. If we take the sum of all Y(l) for $2 \leq l \leq L$, it yields which contains L - 1 times the pilot signal of interest $\mathbf{X}\mathbf{H}_{1,1}$ and L - 2 times the sum of all inter-cell interferences. Based on this observation, the proposed estimator 2 that reads:

$$\begin{aligned} \tilde{\mathbf{Y}}_2 &= \mathbf{Y}(0) + \sum_{l=2}^L \mathbf{Y}(l) - (L-1)\mathbf{Y}(1) \\ &= \tilde{\mathbf{X}}\mathbf{H}_{1,1} + \tilde{\mathbf{Z}}_2, \end{aligned}$$

Then applying LS estimation

$$\begin{aligned} \hat{\mathbf{H}}_{CE-2} &= (\tilde{\mathbf{X}}^H \tilde{\mathbf{X}})^{-1} \tilde{\mathbf{X}}^H \tilde{\mathbf{Y}}_2 \\ &= \mathbf{H}_{1,1} + \frac{1}{L^2 K} \tilde{\mathbf{X}}^H \tilde{\mathbf{Z}}_2. \end{aligned}$$



Compared to the previous works our scheme is not requires the covariance matrices of both desired user channels and interfering user channels and saves some pilot symbols and does not suffer from the peak power problem.

Although support less maximum number of users than classical scheme, the proposed one shows more advance when active users number per cell is not too large. Two estimators are proposed to completely remove pilot contamination. The exact closedform expression for average Mean Square Error (MSE) of both estimators are provided. The gains over existing channel estimation scheme are confirmed via simulated results.

More information on our proposal can be found in [1].

[1] Vu, T. X., Vu, T. A., & Quek, T. Q. Successive Pilot Contamination Elimination in Multiantenna Multicell Networks. IEEE Wireless Communications Letters, Vol.3(6),617-620, Dec. 2014. ISSN: 21622337

Flexible and Efficient Wireless Sensor Network for Detecting Rainfall Induced Landslides

Research topics: Wireless Sensor Network (WSN)

Chinh D. Nguyen (VNU), Tan D. Tran (VNU), Nghia D. Tran, Tue Huu Huynh, Duc T. Nguyen

ABSTRACT: Landslide is the dangerous phenomena. There are some studies about landslide monitoring system based on WSN technique. But no WSN is the preferred standard for landslide monitoring system. This paper focuses on the development of a flexible and efficient WSN for detecting rainfall induced landslides. A flexible switching between star and tree topologies is used to adapt to weather conditions in order to maximize the reliability of the transmission. Moreover, the power management is designed concurrently with the weather condition to improve both the operation reliability and the power efficiency.

These landslide monitoring systems can split into two groups: long term and short term monitoring. For short term monitoring systems, Wireless Sensor Networks (WSN) have proved its advantages such as real-time monitoring of different geographical regions, remote monitoring, and the system being easily extended. There are methods proposed to monitor and/or predict landslides.

Our WSN system consists of sensor nodes that are capable of data acquisition, data storage, data processing, and wireless data transmission. The proposed WSN provides method to collect data on soil pore water pressure, moisture content, vibration of earth, soil movement and temperature of the environment.

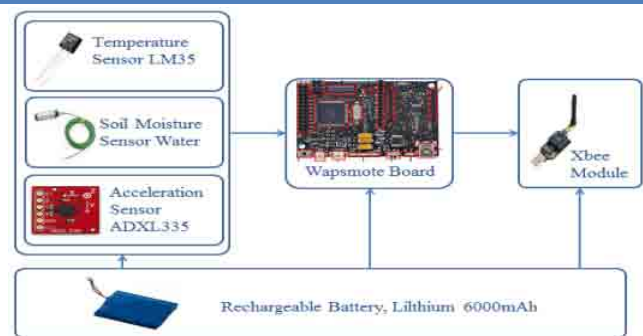


Figure 2. Block diagram of a sensor column

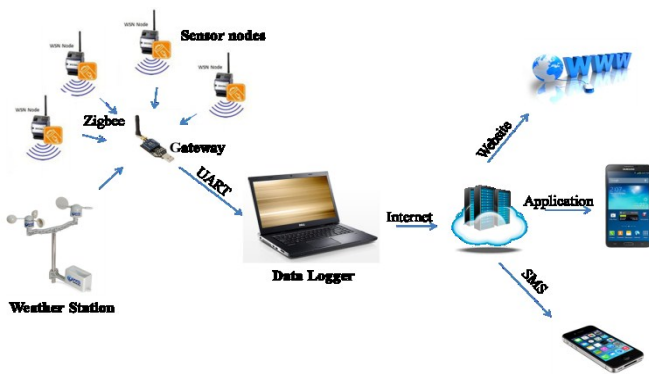


Figure 1: Illustration of the system connection in our proposed WSN

The software modules implemented in WSN include three main modules: Data acquisition module, Data processing module (sensor sampling, health monitoring, power saving) and Data communication module. In our work, for detecting rainfall induced landslides we propose a flexible and efficient configuration as illustrated in Fig.3. The total average power of a sensor column in the active mode is comgiven by $\Sigma(I \times V) = 100.255 \text{ mW}$, and the total average power of a sensor column in the sleep mode is calculated as 0.18 mW.

In practice, the lifetime of the sensor columns will vary from 161 to 1162 days (depend on the weather in this year).

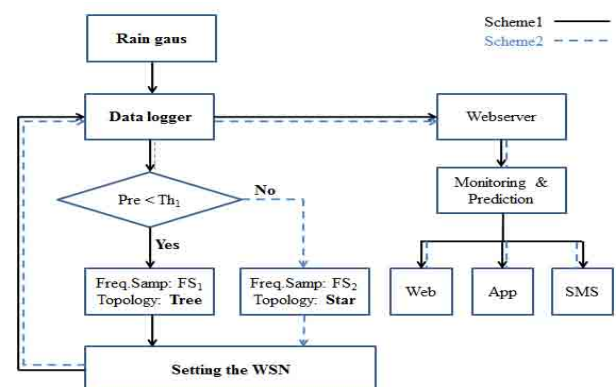


Figure 3: The working principle of the proposed WSN that shows the flexible configuration to the weather condition

Based on OMNeT++, this network is simulated including network topology (e.g. star), network protocol and parameters of hardware. Some simulation parameters in the physical layer are shown as: the output power level is 10 dB, the received sensitivity is -100 dBm, the system operating margin is 99.9%, the gain of the antenna is 6 dBi, and the range of frequency is 2.405-2.465 GHz.

A flexible switching between star and tree topologies is used to adapt to the weather condition in order to maximize the reliability of the transmission.

More information on our design can be found in [1].

Self-Deployment Strategy for a Swarm of Robots with Global Network Preservation to Assist Rescuers in Hazardous Environments

Research topics: Multirobot Systems, Connectivity Control, Network Preservation

D-H. Pham (VNU), M-T. Pham (VNU), Q-V. Tran (VNU), T-D. Ngo

ABSTRACT: We present a self-deployment strategy for a robot swarm to explore and identify victims in an unknown structured environment while preserving a global network interconnectivity. The strategy reduces swarm population while increasing its capacity of exploration and coverage. It is conducted in two phases: self-displacement and then self-dispersion and aggregation for exploration and coverage in each room. A decentralised control is built up by decentralised node control governing the dispersion and aggregation and decentralised connectivity control guaranteeing the global network preservation.

Swarm robotics has been received a lot of attentions due to its challenges and potential applications. A swarm of mobile robots can be utilised in hazardous environments for exploration and rescue services, surveillance and reconnaissance and patrolling. Deployment strategy for exploration, search and rescue services in large-scale unknown environments is one of the most challenges of swarm robotics. Existing deployment algorithms are classified into three main streams: Voronoi graph based unifying geometric method, probabilistic model based controllers, and artificial potential field (APF) based controller. APF was widely used, such as for deployment of mobile sensor networks in [1], where robots automatically disperse out to cover all areas in the environment. However, this neither guarantees the global robot network preservation nor controls mobility of the robots and their connectivity.

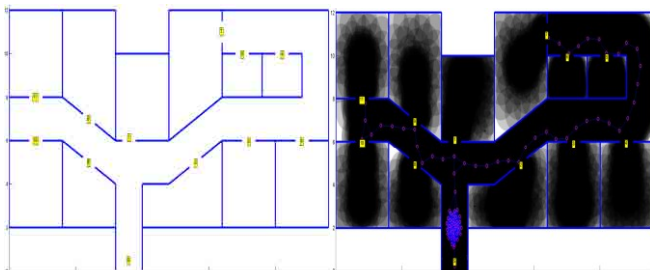


Figure 1: a) Environment map b) Exploration result

We propose a self-deployment strategy for a swarm of mobile robots in unknown structured building environment and design a decentralized controller for two primary objectives: preserving the global network integrity during deployment and reducing the number of robots used for exploration and coverage, compared to the strategy in [1]. The decentralised control for all mobile robots is synthesised in a hierarchical structure: decentralised node control (DNC), added on behavioural control to keep the swarm connected robustly, and decentralised connectivity control, implemented on top of the DNC to allow for connectivity topologies minimisation by selectively removing redundant connectivities in global network. The self-deployment algorithm includes two phases. In self-displacement phase the swarm shifts from room to room in three stages: moving along the corridor to explore victims, anchoring the robots to establish the network backbone, and recognising the doors for the self-dispersion and aggregation.

In self-dispersion and aggregation phase, robots are first dispersed away, then the swarm is self-formed to hexagons in the presence of obstacles so that the swarm can adapt to disperse in different structured areas. If victims are identified, the information is sent to the base station via the well maintained backbone. Once the room is fully covered, the whole swarm will be aggregated to displace to the new room for exploration. The self-displacement is reactivated when the last robot was out of the room. If the swarm reaches one end of the corridor, it moves backwards until observing an unexplored branch. When all branches are explored, the swarm follow the backbone to escape the structured building.

We used 80 robots (compared to 316 in [1]) for experiments in the scenario as seen in Fig. 1a. The robotic swarm successfully explored all the room and identified all 24 random distributed victims as shown in Fig. 1b while preserving the global network integrity through all the robots as illustrated in the Fig. 2. Time consuming is proportional to the size of the explored rooms and the relative distance of two nearby rooms (Fig. 3). The simulation results demonstrated great potential of the strategy for applications of exploration, search and rescue services.

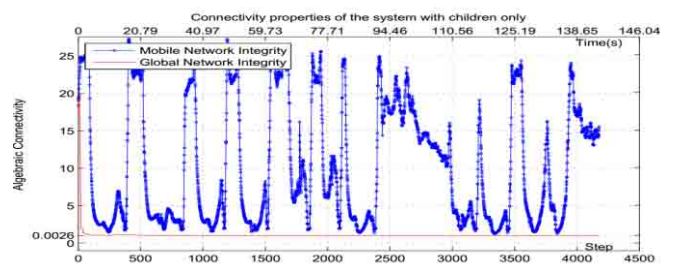


Figure 2: Connectivity properties of the robotic swarm

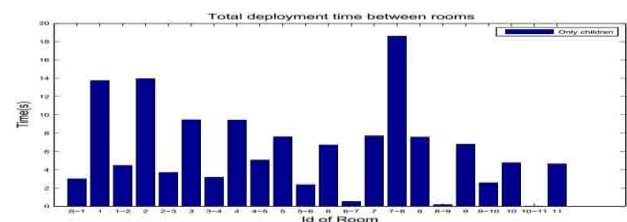


Figure 3: Time consuming for the deployment strategy

More information about our work can be found in [2].

- [1] M. J. M. Andrew Howard and G. S. Sukhatme, Mobile sensor network deployment using potential fields: A distributed, scalable solution to the area coverage problem, in Proceedings of the International Symposium on Distributed Autonomous Robotic Systems, pp. 299–308, 2002.
- [2] D-H. Pham, M-T. Pham, Q-V. Tran and T-D. Ngo, Self-Deployment Strategy for a Swarm of Robots with Global Network Preservation to Assist Rescuers in Hazardous Environments, International Conference on Robotics and Biomimetics (ROBIO), pp.2655-2660, 2014.

Constrained Optimum Design of 3-DOF Micro Accelerometers

Research topics: MEMS, sensor, accelerometer.

Tran Duc-Tan (VNU), Tue Huu Huynh, Sébastien Roy and Dzung Viet Dao

ABSTRACT: This paper presents a technique to optimize with constraints, the performance of three-degree of freedom silicon accelerometers. A flexure configuration has been proposed in order to meet requirements of small cross-axial acceleration, high and linear sensitivity. The purpose of this constrained optimization process is to achieve the highest sensitivity or resolution while imposing conditions on other parameters. It has been done based on considerations of the junction depth, the doping concentration of the piezoresistor, the temperature, the Signal to Noise Ratio, and the power consumption. Such an optimized accelerometer offers a much better performance compared to others.

Accelerometers are in great demand for many applications ranging from guidance and stabilization of spacecraft to research on vibrations of Parkinson patients' fingers. Generally, it is desirable that accelerometers have high sensitivity and fine resolution. Among several technological alternatives, silicon piezoresistive accelerometers are noteworthy since it is compatible with microelectronic batch fabrication technology [1], and therefore, the die size and the cost are reduced. There is an extensive research on silicon piezoresistive accelerometer to improve its performance and further miniaturization. However, up to now, there is no available analysis on the impact of physical parameters, such as the size, doping concentration and the temperature coefficient sensitivity of piezoresistor, noise, and power consumption on the sensitivity and resolution. High sensitivity and small cross-axis sensitivity are important requirements for the 3-DOF accelerometer. We proposed a configuration as shown in Fig. 1 to meet these critical characteristics. It consists of a proof mass connected to four surrounding beams, which are fixed to the outer frame at the centers.

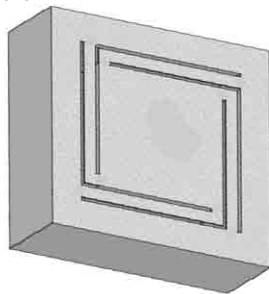


Figure 1: 3D model of the 3-DOF piezoresistive accelerometer

Figure 2 shows the flowchart of the sensitivity/resolution optimization process. This process is implemented via a MATLAB program. The structure of this 3-DOF accelerometer is fixed with specific dimensions and two parameters, that is, resistor length and impurity concentration were used as independent variables. An important constraint imposed in the optimization process is the power consumption. Indeed, in various types of applications which require wireless sensors, such as structure health monitoring or patient monitoring, low power consumption is a crucial requirement.

Fig. 3 shows the results of the AZ acceleration component for this second experiment along with the theoretical results of the optimum structure presented in this paper.

Obviously, the new optimum design yields higher sensitivity at lower power.

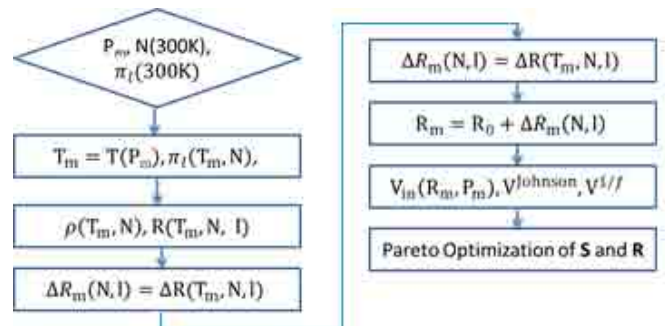


Figure 2: Flowchart of the sensitivity/resolution optimization process

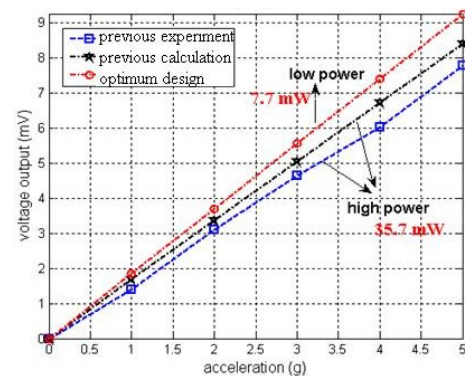


Figure 3: Comparisons among previous experiment, previous calculation, and new proposed design

Table 1 summarizes the optimal results on the sensitivity and resolution of the sensor. By applying our optimization procedure, we can both enhance the sensitivity or the resolution.

Table 1: Sensor Parameters for fabrication process

	Ax, Ay		Az	
	Previous calculation	Optimum design	Previous calculation	Optimum design
Sensitivity (mV/g)	0.76	0.89	1.68	1.91
Resolution (mg)	1.35	0.86	0.49	0.33

More information on our design can be found in [1].

Study, Design and Fabrication of Microstrip Antennas for Smart Mobile Phones

Research topics: Dual- band Antenna, 4G-LTE, Smart Mobile Phones

T.V.B. Giang, N.M. Tran (VNU)

ABSTRACT:

In this project, a dual-band antenna that works at 1780 MHz and 2610 MHz has been proposed for 4G-LTE mobile devices. The antenna has been designed on FR4 substrate with sizes of 20×50×1.2 mm to fit the mobile casing. The simulation and measurement results of both return loss and radiation patterns have also been presented. Good agreement between simulated and measured data has been obtained.

Table 1.
 Allocated Frequency Bands for 4G-LTE in Vietnam

Low Frequency Band	1785 – 1805 MHz /1880 – 1990 MHz
High Frequency Band	2570 – 2575 MHz /2615 – 2620 MHz

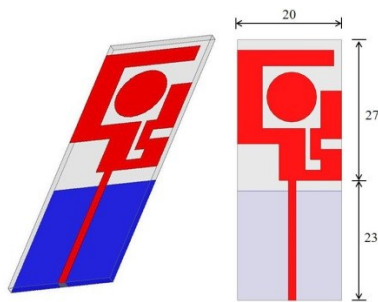


Fig. 1: The designed antenna in 2D and 3D

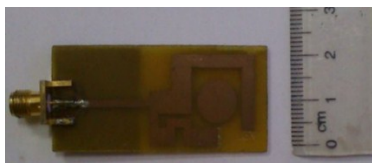


Fig. 2: The fabricated antenna sample



Fig. 3: Measurement using a vector network analyzer in an anechoic chamber

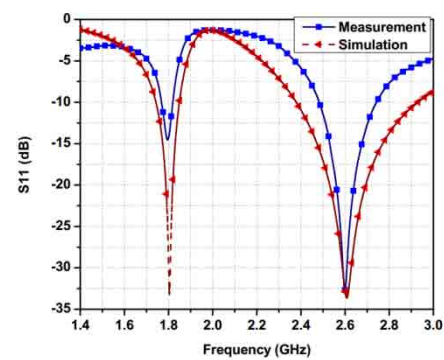


Fig. 4: The S₁₁ parameter

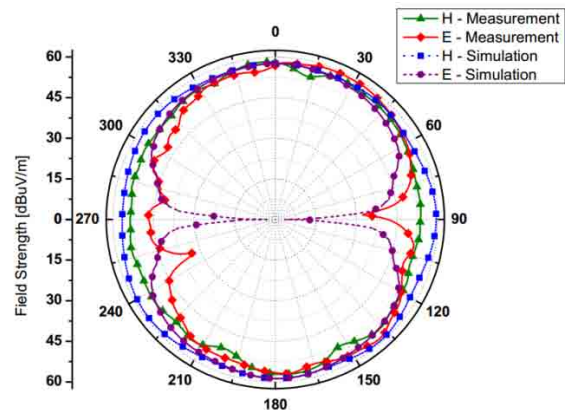
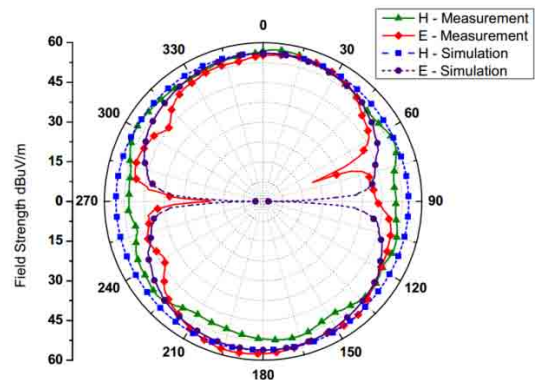


Fig. 5: The radiation pattern

[1] N.M. Tran and T.V.B Giang. Dual-band Microstrip Antenna for 4G-LTE Handheld Devices, VNU Journal of Science: Comp. Science & Com. Eng. Vol. 31, No. 1, pp. 55–59, 2015.
 [2] D.N. Hoan, N.M. Tran, T.O. Nhuong and T.V.B Giang, Design and Fabrication of a Microstrip Antenna for IEEE 802.11 b/g/n Applications, The 2013 International Conference on Integrated Circuits, Design, and Verification (ICDV 2013), HCM city, Nov., 2013, pp. 268-271.

Influence of ASE noise on performance of DWDM networks using low-power pumped Raman amplifiers

Research topics: Raman amplifier, Long-Reach PON

Trung Ninh Bui (VNU), Quoc Tuan Nguyen (VNU), Van Hoi Pham (VAST)

ABSTRACT: We present the results of investigation of influence of amplified spontaneous emission (ASE) noise, noise figure (NF) and dispersion chromatic on the performance of middle-distance Dense-wavelength-division-multiplexing (DWDM) networks using low-power pumped distributed Raman amplifiers (DRAs) in two different pump configurations, i.e., forward and backward pumping. We found that the pumping configurations, ASE noise, and dispersion play an important role for improving network performance by reduction of noise figure and bit error rate (BER) of the system. Simulation results show that the lowest bit error rate and low noise figure were obtained, when using forward pumping configuration. Moreover, we have also compared ASE noise powers of the simulation with these of the experiment. These results conclude that DRA with low pump power (<1W) is the promising key technology for short- and/or middle-distance DWDM transmission networks.

Optical nonlinear effects within optical fiber such as stimulated Raman scattering, stimulated Brillouin scattering or stimulated four-photon mixing may be employed to provide optical amplification by injecting a high-power laser beam into optical fiber. Among these, Raman amplification exhibits advantages of self-phase matching between the pump and signal together with a broad gain-bandwidth in comparison with the other nonlinear processes. Thus it is attractive for current dense wavelength division multiplexed (DWDM) systems since it provides gain over the entire fiber band.

Several transmission experiments using distributed Raman amplification technology have been reported, but so far, there are very few theoretical nor experimental reports on the noise performance comparison between the pumping configurations of the low-power pumped Raman amplification system for the middle-distance networks.

we use theoretical and simulation model of distributed Raman optical amplifier in SMF-28 bidirectional optical fiber with two different pumping configurations at pump wavelength of 1470 nm and pump power of 880mW, which is smaller than traditional Raman amplifier's pump. We calculated ASE noise powers and its affection to bit error rate and noise figure of the system. Moreover, we also compare these noise powers with experimental results of the real WDM network system.

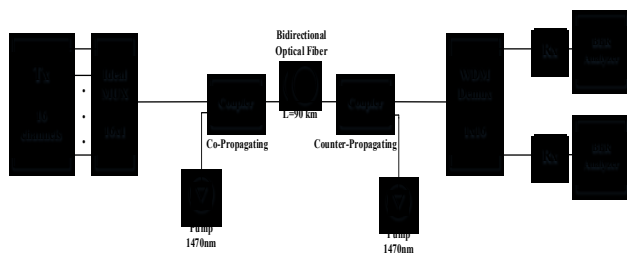


Figure 1: Block diagram of a DWDM system using distributed Raman amplifier.

Simulations have been carried out to estimate the effects of ASE noise, noise figure, and chromatic dispersion on performance of network in different pump configurations. Key parameters used for this simulation are listed in Table 1.

Name	Symbol	Value
Length of DRA	L	$0 \div 90$ km
Effective area	A_{eff}	$80 \mu^2$
Bit rate	R_b	10Gbps
Signal frequency	f_s	193.1 - 193.85 THz
Pump wavelength	λ_p	1470 nm
Pump power	P_p	880mW
Dispersion chromatic	D	14, 15, 16 ps/ nm.km

We found that the different pumping configurations and ASE noise play an important role in network performance. Simulation results show that the low bit error rate and noise figure were obtained when using forward pumping configuration for the fiber amplifier length of 90 km. The calculation results are also compared with the experimental one, and they are well matched. In addition, the amplification of DRA depends on both power and wavelength pump. From this study, we conclude that DRA with low-power pump (<1W) is the promising key technology for short- and/or middle-distance DWDM transmission networks.

More information on our design can be found in [1].

Hardware Implementation for Entropy Coding and Byte Stream Packing Engine in H.264/AVC

Research topics: H.264/AVC, entropy coding, CAVLC, Exp-Golomb, Video byte stream

N.-M. Nguyen, E. Beigne, S. Leseq, P. Vivet, D.-H. Bui (VNU-UET), X.-T. Tran (VNU-UET)

ABSTRACT: Entropy coding (EC) and data packing are the major phases in video coding. The H.264 Advanced Video Coding (H.264/AVC) standard adopts Exp-Golomb and Context-Adaptive coding methods to increase data compression ratio. We propose a hardware architecture of EC and byte stream data packing engines for the H.264/AVC. Our EC engine, containing Exp-Golomb and Context-Adaptive Variable Length Coding (CAVLC), supports the baseline and main profiles of the standard. The proposed architecture is implemented using 180nm technology from AMS. The design consumes only 1.56mW at the operating frequency of 100MHz.

Recommended by both the ITU-T Video Coding Experts Group (VCEG) and the ISO/IEC Moving Picture Experts Group (MPEG), the H.264 Advanced Video Coding (H.264/AVC) can save approximately 50% of bit rate in comparison with previous standards thanks to the adoption of several features. The H.264/AVC also provides high loss/error robustness using separated parameter set structures, which keep key information. For instance, the NAL unit syntax structure enables "network friendliness" to customize the use of the Video Coded Layer (VCL) for various systems and networks.

Many works propose hardware (HW) implementation of the standard. However, they mostly focused on the prediction part of encoders/decoders and on the improvements of algorithms. It can be seen in the literature that for EC in baseline profile (i.e. the Exp-Golomb and CAVLC coding techniques), hardware EC engines usually only encode the data at MB level, i.e. SPS, PPS and Slice header might be implemented in software.

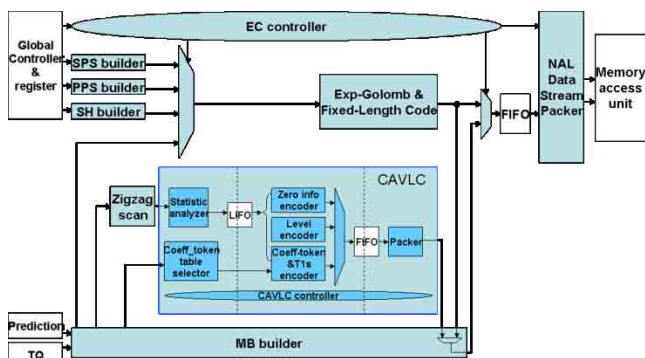


Figure 1: Architecture of entropy coder.

We propose a new architecture of the entropy coding and data packing engine as shown in Figure 1. Encoded syntax elements are transferred from entropy coding to data packing via a FIFO. The main part of the entropy coding engine consists of two encoders, namely, the Exp-Golomb and Fixed-length code (EGF) and CAVLC modules [1]. SPS, PPS, SH, and MB builders are implemented to collect the to-be-encoded data and send them to the EGF module in the

specified order. SPS, PPS, SH's information is provided by a global controller via system registers. The MB header information is received from Intra-, Inter- and TQ engines.

The architecture proposed has been modeled in VHDL at RTL level. To verify, our EC and data packing module has been integrated into a hardware H.264 video encoding system. Using the video encoder system with the proposed EC NAL module, we encode raw test video sequences in the CIF format (which is one format we target as it is used for mobile applications). The encoded videos are received from the output of the data packing module. For validation purpose, these encoded videos are then successfully decoded with the JM decoder.

The simulation is done by using ModelSim from Mentor Graphics and the design is synthesized with AMS CMOS 180nm technology by using DC Compiler from Synopsys. Some implementation results of our EC and byte-stream packing data engines are presented in Table 1.

Table 1: Implementation results of the proposed design

Technology	Cycles/MB	Frequency	Area cost	Power
AMS	691 in the worst case	100MHz	73.5 Kgates	1.56mW at 100MHz

Due to the implementation of the table selector for coeff_token syntax element and the full hardware implementation of the EC, including SPS, PPS, slice header data generators, our design occupies a slightly larger silicon area (approximately 73.5Kgates) than the ones found in the literature.

However, in terms of throughput, our EC engine encodes an MB in maximum 691 cycles (151 cycles for the worst case of MB header plus 540 cycles for the worst case of residual data). With this speed and at the operating frequency of 100MHz, the design is suitable for 720HD video format. Moreover, in average, the encoding process only requires 25 to 90 cycles for MB header and 450 cycles for MB residual. In terms of power consumption, at 100MHz, it only consumes 1.56mW which is less than most of the low-power designs that operate at 27MHz.

More information on our design can be found in [2].

- [1] N.-M. Nguyen, X.-T. Tran, P. Vivet, and S. Leseq. An efficient Context Adaptive Variable Length coding architecture for H.264/AVC video encoders. International Conference on Advanced Technologies for Communications (ATC), pp. 158-164, 2012.
- [2] N.-M. Nguyen, E. Beigne, S. Leseq, P. Vivet, D.-H. Bui, X.-T. Tran, Hardware implementation for entropy coding and byte stream packing engine in H.264/AVC. International Conference on Advanced Technologies for Communications (ATC), pp. 360-365, 2013.

RESEARCH ACHIEVEMENTS
IN
ENGINEERING MECHANICS AND AUTOMATION



Study of the Climate Change Impacts on Water Quality in the Upstream Portion of the Cau River Basin, Vietnam

Ha Ngoc Hien^{1,2} & Bui Huy Hoang¹ & Tran Thi Huong¹ & Tran Thanh Than¹ & Pham Thi Thu Ha¹
& Ta Dang Toan¹ & Nguyen Minh Son¹

¹Institute of Environmental Technology, Vietnam Academy of Science and Technology

²University of Engineering and Technology, National University of Hanoi

ABSTRACT: Simulation results of climate change impacts on water quality in the upstream portion of the Cau River Basin in the North of Vietnam are presented. The integrated modeling system GIBSI was used to simulate hydrological processes, pollutant and sediment wash-off in the river basin, and pollutant transport and transformation in the river network. Three projections for climate change based on emission scenarios B1, B2, and A2 of IPCC Special Report on Emission Scenarios (SRES) were considered. By assuming that the input pollution sources and watershed configuration were constant, based on 2008 data, water quality in the river network was simulated up to the terminal year 2050. For each climate change scenario, patterns of precipitation in wet and dry year were considered. The change in annual and monthly trends for dissolved oxygen (DO), biochemical oxygen demand (BOD), and ammonium ions (NH₄⁺) load and concentration for different portions of the watershed have been analyzed. The results of these simulations show that climate change has more impact on changing the seasonal water quality parameters than on altering the average annual load of the pollutants. The percent change and change pattern in water quality parameters are different for wet and dry year, and the changes in wet year are smaller than those in dry year.

The combined effects of temperature and precipitation under climate change conditions on water quality in Cau River basin in the North of Vietnam have been studied. The main conclusions drawn are the following:

- Climate change has more impact on changing the seasonal water quality parameters than on altering average annual load of the pollutants. In general, the change of water quality parameters displays a similar trend for all climate change scenarios.
- The percent change and change pattern are different for wet and dry year; the changes in the wet year are smaller than those in the dry year.
- The total DO annual load decreases in all portions of the Cau River basin, and the mean monthly DO concentrations decrease for most of cases except for the higher portions of the watershed during the dry period.
- The total annual BOD load also decreases in all portions of the Cau River basin. Although BOD load decreases for most

cases, the mean monthly BOD concentrations may increase in some portions of the basin during the dry period (Table 1).

- The total annual NH₄⁺ load increases in all portions of the basin. The change in mean monthly NH₄⁺ load depends largely on the change in precipitation. It increases during periods of high water and decreases during periods of low water.
- The CC impact on water quality in the study area is significant and should be taken into account when considering water quality change tendency in the future. Moreover, according to the data of the period 2005–2011, it can be concluded that economic development or pollution control measures have implications that are an order of magnitude larger than climate change.

The results are only valid under currently used climate scenarios in the study area. The model results cannot be used directly for planning works, but they can be useful to predict potential changes of the water system and provide insight into possible strategies to adapt to related climate change scenarios. More information can be found in [1,2].

Table 1 Annual BOD load change (%) at stations in 2050

Station	Base run (ton)		B1		A2	
	Dry year	Wet year	Dry year	Wet year	Dry year	Wet year
CauVat	1500.89	3506.97	-8.10	-3.60	-9.20	-4.14
GiaBay	2396.93	4117.81	-4.22	-2.08	-4.82	-2.39
GiangTien	179.99	317.18	-1.23	-0.99	-1.40	-1.16
ThanSa	171.08	426.70	-1.23	0.67	-1.46	0.72
ThacRieng	768.38	1260.60	-2.14	-1.16	-2.45	-1.36

[1] Ha Ngoc Hien & Bui Huy Hoang & Tran Thi Huong & Tran Thanh Than & Pham Thi Thu Ha & Ta Dang Toan & Nguyen Minh Son, Study of the Climate Change Impacts on Water Quality in the Upstream Portion of the Cau River Basin, Vietnam, *Environ Model Assess* (2016) 21:261-277.

[2] Ha Ngoc Hien, Integrated water resources management in Cau River basin. VAST: Final Report of project (2012).



CRACK DETECTION IN PILE BY MEASUREMENTS OF FREQUENCY RESPONSE FUNCTION

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Nguyen Tien Khiem (VNU-UET) et al.

Abstract: *Explicit expressions of either frequency equation or frequency response function have been derived for multiple cracked bar. The expressions allow thoroughly investigating effect cracks on the modal parameters such as natural frequencies and frequency response function of bar with different boundary conditions. The exact expression of frequency response function provides a basis to propose an efficient procedure for multi-crack detection in pile by modal testing technique. Numerous examples are numerically examined for illustrating the developed theory and an experimental study is accomplished for validating the proposed crack detection procedure.*

This work aimed to develop a procedure for crack localization based on the measured frequency response function in longitudinal vibration of bar. The crack is modeled as an axial spring of stiffness calculated from the crack depth [4]. First, the effect of position and depth of multiple cracks on frequency response function is thoroughly investigated. The revealed change in frequency response function is crucially important for FRF-based crack detection. An efficient procedure is proposed to identify multiple cracks in pile by measurement of frequency response function. This procedure was validated by an examined experimentation.

Concluding remarks

Thus, in this study the following results have been obtained:

1. An explicit expression is constructed for either the characteristic equation or frequency response function of multiple cracked bar that allows studying not only the change in natural frequencies but also deviation of frequency response function induced by multiple cracks;
2. Based on the expression of frequency response function, an iteration procedure is developed for multiple crack localization in pile by measurement of frequency response function.
3. Numerical analysis shows that deviation of the frequency response function induced by multiple cracks is typical and useful for crack detection from measured frequency response function;
4. An experimental model of concrete pile with two cracks has been fabricated and employed for crack localization by measured frequency response function;
5. The numerical and experimental results demonstrate that frequency response function is really promising for multi-crack detection and it is worthy to further development and implementation.

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REFERENCES

1. R.D. Adams, P. Cawley, C.J. Pye, B.J. Stone (1978) A vibration technique for non-destructive assessing the integrity of structures. *Journal of Mechanical Engineering Science*, 20: 93-100.
2. Y. Narkis (1994) Identification of crack location in vibrating simply supported beams. *Journal of Sound and Vibration*, 172: 549-558.
3. S.W. Doebling, C.R. Farrar, M.B. Prime and D.W. Shevitz (1996) Damage Identification and Health Monitoring of Structural and Mechanical Systems from Changes in Their Vibration Characteristics: A Literature Review. Report LA-13070-MS, Los Alamos National Laboratory, New Mexico.
4. B.S. Haisty and W.T. Springer (1998) A general beam element for use in damage assessment of complex structures. *Journal of Vibration, Acoustics, Stress and reliably in Design*. Transactions of the ASME, 110, 389-394.
5. H. Sohn, C.R. Farrar, F.M. Hemez, D.D. Shunk, D.W. Stinemates, B.R. Nadler and J.J. Czarnecki (2004) A Review of Health Monitoring Literature 1996-2001. Report No LA-13976-MS, Los Alamos National Laboratory, New Mexico.
6. W. Fan, P.Z. Qiao (2011) Vibration-based Damage Identification Methods: A Review and Comparative Study. *Structural Health Monitoring*, 10(1): 83-111.
7. S.K. Thyagarajan, M.J. Schulz, P.F. Pai and J. Chung (1998) Detecting Structural Damage Using Frequency Response Functions. *Journal of Sound and Vibration*, 210(1), 162-170.
8. U. Lee and J. Shin (2002) A frequency response function-based structural damage identification method. *Computer and Structures*, 80, 117-132.
9. G.M. Owolabi, A.S.J. Swamidas and R. Seshadri (2003) Crack detection in beams using changes in frequencies and amplitudes of frequency response functions. *Journal of Sound and Vibration*, 265, 1-22.
10. N.M.M. Maia, J.M.M. Silva and E.A.M. Almas (2003) Damage Detection in Structures: From Mode Shape to Frequency Response Function Methods. *Mechanical Systems and Signal Processing*, 17(3), 489-498.
11. H.Y. Hwang and C. Kim (2004) Damage detection in structures using a few frequency response function measurements. *Journal of Sound and Vibration*, 270, 1-14.
12. X. Liu, N.A.J. Lieven and P.J. Escamilla-Ambrosio (2009) Frequency response function shape-based method for structural damage localization. *Mechanical Systems and Signal Processing*, 23, 1243-1259.



Dynamic analysis of a cracked beam-like bridge subjected to earthquake and moving vehicle

Khoa Viet Nguyen

Abstract

This paper [1] presents the influence of a crack on the dynamic behavior of a beam-type bridge subjected to separately or simultaneously a moving vehicle and earthquake excitation. In this study, the bridge is modelled as a 3D beam by the finite element method. The stiffness matrix of a cracked beam element with rectangular section adopted from fracture mechanics is presented. The influences of crack appearance time, crack location, crack depth, and vehicle speed on the dynamic response of the bridge are investigated. When a crack is induced during external excitation the stiffness of the structure is changed leading to a change in natural frequencies during vibration. This change in the frequency is analysed by wavelet spectrum, a time-frequency analysis which can examine locally a signal in both time and frequency domains. The relationship between the crack depth and the instantaneous frequency (IF) of the structure is established which may prove useful for assessment of the crack depth. Numerical simulation results are presented to investigate the efficiency of the method.

Dynamic analysis of a triple-beam subjected to a moving load

Khoa Viet Nguyen, Anh Ngoc Dang

Abstract

This paper [2] presents the dynamic response of a triple-beam subjected to a moving load. The triple-beam system consists of a main beam with a moving force, and two auxiliary beams, with a uniform distributed spring k and dashpot c in parallel between the three beams. In this study, Euler – Bernoulli beam is used for modelling the three different beams. Since the finding of exact solution for the dynamic response of the triple-beam system consists of three different beams is not an easy task, then the finite element method is applied to analyse the triple-beam system subjected to a moving load. The influences of the medium stiffness and damping on dynamic response are studied. The effect of the variation of the stiffness of the auxiliaries beam on the dynamic responses is also investigated. Numerical illustrations are provided in this paper.

Flutter analysis of a high cracked slender structure

Khoa Viet Nguyen, Quang Van Nguyen, Mai Van Cao

Abstract

This paper [3] presents the effect of dynamic wind load on a high cracked slender structure. When the slender structure is located at a high location in comparison with the sea level, the effects of dynamic wind load on the structure need is of importance. Especially, when the structure has damages such as cracks, the effects of dynamic wind load on the structure need to be investigated carefully to avoid the collapse of the structure due to the self-excited vibration. In this study, the flutter phenomenon of the structure under the dynamic wind load is analyzed using the finite element method. In this paper the dynamic response of the structure at flutter speed is also calculated. The theory of flutter phenomenon and dynamic response of the high cracked slender structure are presented and the numerical simulation results are provided.



Simultaneous influences of surface irregular parameters and moving speed on dynamic response of a cracked double beam subjected to moving vehicle

Khoa Viet Nguyen, Oluremi A Olatunbosun, Anh Tuan Bui

Abstract

This paper [4] presents the dynamic response of a double cracked beam subjected to a moving load. The model of a double cracked beam is modelled by using finite element analysis. The dynamic response of the double beam depends on many parameters such as medium stiffness and damping, the surface irregularity depth and length, and the speed of moving load. In this study, the simultaneous influence of these parameters on the dynamic response of the beam is investigated. Numerical results are also provided in this paper.

Element Stiffness Index Distribution Method For Multi-Cracks Detection of A Beam-Like Structure

Khoa Viet Nguyen, Quang Van Nguyen

Abstract

In this paper [5], a method using “element stiffness index distribution” for multi-crack detection of a beam like structure is presented. The element stiffness index distribution is defined as a vector of norms of sub-matrices corresponding to element stiffness matrices calculated from the reconstructed global stiffness matrix of the beam. When there is a crack at an element, the element stiffness index of that element will be changed. Therefore, by monitoring the change in the element stiffness index distribution, the crack can be detected. A significant peak in the element stiffness index distribution is the indicator of the crack existence. The crack location and the crack depth can be determined from the location of the peak and the height of the peak. In this study, the global stiffness matrix is reconstructed from the measured frequency response functions instead of mode shapes to avoid some limitations of the mode shape based methods for crack detection. Numerical simulation results for the cases of single crack and double cracks are provided. The results showed that cracks with a depth as small as 10% of the beam height can be detected by the method. The proposed method can be applied with the noise level up to 10%.

Dynamic Analysis of A Damaged Slender Structure Excited By Centrifugal Force

Khoa Viet Nguyen, Mai Van Cao

Abstract

This paper [6] presents the dynamic response of the damaged slender structure under the centrifugal excitation. The dynamic response of the damaged slender structure is analyzed in the time domain using finite element method. The trajectories of nodes on main columns of the structure at resonant frequencies before and after the damage appearance are compared together. The simulation results showed that the trajectories of nodes on the main columns change when there is damage. This is useful for damage detection of the structure subjected to the centrifugal excitation.



Dynamic Analysis of A Damaged Slender Structure Under Wind Load And Its Application For Damage Localization

Khoa Viet Nguyen, Quang Van Nguyen, Mai Van Cao

Abstract

This paper [7] presents the effect of dynamic wind load on a cracked slender structure. When a slender structure is located at height levels, the effects of dynamic wind load on the structure are of importance. Especially, when the structure is damaged the dynamic response of structure under wind load needs to be investigated carefully to avoid the collapse of the structure. In this study, the dynamic response of damaged structure under dynamic wind load is analyzed in the time domain using finite element method. The trajectories of nodes on main columns of the structure before and after the damage appearance are compared together to assess the influence of the wind load on the dynamic response of structure. The simulation results showed that the trajectories of nodes on the main columns are useful for damage detection of the structure under wind load. The theoretical background of time domain buffeting analysis and vibration analysis of the cracked high slender structure are presented and the numerical simulation results are provided.

Dynamic Analysis of A Triple Beam on An Irregular Elastic Foundation Subjected To Moving Vehicle

Khoa Viet Nguyen, Anh Ngoc Dang

Abstract

This paper [8] presents the dynamic response of triple-beam on an irregular elastic foundation subjected to a moving vehicle. The triple-beam system consists of three different single beams connected by uniform distributed spring k and dashpot c in parallel between. In this study, Euler – Bernoulli beam is used for modelling triple-beam. Since the finding of exact solution for the dynamic response of the triple-beam system consisting of different beams is complicated, the finite element method is applied to analyze the triple-beam system resting on irregular elastic foundation subjected to a moving vehicle. The effect of the variation of the foundation stiffness on the dynamic response of the vehicle is investigated. Numerical illustrations are provided in this paper.

References

- [1] Khoa Viet Nguyen. *Dynamic analysis of a cracked beam-like bridge subjected to earthquake and moving vehicle*. Advances in Structural Engineering 2015, Vol 18 (1), p. 75-96.
- [2] Khoa Viet Nguyen, Anh Ngoc Dang. *Dynamic analysis of a triple-beam subjected to a moving load*. International Conference on Engineering Mechanics and Automation 2014, Hanoi, Vietnam, p. 57-64.
- [3] Khoa Viet Nguyen, Quang Van Nguyen, Mai Van Cao. *Flutter analysis of a high cracked slender structure*. International Conference on Engineering Mechanics and Automation 2014, p. 433-440.
- [4] Khoa Viet Nguyen, Oluremi A Olatunbosun, Anh Tuan Bui. *Simultaneous influences of surface irregular parameters and moving speed on dynamic response of a cracked double beam subjected to moving vehicle*. International Conference on Engineering Mechanics and Automation 2014, Hanoi, Vietnam, p. 49-56.
- [5] Khoa Viet Nguyen, Quang Van Nguyen. *Element stiffness index distribution method for multi-cracks detection of a beam-like structure*. Accepted by Advances in Structural Engineering.
- [6] Khoa Viet Nguyen, Mai Van Cao. *Dynamic analysis of a damaged slender structure excited by centrifugal force*. Hội nghị Khoa học toàn quốc Cơ học Vật rắn biến dạng lần thứ XII Đại học Duy Tân, TP Đà Nẵng, 6-7/8/2015. Đã chấp nhận đăng.

RESEARCH ACHIEVEMENTS
IN
ENGINEERING PHYSICS AND NANOTECHNOLOGY



Organic Solar Cells based on Nanocomposite and Quantum Dot Photoactive Layers

Research topics: Nanocomposites for OSC, Photoelectrical energy conversion

Tran Thi Thao, Nguyen Nang Dinh (VNUH), Vo-Van Truong (Canada), Tran Quang Trung (VNU-HCM)

ABSTRACT: With the aim to find out an enhanced operating-temperature range for photovoltaic device parameters, two types of the photoactive layer were prepared: MEHPPV-CdS/CdSe and P3HT+nc-TiO₂. For a quantum solar cell (Q-SC) with the laminar structure of Al/MEHPPV-CdSe/PEDOT/ITO, the photovoltaic conversion efficiency was reached a value of 1.52%. Whereas the enhancement obtained for the photoelectrical conversion efficiency of the solar composite-based cells (SCC) is attributed to the presence of nano-heterojunctions of TiO₂/P3HT. For the temperature range of (30 – 70) °C, the decrease of the open-circuit potential was compensated by an increase of the fill factor; and the increase in the short-circuit current resulted in an overall increase of the energy conversion efficiency. At elevated temperatures of 60 – 80°C the efficiency of the P3HT-organic solar cell and SCC reached a maximum value of 1.6% and 2.1%, respectively. Over this temperature range the efficiency of P3HT-based SCC decreased strongly to zero, while for the SCCs it maintained a value as large as 1.2 % at the temperature range of (110 – 140) °C. The improved thermal stability of the composite-based device was attributed to the lowered thermal expansion coefficient of the nanocomposite photoactive layer.

INTRODUCTION

Organic solar cells (OSC) can be processed from solution have been investigated as a low-cost alternative. Among conducting polymers, poly(3-hexylthiophene) (P3HT) is used for flexible polymer electronic devices and OSC. P3HT with an energy bandgap of 1.9 eV is often used as the electron donor in a bulk heterojunction, while the electron acceptor was [6,6]-phenyl C₆₁-butyric acid methyl ester (PCBM). The enhanced solubility of PCBM compared to C₆₀ allows a high fullerene/conjugated polymer ratio and strongly supports the formation of bulk donor-acceptor heterojunctions. As compared to inorganic solar cells like Si-single crystalline cells, the production technology for either materials or devices of OSCs is much cheaper. By embedding inorganic nanocrystalline oxides like TiO₂ nanoparticles (nc-TiO₂) into polymer matrices, one can enhance the efficiency and service duration of the organic devices. The embedded oxides can substantially influence both the electrical and optical properties of the polymer, for instance MEH-PPV + nc-TiO₂ composite thin films were studied as a photoactive material.

We here have combined CdSe and CdS QDs with the conjugated Poly[2-methoxy-5-(2'-ethyl-hexyloxy)-1,4-phenylene vinylene] (MEH-PPV) to create charge transfer junctions with high interfacial area. From the schematic energy level diagram for CdSe, CdS and MEH-PPV, it can be seen that CdSe is electron accepting and MEH-PPV is hole-accepting. QDs are used as the electron transport material, whereas MEH-PPV is an effective hole transport material. This kind of organic solar cells is called Q-SC. For OSCs, it is very important to improve the thermal stability of the device performance under operating conditions. In particular the thermal expansion of the polymeric layer plays an important role in the thermal stability of the devices.

In this paper, we demonstrate the advantage of both the Q-SC and composite-based SC (SCC) under operating conditions of temperatures.

EXPERIMENTAL

ITO-coated glass with a sheet resistance of 10 Ω were used for substrates. MEH-PPV:QDs solution (with a ratio of 10:1) were prepared by dissolving its powders in xylene as follows: 10 mg of polymer in 10 ml of xylene. PEDOT:PSS was used for the acceptor layer. Spin-coating layers PEDOT-PSS/ITO and MEH-PPV:QD/PEDOT-PSS were made. The films used for photoluminescence (PL) characterization were spin-coated onto glass pieces with 1.2 cm × 1.2 cm in size. To dry the films, the samples were put in a flow of dried gaseous nitrogen for 4 hours. Then a 100 nm-thick Al-electrode on the top was thermally evaporated in a vacuum of 1.33×10⁻³ Pa, using a mask with windows of 4 mm × 5 mm in size. Therefore, the active area of a cell is 0.20 cm². By this way, two type of nanocomposites, namely MEH-PPV+CdSe and MEH-PPV+CdS (abbreviated to MC1 and MC2, respectively) were prepared for devices. Q-SCs made from MC1 and MC2 are called Q-SC1 and Q-SC2 which have a structure of Al/PEDOT/MC1/ITO and Al/PEDOT/MC2/ITO, respectively. And Al/PEDOT/MEH-PPV/ITO is called P-SC.

To compare the photoactive behavior of the pure P3HT and a composite consisting of P3HT and TiO₂ nanoparticles (abbreviated to PTC) and also the performance of the devices. In our work ITO-coated glass substrates used for spin-coating nanocomposite films were ultrasonically cleaned in distilled water, followed by cleaning in ethanol and acetone. For improvement of the ITO contact, the ITO was coated with a 70 nm-thick layer of polyethylene dioxythiophene (PEDOT). To deposit the active layers onto PEDOT, the P3HT solution was prepared by dissolving 8 mg of P3HT powders in 1 ml of chlorobenzene. For the composite, TiO₂ nanoparticles of 5 nm in size were embedded in the P3HT solution according to a weight ratio TiO₂/polymer of 0.05 (5 wt. %). For the acceptor layer, a 50 nm-thick PCBM layer was spin-coated onto the P3HT and PTC layers. The thickness of the P3HT:PCBM and PTC:PCBM active layers was about 100 nm. The

samples were put in a flow of dried gaseous nitrogen for 12 hours. As electrodes, a PEDOT/ITO film on one side and a LiF/Al bilayer contact on the other side were used. A LiF/Al electrode was chosen instead of pure Al in order to ensure a good ohmic contact between the metal and the organic layer. A 80 nm-thick Al-electrode on the top was thermally evaporated in a vacuum of 1.33×10^{-3} Pa, using a mask with windows of $2.5 \text{ mm} \times 3 \text{ mm}$ in size. Therefore, the active area of a cell was 0.09 cm^2 . By this way, organic solar cells with respective structures of ITO/PEDOT/P3HT:PCBM/LiF/Al and ITO/PEDOT/P3HT:PTC/LiF/Al (respectively abbreviated to SCC-1 and SCC-2) were prepared, where the active layer of the SCC-1 and SCC-2, respectively is P3HT and PTC films. To heat up the devices, we used a thermoelectric heater plate, the temperature of which can be setup and automatically controlled.

RESULTS AND DISCUSSION

Figure 1 shows the absorption spectra of pure MEH-PPV, CdS and CdSe quantum dots solutions. The absorption peak was found at $\sim 470 \text{ nm}$ for CdS, 520 nm for MEH-PPV and CdSe has a peak at 610 nm for CdSe. All these three broad spectra are in the solar visible range, thus the combinations of MEH-PPV and both two QDs are suitable for use in Q-SCs. However, comparing bandgap diagrams of CdSe and CdS relative to MEH-PPV and their absorption wavelength range, CdSe-QDs exhibit a better electron accepting material. In comparison with the pure MEH-PPV, the absorption spectra of both MC1 and MC2 occupy a much larger area of wavelengths range and intensities of their absorption peaks are also much higher than that of MEH-PPV (Fig. 1).

The largest absorbance was observed at bright green wavelengths (530 nm) for MC1 sample. With two nanocomposites opposite shifts were obtained, the red shift for MC1 and the blue shift for MC2. The values of the wavelength shifts constitute $\sim 7 \text{ nm}$ (for blue) and $\sim 15 \text{ nm}$ (for red). From the separated absorption spectra (see Fig. 2) and bandgap (E_g) values (Fig. 1a) of three components, these shifts are clearly related to their bandgap structures: Blue shift occurred in MC2 and red shift in MC1, where $E_g(\text{CdS}) > E_g(\text{MEH-PPV}) > E_g(\text{CdSe})$. In some cases, the blue shift was explained due to a reduction of the conjugation chain length in a conducting polymer (PPV), when nanoparticles (SiO_2) were embedded in the polymer as reported in [15]. However, QDs used in our work have too small size to break the conjugation chains of MEH-PPV.

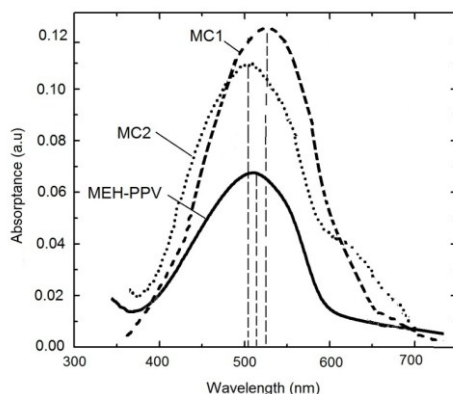


Fig. 1. The absorbance spectra of pure MEH-PPV, nanocomposite MC1 and MC2.

From the measurement of the performance of three devices P-SC, Q-SC1 and Q-SC2 one can get J-V curves in a dark and illuminated regimes (here these curves are not showed). From the J-V curves we calculated the values of all parameters of three devices, such as fill factor (FF), open-circuit voltage (V_{oc}), short-cut current density (J_{sc}) and photoelectrical conversion efficiency (η). In fact, there is a competition between charge carrier recombination and transport. The FF can be determined by:

$$FF = \frac{(J \times V)_{\max}}{J_{sc} \times V_{oc}} \quad (1)$$

where $(J \times V)_{\max}$ is the rectangle having the largest area. η can be determined by:

$$\eta = \frac{FF \times J_{sc} \times V_{oc}}{P_{in}} \quad (2)$$

where P_{in} is the density of the illuminating power, in mW/cm^2 (in our experiments $P_{in} = 56 \text{ mW/cm}^2$). Characterization of the performance device parameters (namely V_{oc} , J_{sc} and FF) was carried out with the Auto-lab.potentiostat using cyclic voltammetry (CV) measurements in both the dark and illumination states. Herein the CV-curves for Q-SCs are not showed, however the calculated results are listed in Table 1. This table shows that by embedding of inorganic nanoparticles as QDs, the performance efficiency of Q-SCs is much enhanced. The fact that both the fill factor and photoelectrical conversion efficiency of Q-SC1 are larger than that of Q-SC2 proves that CdSe-QD is a better additive embedded in conjugate polymer than CdS-QD for Q-SCs.

Table 1. Parameters of Q-OSC obtained from J-V characteristic for three devices.

Device	V_{oc} (V)	J_{sc} (mA/cm^2)	FF	η (%)
P-SC	0.45	0.28	0.21	0.18
Q-SC2	0.46	0.75	0.43	1.05
Q-SC1	0.48	0.94	0.65	1.52

The CV-curves for SCCs shown in Fig. 2 revealed the current-voltage (I-V) characteristics of the two devices, SCC-1 and SCC-2, under an illumination with a power density of 56 mW/cm^2 .

The fill factor and photoelectrical conversion efficiency which were calculated by Eq. (1) and Eq. (2), together with V_{oc} and J_{sc} taken from the I-V curves are displayed in Table 2. The V_{oc} of the two cells have almost the same value (namely 710 and 715 mV), but the J_{sc} of the composite cell, SCC-2, is larger (2.34 mA/cm^2) than that of the polymer cell, SCC-1 (2.13 mA/cm^2). The fact that the FF of the SCC-2 is larger than that of SCC-1 proves that the PTC nanostructured composite is a good matrix where TiO_2 particles are tightly surrounded.

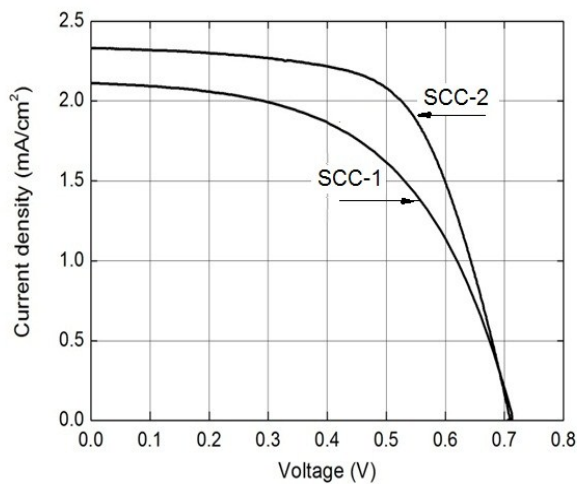


Fig. 2. I-V characteristics obtained in the illumination regime for the cells with a structure of ITO/PEDOT/P3HT:PCBM/LiF/Al (SCC-1) and ITO/PEDOT/P3HT:PTC/LiF/Al (SCC-2).

This is because during the spinning process, the TiO₂ nanoparticles can adhere by strong electrostatic forces to the polymer, and the capillary forces can then draw the P3HT solution around the nanoparticles into cavities without opening up pinholes through the device. This results in an increase of the J_{sc}, and consequently the efficiency, η , of the composite based devices. The η -value (1.73%) is small in comparison with solid-state PbS-QDs/TiO₂ heterojunction solar cells. However, it can be comparable to the efficiency of a solid-state photovoltaic device using a surface-adsorbed dye complex for light absorption and electron injection to the TiO₂ layer, in which an extremely thin absorber is sandwiched between two wide-band gap semiconductors, one n-type and the other p-type.

Table 2: Solar cell data for SCC-1 and SCC-2 devices

Device	V _{oc} (mV)	J _{sc} (mA/cm ²)	FF	η (%)
SCC-1	715	2.13	0.52	1.45
SCC-2	710	2.34	0.58	1.73

Figure 3 illustrates the detailed temperature-dependence of η for SCC-1 and SCC-2 in a temperature range of (30 – 140)°C. A similar positive dependence of η for OSC-1 and OSC-2 is observed in a temperature range of (30 – 60) °C. From 60°C, η of SCC-1 decreased with $d\eta/dT = 0.04\%/K$ with increased temperature and almost diminished to zero at 140°C. For the composite-based SCC-2 the maximum efficiency was reached at 70°C, then decreased with $d\eta/dT = 0.02\%/K$ which is much smaller than that of SCC-1. Moreover, η had a critical value of ca. 1.2%. This means that the performance of the SCC-2 was maintained at temperatures as large as (120 – 140) °C. This clearly demonstrates the advantage of the nanocomposite-based solar cells when the devices are exposed outdoor at high temperatures of solar illumination. In the

P3HT+nc-TiO₂ film, the TiO₂ nanoparticles filled up the cracks, creating numerous heterojunctions of TiO₂/polymers. These junctions favor the injection of the generated electrons from the active layers (P3HT) to the Al-electrode, resulting in an enhancement of the so-called charge separation. This would enable performance parameters of the SCC such as V_{oc}, J_{sc} and FF to be improved. Thus η of the SCC-2 is much larger than that for SCC-1 (Fig. 3).

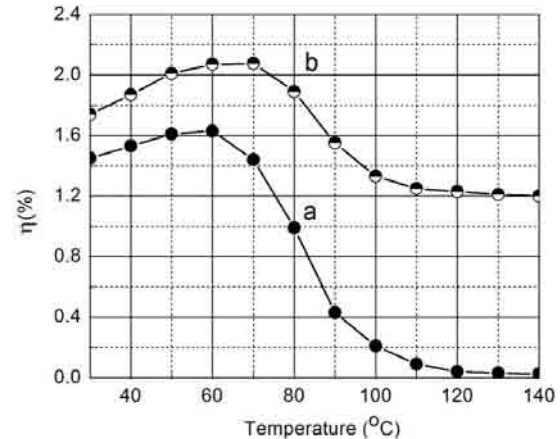


Fig. 3. Temperature dependence of the photoelectrical conversion efficiency of SCC-1 (curve "a") and SCC-2 (curve "b").

The fact that over 70 °C the efficiency of SCC-1 decreased strongly and the device stopped working at over 110 °C, while by SCC-2 the photoelectrical energy conversion process was continued with a value $\eta = 1.2\%$ (at 140 °C), demonstrates an excellent thermal stability of the composite-based devices. At such a high temperature of 140 °C, the nanocracks in P3HT would grow further, creating numerous large canals which can block the charge transport in the P3HT active layer. For the composite film where nanocracks do not exist and α is very small, the increase of temperature up to 140°C did not affect much the performance of this active layer. Thus η of SCC-2 decreased about 30% from 1.73% (at room temperature) to 1.20% (at 140°C) and possessed a largest η at 70°C (namely ~ 2.1%). These results showed that the effective temperature range (60 - 80 °C) for polymeric photovoltaic devices is much lower than that for some types of inorganic solar cells (100 –170 °C).

CONCLUSION

A large photoelectrical conversion efficiency of the SCCs was attributed to the presence of nano-heterojunctions of TiO₂/P3HT. For the temperature range under investigation, the increase of the fill factor compensated the decrease of the open-circuit voltage, and the increase in the short-circuit current resulted in an overall increase of the energy conversion efficiency with increasing temperature. At elevated temperatures (60 – 80) °C the efficiency of the polymeric and composite cells reached a maximum value of 1.6% and 2.1%, respectively. Over these temperatures the efficiency decreased strongly, however for the composite cells, it maintained a critical value of 1.2 % in a temperature range from 110 to 140 °C. Compared to polymeric devices, composite-based solar cells exhibited much better thermal stability. This fact is closely related to the lowered thermal expansion coefficient of the photoactive P3HT+nc-TiO₂ layer in the composite-based devices.



Fabrication and Characterization of Large-Pixel Size OLEDs Used For Opto-Biomedical Analysis

Research topics: Nanocomposites for OLED, Microfluidic, Opto-Biomedical Analysis

Nguyen Nang Dinh (VNU), Vo-Van Truong (Canada), Do Ngoc Chung, Tran Thi Thao (VNU)

ABSTRACT: With the aim to use a “flat film-like shape” excitation source in the opto-biomedical analysis system (OBMAS), a deep-blue organic light emitting diodes (OLED) with 240 mm² in size and an emission wavelength of 455 nm were fabricated by vacuum evaporation of low-molecular-weight polymers. In the devices polymer NPB was used for hole transport layer (HTL), MADN – for emitting layer (EML) and Alq3 – for electron transport layer (ETL). The output power, the luminous efficiency, the peak wavelength and the full width at half-maximum (FWHM) of the deep-blue OLED were 1.5 mW, 1.0 cd/A, 455 nm and 100 nm, respectively, at a forward current of 30 mA. Under excitation of this excitation source, the photoluminance of the CdSe-QDs attached with listeria monocytogenes bacteria exhibit clear orange colour light. The image of the luminance was detected by a 1.3 Mpx sensitive webcam. This can be used in the biomedical analysis by using an optic microscope acting like an opto-biomedical microanalysis system (OBMAS). With use of the OBMAS one can qualitatively detect the presence of bacteria attached to the QDs through specific antibodies.

INTRODUCTION

As an excitation light, OLED possess another advantage in comparison with LEDs in the *flat film-like shape* that makes OLED easy to integrate monolithically with microfluidic mixers made on flat glass substrates. Kopelman et al reported a fluorescent chemical sensor platform integrating an OLED device light-source with a fluorescent probe for oxygen sensor. Qiu and co-workers presented an integrated PDMS microfluidic device with a 520 nm (peak wavelength) green OLED and optical fibers. Kim et al reported an advanced and compact microchip coupled with a green OLED of 530 nm (peak wavelength) and a PIN photodiode for fluorescence detection which achieving a detection limit of 10⁻⁵ M Rhodamine 6G (10 μM) as reported. In a lab-on-a-chip (LOC) the cross-polarized technique is needed, as it can distinguish excitation light from emission light by polarization, even if the excitation and signal light overlap in wavelength.

In this work we present recent results on the preparation and characterization of the large-pixel size OLEDs that can be served as the *flat film-like shape* excitation sources in the LOC for the opto-biomedical analysis. The working principle of the opto-biomedical analysis system (OBMAS) has also been investigated.

EXPERIMENTAL

Conducting polymers or organic semiconducting materials used in this work are the “low-molecular-weight” polymers like tris(8-hydroxyquinolinato)aluminum(III) or N, N-Bis(naphthalen-1-yl)-, N,N-bis(phenyl) benzidine. Thin or/and ultrathin films of these polymers can be made by sublimating (evaporating) in vacuum. The initial materials used for the evaporation are the polymers purchased from Sigma-Aldrich Ltd. The chemicals, their abbreviation and function are listed in Table 1. All the layers in devices were made by evaporation in high vacuum, the pressure in the vacuum chamber is of ~ 2.5×10⁻⁴ Pa.

Table 1. Conjugate polymers used for OLEDs preparation

Name	Abbreviation	Function
N, N-Bis(naphthalen-1-yl)-, N,N-bis(phenyl) benzidine	NPB	HTL
2-methyl-9,10-bis(naphthalene-2-yl)anthracene	MADN	EML
Tris (8-hydroxyquinolinato) aluminum (III)	Alq3	ETL or EML
Bis(10-hydroxybenzo[h]quinolinato)-beryllium	Bebq2	ETL

The ITO-coated glass pieces with 25×25 mm² in size were used as substrates, further as the transparent anode. The ITO coating was etched leaving a working area of 9 mm², on each ITO piece there are four square cells. For the large-area OLED, the working area consists of 240 mm² for one ITO piece. The substrates were ultrasonically cleaned following three steps: 15 min in acetone, 10 min in ethanol and 5 min in distilled water. Finally, the substrates were dried by nitrogen gaseous flow and kept in a argon glove-box until further use.

The organic layers NPB as HTL, MADN as EML and Alq3 as ETL were obtained by deposition through shadow mask in the high-vacuum chamber. Further, a shallow contact (ultrathin LiF layer) with aluminum cathode (Al) followed by 100 nm thick layer served as the cathode were successively evaporated. The working area of OLED pixels defined by the overlap of anode and cathode layouts is 3×3 mm² (or 15×16 mm² for the larger-area OLEDs). Finally, the fabricated samples were hermetically encapsulated using glass with getter before taking out of the glove-box for measurements.

The thickness of the films was automatically controlled by using a quartz crystal microbalance (QCM) during evaporation. For comparison, the different devices were made, as follows (the number in brackets shows the thickness of the films in nanometer):

ITO/NPB(50)/Alq3(40)/LiF(0.5)/Al
ITO/NPB(50)/Alq3(40)/Bebq2(20)/LiF(0.5)/Al
ITO/NPB(50)/Bebq2(40)/Alq3(20)/LiF(0.5)/Al
ITO/NPB(50)/MADN(50)/Alq3(20)/LiF(0.5)/Al

Comparing with Alq3 ($C_{27}H_{18}AlN_3O_3$), MADN ($C_{35}H_{24}$) has a less complicated molecular structure. However, MADN is a prospective polymer that can be used for the EML in OLEDs, because MADN is stable at temperatures higher 330 °C and the sublimation efficiency is larger 99%. Moreover, the bandgap of MADN is larger than that of Alq3.

RESULTS AND DISCUSSION

Comparing with Alq3 ($C_{27}H_{18}AlN_3O_3$), MADN ($C_{35}H_{24}$) has a less complicated molecular structure. However, MADN is a prospective polymer that can be used for the EML in OLEDs, because MADN is stable at temperatures higher 330 °C and the sublimation efficiency is larger 99%. Moreover, the bandgap of MADN is larger than that of Alq3.

Fig. 1 presented EL curves of two other devices, the first is the OLED with using Alq3 served simultaneously as EML and ETL, while the second one is the OLED with using Alq3 and Beq2 served as EML and ETL, respectively.

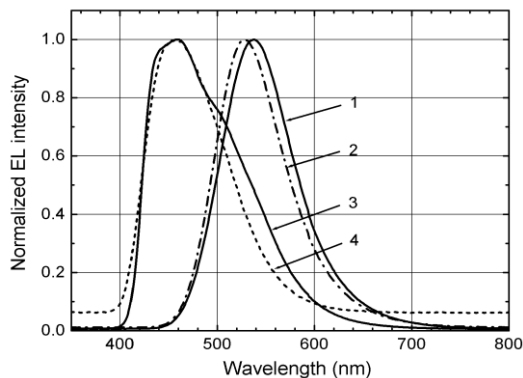


Fig 1. EL spectra of different laminar OLEDs: ITO/NPB/Alq3/LiF/AI (1) ITO/NPB/Alq3/Beq2/LiF/AI (2), ITO/NPB/MADN/LiF/AI (3), ITO/NPB/MADN/Alq3LiF/AI (4).

The luminous efficiency vs. luminance of the devices is plotted in Fig. 2. From this figure one can see that at the same value of the luminance, the MADN-OLED with ETL (Alq3) exhibits much larger luminance efficiency. The effect of both the HTL and ETL on the enhancement of electroluminescence efficiency or (luminance efficiency) was well demonstrated, associated with the equalization process of injection rates of holes and electrons. Indeed, The electroluminescence efficiency can be determined by using an expression obtained by Tsutsui and Saito:

$$\eta_{\phi} = \gamma \times \eta_r \times \phi_f \quad (1)$$

where γ is a double charge injection factor which is dependent on the processes of carrier injection and is maximal ($\gamma = 1$) if a balanced charge injection into the emission layer of the device is achieved, i.e. the number of injected negative charges (electrons) equals the number of injected positive charges (holes); η_r quantifies the efficiency of the formation of a singlet exciton from a positive and a negative polaron, and ϕ_f is the photoluminescence quantum efficiency.

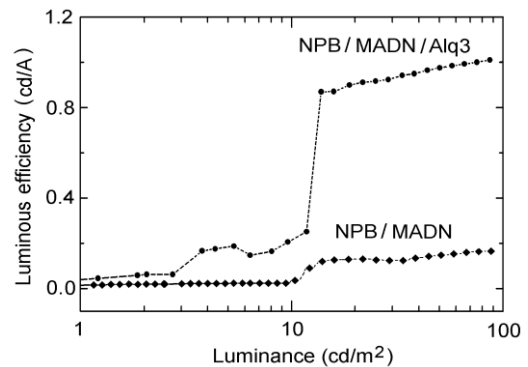


Figure 2. The luminous efficiency vs. luminance of MADN device without ETL (bottom curve) and with the ETL (top curve).

The deep-blue OLED with MADN as the EML was used for a flat excitation source excitation in so called "Opto-Bio-Medical Micro-analysis System" (OBMAS), as shown in Fig. 3.

The abrupt increase in efficiency occurred at the value of luminance about 110 cd/m^2 . This relates to the most effective current range corresponding polarized potentials that was applied onto the transparent anode (ITO), where the current density in the I-V characteristic raised with an abrupt value. For testing the working principle of the OBMAS, the colloidal CdSe quantum dots (CdSe-QDs) with 18 – 20 nm in size were used, this material emits luminance with a peak at ~ 655 nm. CdSe-QDs were attached with the DNA of some bacteria, for instance, listeria monocytogenes bacteria (LMB). The deep-blue light emitted from the OLED light was polarized by the first polarizer to distinguish excitation light and signal light (Fig. 3). The last emitted from the sample cell containing colloidal CdSe-QDs attached with the LMB. The signal light or luminous emission was recorded by using a webcam with the resolution of 1.3 Mpx. The results on observing the presence of the LMB are shown in Fig. 4.

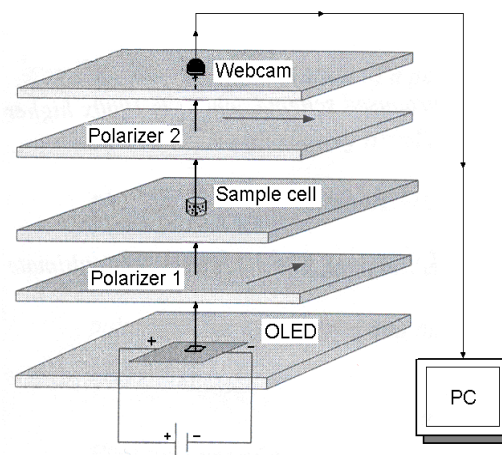


Fig. 3. Schema of an opto-biomedical analysis system based two cross-polarizers and a photodigital camera or a sensitive webcam.

Without using polarizer 1, the image of the light emitted from the deep-blue OLED is strongly bright (Fig. 4a) and with using polarizer 1 and 2, the image became dark (Fig. 4b). This proves that the light was completely polarized by polarizer 1. When the sample cell was put on the pathway of the polarized excitation light, we observed the luminance image with the orange colour (Fig. 4c). The image reflects the photoluminescence of the CdSe-QDs under excitation of the deep-blue polarized light from the OLED. This clearly shows that using OBMAS one can qualitatively detect the presence of bacteria.

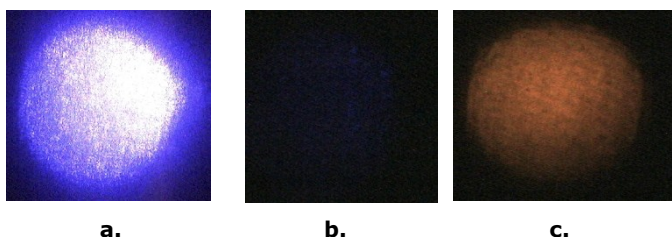


Figure 4. Image of the excitation beam without (a), with polarizer 1 (b) and image of luminous emission of CdSe-QDs attached with LMB (c).

CONCLUSIONS

Deep-blue OLEDs with 240 mm² in size and an emission wavelength of 455 nm were fabricated. The emission spectrum possesses a full width of half maximum (FWHM) of 100 nm. Using these OLEDs for a so called "flat film-like shape" excitation source, the photoluminescence of the CdSe-QDs attached with listeria monocytogenes bacteria exhibited clear orange colour light. The image of the luminance was detected due to taking a photograph by a sensitive webcam. This suggests a very useful application for the biomedical analysis by using an optic microscope incorporated with two cross-polarizers that can work as an opto-biomedical microanalysis system (OBMAS). With use of the OBMAS one can qualitatively detect the presence of the bacteria, once the last are attached to the QDs through specific antibodies.

UNIVERSITY'S SELECTED PUBLICATIONS IN 2015

Articles

- [1] Ngoc Thang Bui, Tu Bao Ho, T.A. Kanda (2015) Semi-supervised Tensor Regression Model for siRNA Efficacy Prediction. *BMC Bioinformatics*, 16 (80). ISSN 1471-2105
- [2] The Duy Bui, Thi-Hoa Nong, Trung Kien Dang (2015) Improving Learning Rule for Fuzzy Associative Memory with Combination of Content and Association. *Neurocomputing*, 149 . pp. 59-64. ISSN 0925-2312
- [3] Thu Hang Bui, Duc Tung Bui, Duc Trinh Chu (2015) Microfluidic Injector Simulation With FSAW Sensor for 3-D Integration. *IEEE Transactions on Instrumentation and Measurement*, 64 (4). 849 -856. ISSN 0018-9456
- [4] Thu Hang Bui, Duc Tung Bui, Duc Trinh Chu (2015) An optimization of IDTs for surface acoustic wave sensor. *International Journal Nanotechnology*. ISSN 1741-8151
- [5] Trung Ninh Bui, Quoc Tuan Nguyen, Van Hoi Nguyen (2015) Influence of ASE Noise on the Performance of DWDM Networks Using Low-Power Pumped Raman Amplifiers. *IETE Journal of Research*, 62 (2). pp. 239-245. ISSN 0974-780X
- [6] Trung Ninh Bui, Quoc Tuan Nguyen, Viet Hung Ta, The Anh Nguyen, Van Hoi Pham (2015) Influence of ASE noise on performance of DWDM networks using low-power pumped Raman amplifiers. *IETE Journal of Research* . ISSN 0974-780X
- [7] Duc Dung Dang, Van Thiet Duong, Odkhuuc Dorj, Viet Cuong Le, Hoang Tuan Nguyen, Cho Sunglae (2015) Room-temperature ferromagnetism in Fe-doped wide band gap ferroelectric Bi_{0.5}K_{0.5}TiO₃ nanocrystals. *Materials Letters*, 156 . pp. 129-133.
- [8] Thanh Hai Dang, Dai Thanh Nguyen, Thi Minh Trang Pham, Si Quang Le, Thi Thu Hang Phan, Cao Cuong Dang, Kim Phuc Hoang, Huu Duc Nguyen, Duc Dong Do, Quang Minh Bui, Bao Son Pham, Sy Vinh Le (2015) Whole Genome Analysis of a Vietnamese Trio. *Journal of Bioscience*, 40 (1). pp. 114-123. ISSN 0250-5991
- [9] Trung Kien Dang, Marcel Worring, The Duy Bui (2015) Building 3D Event Logs for Video Investigation. *Multimedia Tools and Applications*, 74 (13). pp. 4617-4639. ISSN 1380-7501
- [10] Thi Thai Mai Dinh, Quoc Tuan Nguyen, Dinh Thong Nguyen (2015) On the Reuse of Shadowed CRs as AF Diversity Relays in Cooperative Spectrum Sensing in Correlated Suzuki Fading Channels. *IEICE Transactions on Communications*, 98 (1). pp. 116-125. ISSN 1745-1345
- [11] Van Chau Dinh, Van Thuong Dinh (2015) The MEH-PPV/YAG:Ce Hybrid Nanocomposite Material for Solution Processing Fabrication of Optoelectronic Device. *Journal of Nanomaterials*, 105 . pp. 1-5. ISSN 1687-4129
- [12] Hong Minh Do, Nguyen Quoc Trinh Bui (2015) Sub-100 nm Ferroelectric-Gate Thin-Film Transistor with Low-Temperature PZT Fabricated on SiO₂/Si Substrate. *Ferroelectrics Letters Section*, 42 (1-3).
- [13] Khac Phong Do, Ba Tung Nguyen, Xuan Thanh Nguyen, Quang Hung Bui, Nguyen Le Tran, Thi Nhat Thanh Nguyen, Van Quynh Vuong, Thanh Ha Le (2015) Spatial Interpolation and Assimilation Methods for Satellite and Ground Meteorological Data in Vietnam. *Journal of Information Processing Systems* . ISSN 1976-913X

- [14] Kim Anh Do, Van Chau Dinh, Nam Nhat Hoang, Van Hiep Vuong, Kurisu Makio (2015) Effect of Cerium Doping on Crystal Structure and Magnetic Properties of $\text{La}_{1-y}\text{Ce}_y\text{Fe}_{11.44}\text{Si}_{1.56}$ Compounds. *Materials Transactions*, 56 . p. 1355.
- [15] Huu Chuc Doan, Gia Duong Bach (2015) Investigation of Rectifier Circuit Configurations for Microwave Power Transmission System Operating at S Band. *International Journal of Electrical and Computer Engineering*, 5 (5). ISSN 2088-8708
- [16] Phuong Hanh Du, Hai Dang Pham, Ba Duy Vu (2015) Trục quan hoá dữ liệu lớn trong ứng dụng giám sát và điều khiển tập trung. *VNU Journal of Science* . ISSN 0866-8612
- [17] David Gaul, Roman Mezencev, Quoc Long Tran, Christina M. Jones, Benedict Benigno, Alexander Gray, Facundo Fernandez, John F. McDonald (2015) Highly-Accurate Metabolomic Detection of Early-Stage Ovarian Cancer. *Scientific Reports*, 5 (16351). ISSN 2045-2322
- [18] Ngoc Hien Ha, Huy Hoang Bui, Thi Huong Tran, Thanh Than Tran, Thi Thu Ha Pham, Dang Toan Ta, Minh Son Nguyen (2015) Study of the climate change impacts on water quality in upstream portion of the Cau River Basin, Vietnam. *Environmental Modeling and Assessment* (4). ISSN 1420-2026
- [19] Dang Thi Thu Hien, Hoang Xuan Huan, Le Xuan Minh Hoang (2015) An Effective Solution to Regression Problem by RBF Neuron Network. *International Journal of Operations Research and Information Systems*, 6 (4). pp. 57-74. ISSN 1947-9328
- [20] Anh Quy Hoang, Minh-Trien Pham (2015) Applying APF and PSO Algorithm for searching task of Multi-robot System. *VNU Journal of Science* . ISSN 1859-3585
- [21] V. Thiem L., Duc Thang Pham, D. Dung D., T. Tu L., G. Kim C (2015) Magnetic Behaviors of Arrays of Co-Ni-P Nanorod: Effects of Applied Magnetic Field. *Materials Transactions*, 56 (9). p. 1327.
- [22] Duc Viet La (2015) Crane sway reduction using Coriolis force produced by radial spring and damper. *Journal of Mechanical Science and Technology*, 29 (3). pp. 973-979. ISSN 1976-3824
- [23] Duc Viet La (2015) Partial Stochastic Linearization of a Spherical Pendulum With Coriolis Damping Produced by Radial Spring and Damper. *Journal of Vibration and Acoustics*, 5 . pp. 137-143. ISSN 1048-9002
- [24] Duc Viet La, Park Youngjin (2015) A Cable-Passive Damper System for Sway and Skew Motion Control of a Crane Spreader. *Shock and Vibration* (507549). p. 11. ISSN 1875-9203
- [25] Dinh Thanh Le, Dai Tho Nguyen (2015) Indoor Fire Detection using Wireless Sensor Networks. *Journal on Information Technologies and Communications* .
- [26] Dinh Trong Le, Thi Thao Tran, Nang Dinh Nguyen (2015) Characterization of the Li-ionic Conductivity of $\text{La}_{(2/3-x)}\text{Li}_3\text{TiO}_3$ ceramics used for all-solid-state batteries. *Solid State Ionics*, 278 . pp. 228-232.
- [27] Khanh Trinh Le, Dinh Hieu Vo, Ngoc Hung Pham (2015) A Method for Automated User Interaction Testing of Web Applications. *Research, Development and Application on Information Technology and Communication Technology*, E3 (8). pp. 28-37.

- [28] Thanh Ha Le, Won Jung Seung, Sun Won Chee (2015) Reduced Reference Quality Metric for Depth Images. *Advanced Multimedia and Ubiquitous Engineering, Lecture Notes in Electrical Engineering*, Volume . pp. 117-122. ISSN 1876-1100
- [29] Viet Cuong Le, Xuan Nghia Nguyen, Duc Thang Pham (2015) Sorting and Trapping Human Cells Using a Matrix of Square Micro-Magnets. *Materials Transactions*, 56 (9). pp. 1431-1433.
- [30] Yang Koo Lee, Thi Hong Nhan Vu, Thanh Ha Le (2015) Dual-phase approach to Improve Prediction of Heart Disease in Mobile Environment. *ETRI Journal*, 37 (2). pp. 222-232. ISSN 1225-6463
- [31] Dang Nhac Lu, Thu Trang Nguyen, Thi Hau Nguyen, Ha Nam Nguyen, Gyoo Seok Choi (2015) Detecting smartphone user habits using sequential pattern analysis. *International Journal of Internet, Broadcasting and Communication*, 7 (1). pp. 20-22.
- [32] Tat Thang NGUYEN, Hideki MURAKAWA, Nobuyoshi TSUZUKI, Ngoc Hai DUONG, Hiroshige KIKURA (2015) Ultrasonic Doppler velocity profile measurement of single- and two-phase flows using spike excitation. *Sensors and Actuators*, 16 (4). pp. 335-344.
- [33] Cong Luong Nguyen, Anissa Mokraoui, Pierre Duhamel, Linh Trung Nguyen (2015) Improved time and frequency synchronization in presence of imperfect channel state information. *EURASIP Journal on Wireless Communications and Networking*, 2015 (1). pp. 1-17. ISSN 1687-1499
- [34] Dac Hai Nguyen, Quoc Tuan Vu, Quang Loc Do, Hoang Hai Nguyen, Duc Trinh Chu (2015) Differential C4D sensor for conductive and non-conductive fluidic channel. *Microsystem Technologies Journal* . pp. 1-10. ISSN 0946-7076
- [35] Dinh Duc Nguyen, Hadavinia Homayoun, Van Thu Pham, Quoc Quan Tran (2015) Vibration and nonlinear dynamic response of imperfect three-phase polymer nanocomposite panel resting on elastic foundations under hydrodynamic loads. *Composite Structures*, 131 . pp. 229-237. ISSN 0263-8223
- [36] Dinh Duc Nguyen, Duc Tuan Ngo, Phuong Tran, Trong Dao Nguyen, Tat Dat Ngo (2015) Nonlinear dynamic analysis of Sigmoid functionally graded circular cylindrical shells on elastic foundations using the third order shear deformation theory in thermal environments. *International Journal of Mechanical Sciences*, 101 . pp. 338-348. ISSN 0020-7403
- [37] Dinh Duc Nguyen, Duc Tuan Ngo, Quoc Quan Tran, Van Quyen Nguyen, Van Anh Tran (2015) Nonlinear mechanical, thermal and thermo-mechanical postbuckling of imperfect eccentrically stiffened thin FGM cylindrical panels on elastic foundations. *Thin-Walled Structures*, 96 . pp. 155-168. ISSN 0263-8231
- [38] Dinh Duc Nguyen, Hong Cong Pham (2015) Nonlinear Thermal Stability of Eccentrically Stiffened Functionally Graded Truncated Conical Shells Surrounded on Elastic Foundations. *European Journal of Mechanics - A/Solids*, 50 . pp. 120-131. ISSN 0997-7538
- [39] Dinh Duc Nguyen, Hong Cong Pham (2015) Nonlinear dynamic response of imperfect symmetric thin S-FGM plate with metal- ceramic-metal layers on elastic foundation. *Journal of Vibration and Control*, 21(4) . pp. 637-646. ISSN 1741-2986
- [40] Dinh Duc Nguyen, Hong Cong Pham (2015) Nonlinear vibration of thick FGM plates on elastic foundation subjected to thermal and mechanical loads using the first order shear deformation plate theory. *Cogent engineering*, 2 . pp. 1-17. ISSN 2331-1916

- [41] Dinh Duc Nguyen, Hong Cong Pham, Duc Tuan Ngo, Phuong Tran, Minh Anh Vu, Dinh Quang Vu (2015) Nonlinear vibration and dynamic response of imperfect eccentrically stiffened shear deformable sandwich plate with functionally graded material in thermal environment. *Journal of Sandwich Structures and Materials* . ISSN 1099-6362
- [42] Dinh Duc Nguyen, Hong Cong Pham, Dinh Quang Vu (2015) Thermal stability of eccentrically stiffened FGM plate on elastic foundation based on Reddy's third-order shear deformation plate theory. *Journal of Thermal Stresses* . ISSN 0149-5739 (Submitted)
- [43] Dinh Duc Nguyen, Hong Cong Pham, Minh Anh Vu, Dinh Quang Vu, Phuong Tran, Duc Tuan Ngo, Hoa Thinh Nguyen (2015) Mechanical and thermal stability of eccentrically stiffened functionally graded conical shell panels resting on elastic foundations and in thermal environment. *Composite Structures*, 132 . pp. 597-609. ISSN 0263-8223
- [44] Dinh Duc Nguyen, Toan Thang Pham (2015) Nonlinear dynamic response and vibration of shear deformable imperfect eccentrically stiffened S-FGM circular cylindrical shells surrounded on elastic foundations. *Aerospace Science and Technology Volume 40*, January 2015, Pages 115–127, 40 . pp. 115-127.
- [45] Dinh Duc Nguyen, Toan Thang Pham (2015) Nonlinear response of imperfect eccentrically stiffened ceramic-metal-ceramic S-FGM thin circular cylindrical shells surrounded on elastic foundations under uniform radial load. *Mechanics of Advanced Materials and Structures*, 22 . pp. 1031-1038. ISSN 1537-6494
- [46] Dinh Duc Nguyen, Toan Thang Pham, Trong Dao Nguyen, Van Tac Hoang (2015) Nonlinear buckling of higher deformable S-FGM thick circular cylindrical shells with metal-ceramic-metal layers surrounded on elastic foundations in thermal environment. *Composite Structures*, 121 . pp. 134-141. ISSN 0263-8223
- [47] Dinh Duc Nguyen, Quoc Quan Tran (2015) Nonlinear dynamic analysis of imperfect FGM double curved thin shallow shells with temperature-dependent properties on elastic foundation. *Journal of Vibration and Control*, 21 (7). pp. 1340-1362. ISSN 1741-2986
- [48] Dinh Duc Nguyen, Quoc Quan Tran, Dinh Luat Vu (2015) Nonlinear Dynamic Analysis and Vibration of Shear Deformable Piezoelectric FGM Double Curved Shallow Shells under Damping-Thermo-Electro-Mechanical Loads. *Composite Structures*, 125 . pp. 29-40.
- [49] Dinh Duc Nguyen, Quoc Quan Tran, Dinh Luat Vu (2015) Nonlinear dynamic analysis and vibration of shear deformable piezoelectric FGM double curved shallow shells under damping-thermo-electro-mechanical loads. *Composite Structures*, 125 . pp. 29-40. ISSN 0263-8223
- [50] Dong Anh Nguyen, X. Hung Le, Duc Viet La, C. Thang Nguyen (2015) Global–local mean square error criterion for equivalent linearization of nonlinear systems under random excitation. *Acta Mechanica*, 226 (9). pp. 3011-3029.
- [51] Dong Anh Nguyen, L. Zakovorotny V., N. Hao D., X. Chiem N. (2015) 1/3 Subharmonic Response Of Duffing Oscillator Under Periodic And Random Excitations. *Journal Bulletin DGTU* .
- [52] Ha Nam Nguyen, Gyoo-Seok Choi (2015) Smartphones Behavior Analysis based on Sequential Pattern Approaches. *Information Journal*, 18 (7). pp. 3245-3252. ISSN 1344-8994

- [53] Khac Thuan Nguyen, Van Hiep Vuong, Thi Kim Anh Do, Nam Nhat Hoang (2015) Stable Gold Carbide Nanostructures. *Materials Transactions*, 56 (9). pp. 1383-186.
- [54] Minh Tran Nguyen, Vu Bang Giang Truong (2015) Dual-band Microstrip Antenna for 4G-LTE Handheld Devices. *VNU Journal of Computer Science and Communication Engineering* . ISSN 0866-8612
- [55] Minh-Tien Nguyen, Tri Thanh Nguyen (2015) DESRM: a Disease Extraction System for Real-time Monitoring. *International Journal of Computational Vision and Robotics (IJCVR)*, 5 (3). pp. 282-301. ISSN 1752-914X
- [56] Ngoc Binh Nguyen, Van Huong Pham, Ngoc Hai Bui (2015) An Approach to Embedded Software Optimization Based on Reverse Engineering. *IEICE Transactions on Information and Systems*, E98-D (6). pp. 1166-1175. ISSN 0916-8532
- [57] Ngoc Tan Nguyen, Anan Suebsomran, Keattisak Sripimanwat, Nam Hoang Nguyen (2015) Design and simulation of a novel indoor mobile robot localization method using a light-emitting diode positioning system. *Transactions of the Institute of Measurement and Control* . 0142331215590470. ISSN 1477-0369
- [58] Phuong Thai Nguyen, Anh Cuong Le, Tu Bao Ho, Van Hiep Nguyen (2015) Vietnamese Treebank Construction and Entropy-based Error Detection. *Language Resources and Evaluation*, 49 (3). pp. 487-519. ISSN 1574-0218
- [59] Phuong Thai Nguyen, Anh Cuong Le, Tu Bao Ho, Van Hiep Nguyen (2015) Vietnamese treebank construction and entropy-based error detection. *Language Resources and Evaluation*, 49 (3). pp. 487-519. ISSN 1574-0218
- [60] Quang Hoang Nguyen, Van Khoa Vu, Van Diep Do (2015) Tuning of PID Controllers for Overhead Cranes Using Genetic Algorithm. *Journal of Science & Technology technical Universities* . ISSN 2354-1083
- [61] Quoc Dat Nguyen, Quoc Dai Nguyen, Bao Son Pham (2015) Ripple Down Rules for Question Answering. *Semantic Web Journal* . ISSN 1570-0844
- [62] Tat Thang Nguyen, TSUZUKI Nobuyoshi, MURAKAWA Hideki, Ngoc Hai Duong, KIKURA Hiroshige (2015) Measurement of the condensation rate in subcooled flow boiling by using two ultrasonic frequencies. *International Journal of Heat and Mass Transfer* .
- [63] Thi Hoai Ha Nguyen, Thi Bich Dao Pham, Thanh Loan Dang, Ngoc Thanh Nguyen, Dinh Tuan Nguyen, Thi Mai Pham, Dang Khoa Tran (2015) Microalgae as indicators of eutrophication in Hoan Kiem lake, Hanoi, Vietnam. *Journal of Biotechnology*, 13 (2). pp. 355-365.
- [64] Thi Huyen Chau Nguyen, Pascal Richard, Emmanuel Grolleau (2015) An FTPAS for Response Time Analysis of Fixed Priority Real-Time Tasks with Resource Augmentation. *IEEE Transactions on Computers*, 64 (7). pp. 1805-1818. ISSN 0018-9340
- [65] Thi Nhat Thanh Nguyen, Quang Hung Bui, Van Hung Pham, Viet Hung Luu, Duc Man Chu (2015) Particulate matter concentration mapping from MODIS satellite data: a Vietnamese case study. *Environmental Research Letters*, 9-10 . ISSN 1748-9326
- [66] Tien Anh Nguyen, Duc Tan Tran, U. Pliquett, G.A. Urban (2015) Behavior and the Response of Cancer Cells on Anticancer Drug Treatment Monitored with Microelectrode Array. *Procedia Engineering*, 120 . pp. 928-931. ISSN 1877-7058

- [67] Van Thuan Nguyen, Vinh Son Tran, Quang Trung Tran, Thi Thao Tran, Nang Dinh Nguyen (2015) Development of laser beam diffraction technique for determination of thermal expansion coefficient of polymeric thin films. *VNU J. Sci.: Mat. – Phys.*, 31 . pp. 21-27.
- [68] Van Toan Nguyen, Duc Kien Nguyen, Nam Hoang Nguyen, Keattisak Sripimanwat (2015) Downlink Channel Allocation Scheme deploying Cooperative Channel Monitoring for Cognitive Cellular-Femtocell Networks. *Journal of Networks*, 10 (6). pp. 338-343. ISSN 1796-2056
- [69] Viet Khoa Nguyen (2015) Dynamic analysis of a cracked beam-like bridge subjected to earthquake and moving vehicle. *Advances in Structural Engineering 2015*, Vol 18 (1), p. 75-96 .
- [70] Viet Khoa Nguyen (2015) Mode shape analysis of a cracked beam and its application for crack detection. *Journal of Sound and Vibration*, 333 . pp. 848-872.
- [71] Xuan Thanh Nguyen, Ba Tung Nguyen, Khac Phong Do, Quang Hung Bui, Thi Nhat Thanh Nguyen, Van Quynh Vuong, Thanh Ha Le (2015) Spatial Interpolation of Meteorologic Variables in Vietnam using the Kriging Method. *Journal of Information Processing Systems*, 11 (1). pp. 134-147. ISSN 1976-913X
- [72] Thi Hoa Nong, The Duy Bui (2015) An Improved Learning Rule for Fuzzy ART. *Journal of Information Science and Engineering*, 30 (3). pp. 713-726. ISSN 1016-2364
- [73] D.H. Yen P., T. Hang N., Van Chau Dinh, Van Thuong Dinh, Nam Nhat Hoang (2015) Estimation of Valence Distribution in Perovskites using the Bond Valence Method. *Information*, 18 (7). pp. 2917-2926.
- [74] Duc Hong Pham, Anh Cuong Le, Hoan Le (2015) Một mô hình hiệu quả đánh giá quan điểm người dùng đối với các thuộc tính sản phẩm sử dụng mạng Noron. *Tạp chí Khoa học và Kỹ thuật*, 16 .
- [75] Hong Cong Pham, Huy Bich Dao, Dinh Duc Nguyen (2015) Nonlinear analysis on flutter of FGM plates using Ilyushin supersonic aerodynamic theory. *VNU Journal of Science*, 31 (1). pp. 22-35. ISSN 0866-8612
- [76] Hong Cong Pham, Thi Ngoc An Pham, Dinh Duc Nguyen (2015) Nonlinear stability of shear deformable eccentrically stiffened functionally graded plates on elastic foundations with temperature-dependent properties. *Science and Engineering of Composite Materials*, 22 (6). ISSN 2191-0359
- [77] Nam Thanh Pham, Khuong Duy Vu, Trieu Duong Dinh, Thanh Ha Le (2015) Efficient Region-of-Interest Based Adaptive Bit Allocation for 3D-TV Video Transmission over Networks. *VNU Journal of Computer Science and Communication Engineering* . ISSN 0866-8612
- [78] Van Tang Pham, Dinh Chinh Nguyen, Quang Huy Tran, Duc Trinh Chu, Duc Tan Tran (2015) Thermal Stability of Magnetic Compass Sensor for High Accuracy Positioning Applications. *Sensors & Transducers*, 195 (12). p. 1. ISSN 1726-5479
- [79] Van Tang Pham, Van Thang Nguyen, Duc Trinh Chu, Duc Tan Tran (2015) 15-State Extended Kalman Filter Design for INS/GPS Navigation System. *Journal of Automation and Control Engineering*, 3 (2). ISSN 2301-3702

- [80] Hai-Phong Phan, Xuan-Tu Tran (2015) Design and Modeling of a Voltage-Frequency Controller for Network-on-Chip Routers based on Fuzzy-Logic. VNU Journal of Computer Science and Communication Engineering, 31 (2). pp. 56-65. ISSN 0866-8612
- [81] Huu Phu Phan, Minh Ngoc Nguyen, Ngoc Viet Nguyen, Duc Trinh Chu (2015) Analytical modeling of a silicon-polymer electrothermal microactuator. Microsystem Technologies Journal . ISSN 0946-7076
- [82] The Long Phan, Duc Thang Pham, A. Ho T., V. Manh T., Dang Thanh Tran, D. Lam V, T. Dang N., C. Yu S. (2015) Local geometric and electronic structures and origin of magnetism in Co-doped BaTiO₃ multiferroics. Journal Applied Physics, 117 .
- [83] A. Ho T, D. Thanh T., V. Manh T., O. Ho T, Duc Thang Pham, L. Phan T., C. Yu S. (2015) Critical Behavior of La_{0.7}Ca_{0.3}MnO₃ Nanoparticles. Materials Transactions, 56 (9). pp. 1331-1334.
- [84] A. Ho T., D. Thanh T., Yikyung Yu, M. Tartakovsky D., O. Ho T., Duc Thang Pham, Anh Tuan Le, The Long Phan, C. Yu S. (2015) Critical behavior and magnetocaloric effect of Pr_{1-x}CaxMnO₃. Journal Applied Physics, 117 (17D122).
- [85] L. Phan T., Ngoc Chung Do, Duc Thang Pham, C. Yu S. (2015) Crystal Structure and Photoluminescence Properties of Eu-Doped Y₂O₃ Nanoparticles Prepared by Mechanical Milling. Materials transactions, 56 (9). p. 1142.
- [86] Ba Tan Tran, Cao Quyen Tran (2015) Thiết kế mạch khuếch đại công suất cho Modem thủy âm số dùng điều chế FSK. Journal of Science & Technology - Hanoi University of Industry, 28 . pp. 15-18. ISSN 1859-3585
- [87] Cao Quyen Tran (2015) Nghiên cứu điều chế không gian cho kênh nước biển nông giàu tán xạ và tán xạ yếu. Journal of Science & Technology - Hanoi University of Industry, 31 .
- [88] Dang Hien Tran, Van Tuan Do, Van At Pham, Hung Son Le (2015) Novel Algorithm for Nonnegative Matrix Factorization. Journal of New Mathematics and Natural Computation, 11 (2). pp. 121-133. ISSN 1793-7027
- [89] Duc Tan Tran, Dinh Chinh Nguyen, Duc Nghia Tran, Duc Tuyen Ta (2015) Development of a Rainfall-Triggered Landslide System using Wireless Accelerometer Network. International Journal of Advancements in Computing Technology, 7 (5). p. 14. ISSN 2233-9337
- [90] Quang Huy Tran, Duc Tan Tran (2015) Ultrasound Tomography in Circular Measurement Configuration using Nonlinear Reconstruction Method. International Journal of Engineering and Technology (IJET), 7 (6). pp. 2207-2217. ISSN 0975-4024
- [91] Quoc Quan Tran, Huy Bich Dao, Dinh Duc Nguyen (2015) Nonlinear analysis on flutter of functional graded cylindrical panels on elastic foundations using the Ilyushin nonlinear supersonic aerodynamic theory. VNU Journal of Science, 31 (2). pp. 1-14. ISSN 0866-8612
- [92] Quoc Quan Tran, Dinh Duc Nguyen (2015) Nonlinear vibration and dynamic response of shear deformable imperfect functionally graded double curved shallow shells resting on elastic foundations in thermal environments. Journal of Thermal Stresses . ISSN 0149-5739
- [93] Quoc Quan Tran, Phuong Tran, Duc Tuan Ngo, Dinh Duc Nguyen (2015) Nonlinear dynamic analysis and vibration of shear deformable eccentrically stiffened S-FGM cylindrical panels with metal-ceramic-metal layers resting on elastic foundations. Composite Structures, 126 . pp. 16-33. ISSN 0263-8223

- [94] Thi Hong Tran, Duc Huyen Yen Pham, Xuan Quang Vu, Tien Dung Phan (2015) Luminescence Properties of Ce/Tb/Sm Co-Doped Tellurite Glass for White Leds Application. *Materials Transactions*, 56 (9). pp. 1419-1421.
- [95] Thi Thao Tran, Quang Trung Tran, Van Truong Vo, Nang Dinh Nguyen (2015) Enhancement of Power Efficiency and Stability of P3HT-based Organic Solar Cells under Elevated Operating-Temperatures by using a Nanocomposite Photoactive Layer. *Journal of Nanomaterials* . ISSN 1687-4129
- [96] Van Hoi Tran, Xuan Truong Nguyen, Duong Bach Gia (2015) Improvement of Step Tracking Algorithm Used for Mobile Receiver System via Satellite. *International Journal of Electrical and Computer Engineering*, 5 (2). pp. 280-288. ISSN 2088-8708
- [97] Hai Long Trieu, Phuong Thai Nguyen, Le Minh Nguyen (2015) A New Feature to Improve Moore's Sentence Alignment Method. *VNU Journal of Computer Science and Communication Engineering*, 31 (1). pp. 32-44. ISSN 0866-8612
- [98] Anh Hoang Truong, Ngoc Khai Nguyen (2015) Hệ thống kiểu tính cận trên số log cho ngôn ngữ giao dịch đa luồng tối giản. *Tạp chí khoa học* .
- [99] Thang Nguyen Van, Trinh Chu Duc, Tran Duc-Tan (2015) Application of Street Tracking Algorithm in an INS/GPS Integrated Navigation System. *IETE Journal of Research*, 61 (3). pp. 251-258.
- [100] Dieu Huong Vu, Yuki Chiba, Kenro Yatake, Toshiaki Aoki (2015) A Framework for Verifying the Conformance of Design to Its Formal Specifications. *IEICE Transactions on Information and Systems*, E98-D (6). pp. 1137-1149. ISSN 1745-1361
- [101] Quoc Tuan Vu, H. Dac Nguyen, T. Quoc Pham, Dinh Duc Nguyen, Trinh Chu Duc (2015) A printed circuit board capacitive sensor for air bubble inside fluidic flow detection. *Microsystem Technologies*, 21 (4). pp. 911-918. ISSN 1432-1858
- [102] Thi Hong Ha Vu, Sh. Atabaev Timur, Young Ahn Ji, Nang Dinh Nguyen, Kook Kim Hyung, Hwae Hwang Yoon (2015) Dye-sensitized solar cells composed of photoactive composite photoelectrodes with enhanced solar energy conversion efficiency. *J. Mater. Chem. A*, 3 . pp. 11130-11136.
- [103] Thi Thuy Anh Vu, Huy Bich Dao, Dinh Duc Nguyen (2015) Nonlinear Stability Analysis of Thin FGM Annular Spherical Shells on Elastic Foundations under External Pressure and Thermal Loads. *European Journal of Mechanics - A/Solids*, 50 . pp. 28-38. ISSN 0997-7538
- [104] Thi Thuy Anh Vu, Huy Bich Dao, Dinh Duc Nguyen (2015) Nonlinear buckling analysis of thin FGM annular spherical shells on elastic foundations under external pressure and thermal loads. *European Journal of Mechanics - A/Solids*, 50 . pp. 28-38. ISSN 0997-7538
- [105] Thi Thuy Anh Vu, Huy Bich Dao, Dinh Duc Nguyen (2015) Nonlinear stability of thin FGM annular spherical segment in thermal environment. *Vietnam Journal of Mechanics* . ISSN 0866-7316
- [106] Thi Thuy Anh Vu, Dinh Duc Nguyen (2015) Nonlinear response of shear deformable S-FGM shallow spherical shell with ceramic-metal-ceramic layers resting on elastic foundation in thermal environment. *Mechanics of Advanced Materials and Structures* . ISSN 1537-6494

- [107] Thi Thuy Anh Vu, Dinh Duc Nguyen (2015) The nonlinear stability of axisymmetric FGM annular spherical shells under thermo-mechanical load. *Mechanics of Advanced Materials and Structures*. ISSN 1537-6494
- [108] Van Tam Vu, Duc Tan Tran, Dang Tien Nguyen, Thanh Thuy Nguyen, Trong Hanh Phan (2015) Data Embedding in Audio Signal by a Novel Bit Marking Method. *International Journal of Advancements in Computing Technology*, 7 (1). ISSN 2233-9337
- [109] Van Tam Vu, Duc Tan Tran, Thanh Thuy Nguyen, Trong Hanh Phan (2015) Embedding Data into Audio Signal by Combining Sliding Window Technique with a Novel Marking Bit Method. In: *Advanced Multimedia and Ubiquitous Engineering*. Springer Berlin Heidelberg, pp. 191-197.

Refereed Conference or Workshop

- [110] Ngoc Thang Bui, Sy Vinh Le, Tu Bao Ho (2015) MVRM: A Hybrid Approach to Predict siRNA Efficacy. In: *KSE: the 2015 International Conference on Knowledge and Systems Engineering*, 8-10 October 2015, Ho Chi Minh city, Vietnam.
- [111] Thi Thuy Duong Bui, Thi Quyen Ha, Thi Thu Ha, Thuy Linh Mai, Hong Thai Pham, Van Quyen Dong (2015) Điều tra sự nhiễm virus black queen cell gây bệnh thối mũ chúa trên các đàn ong mật tại Việt Nam. In: *Hội nghị Công nghệ sinh học toàn quốc*, 9-10 July 2015, Danang, Vietnam.
- [112] Thi Minh Hue Chu, Duc Hanh Dang, Ngoc Binh Nguyen (2015) Phương pháp sinh tự động ca kiểm thử từ mô hình ca sử dụng (Automatic Generation of Test Cases based on Use Cases Model). In: *Hội nghị khoa học quốc gia lần thứ VIII “Nghiên cứu cơ bản và ứng dụng Công nghệ Thông tin” năm 2015 (FAIR 2015)*, 9-10 July 2015, Hanoi, Vietnam.
- [113] Nam-Khanh Dang, Michael Meyer, Yuichi Okuyama, Abderazek Ben Abdallah, Xuan-Tu Tran (2015) Soft-Error Resilient 3D Network-on-Chip Router. In: *IEEE iCAST: The IEEE 7th International Conference on Awareness Science and Technology*, 22-24 September 2015, Qinhuangdao, China.
- [114] Thanh Toan Dao, Tuan Anh Vu, Bach Thang Phan, Thanh Hai Nguyen, Quang Vinh Tran (2015) Controllable CMOS Circuits with Floating-Gate Like-based OTFT. In: *ICDV: the 2015 International Conference on Integrated Circuits, Design, and Verification*, 10-11 August 2015, Ho Chi Minh city, Vietnam.
- [115] Thi Huong Dao, Van Khanh To, Ninh Thuan Truong, Quang Ton Chu, Viet Ha Nguyen (2015) Integrating and Checking Access Permissions in Object Oriented Models. In: *NICS: 2nd National Foundation for Science and Technology Development Conference on Information and Computer Science*, 16-18 September 2015, Ho Chi Minh city, Vietnam.
- [116] Van Chau Dinh, Van Thuong Dinh, Nam Nhat Hoang, Thi Hang Nguyen (2015) Application of Bond Valence Method to Estimate the Valence Charge Distribution in the Metal-to-Oxygen Bonding Spheres in Perovskites. In: *2015: the 1st International Joint Conference on Convergence (IJCC)*, 4-8 February 2015, Ho Chi Minh city, Vietnam.
- [117] Duc Dong Do, Ngoc Ha Tran, Thanh Hai Dang, Cao Cuong Dang, Xuan Huan Hoang (2015) An efficient algorithm for global alignment of protein-protein interaction networks. In: *ATC: the 2015 International Conference Advanced Technologies for Communications*, 14-16 October 2015, Ho Chi Minh city, Vietnam.

- [118] Van Toi Dong, Gia Duong Bach (2015) Research, Design and Fabrication of a UHF-Band Power Amplifier Module for Television Transfer Systems. In: VJMW: the 2015 Vietnam-Japan Microwave, 10-11 August 2015, Ho Chi Minh city, Vietnam.
- [119] Viet Huy Duong, Dinh Viet Nguyen (2015) DF-AMS: Proposed solutions for multi-sensor data fusion in wireless sensor networks. In: KSE: the 2015 International Conference on Knowledge and Systems Engineering, 8-10 October 2015, Ho Chi Minh city, Vietnam.
- [120] Viet Huy Duong, Dinh Viet Nguyen (2015) Đề xuất giải pháp tiên xử lý để tổng hợp dữ liệu nhiều cảm biến trong mạng cảm biến không dây. In: the 8th National Conference on Fundamental and Applied IT Research, 2015.
- [121] Thi Quyen Ha, Thi Thu Ha, Thuy Duong Bui, Van Quyen Dong (2015) Nghiên cứu phát hiện virus gây bệnh thối đen mũ chúa (black queen cell virus) trên ong mật ở một số tỉnh miền Bắc Việt Nam năm 2013. In: Hội nghị Khoa học toàn quốc về Sinh thái và tài nguyên Sinh vật, 14-16 October 2015, Hanoi, Vietnam.
- [122] Duc Tam Hoang, Le Minh Nguyen, Bao Son Pham (2015) L2S: Transforming natural language questions into SQL queries. In: KSE: the 2015 International Conference on Knowledge and Systems Engineering, 8-10 October 2015, Ho Chi Minh city, Vietnam.
- [123] Wongpatikaseree Konlakorn, Hoai Son Nguyen, Tan Yasuo (2015) Thermal simulation for evaluation of thermal comfort in real houses. In: SGSH 2015: Smart Grid and Smart Home.
- [124] K. Quynh L., Dinh Tu Bui, X. Dang D., Quoc Viet Dong, Huu Duc Nguyen, Thi Hien Le, Thi Huong Giang Do (2015) Fabrication and investigation of magnetic sensor based on anisotropy magnetoresistance effects for magnetic beads detection. In: Hội nghị Vật lý chất rắn và Khoa học vật liệu toàn quốc lần thứ 9, 2015, Ho Chi Minh city, Vietnam.
- [125] K. Quynh L., Dinh Tu Bui, Quoc Viet Do, T. Thuy N., Xuan Toan Nguyen, Mau Danh Tran, Huu Duc Nguyen, Thi Huong Giang Do (2015) Research, manufacturing optimal structure sensor measure the low magnetic field structure Wheatstone bridge based on anisotropic magnetoresistance effects. In: The 5th International Workshop on Nanotechnology and Application, 11-14 November 2015, Vung Tau, Vietnam.
- [126] Hoang Quynh Le, Mai Vu Tran, Thanh Hai Dang, Nigel Collier (2015) The UET-CAM System in the BioCreAtIvE V CDR Task. In: The 5th BioCreative Challenge Evaluation, 2015, Spain.
- [127] Hoang Quynh Le, Mai Vu Tran, Thanh Hai Dang, Collier Nigel (2015) The UET-CAM System in the BioCreAtIvE V CDR Task. In: 2015: the 5th BioCreative challenge evaluation workshop, 2015, Sevilla, Spain.
- [128] Hong Anh Le, Ninh Thuan Truong, Shin Nakajima (2015) Verifying eventuality properties of imprecise system requirements using event-B. In: SAC 2015, 2015.
- [129] Phe Do Le, Trung Truc Le, Manh Trung Mai, Thi Thu Thao Le, Thi Len LêLe, Dang Thuan Do, Van Thang Nguyen, Cong Thanh Do (2015) Hệ mật mã kép an toàn. In: Kỷ yếu Hội thảo Quốc gia lần thứ 17 "Một số vấn đề chọn lọc của CNTT & TT", 2015, Dac Lac.
- [130] Phe Do Le, Canh Hoang Nguyen (2015) Entropy và ngưỡng an toàn trong lưu trữ và truyền thông tin. In: Hội thảo Quốc gia lần thứ 18 "Một số vấn đề chọn lọc của CNTT & TT", 5-6 November 2015, Ho Chi Minh city.

- [131] Phe Do Le, Canh Hoang Nguyen (2015) Phân tích hội quy và đánh giá chất lượng cuộc sống. In: Hội nghị toàn quốc lần thứ 4 về Xác suất - thống kê, 21-23 March 2015, Danang, Vietnam.
- [132] Thi Hien Le, Thi Huyen Vu, A. Krutyakov Yu (2015) Ứng dụng thuốc thú y mới Argumistin trên nền hạt nano bạc để điều trị bệnh viêm nội mạc tử cung sau sinh ở bò. In: Hội nghị Khoa học toàn quốc Chăn nuôi - Thú y (AVS 2015), 28-29.04.2015, Cần Thơ, Việt Nam, Tr. 554., 2015.
- [133] Thi Duyen Ngo, The Duy Bui (2015) A Vietnamese 3D Taking Face for Embodied Conversational Agents. In: RIVF: the 2015 IEEE-RIVF International Conference on Computing and Communication Technologies, 25-28 January 2015, Can Tho, Vietnam.
- [134] Thi Duyen Ngo, The Duy Bui (2015) A Vietnamese 3D Taking Face for Embodied Conversational Agents. In: RIVF: 2015 IEEE RIVF International Conference on Computing Communication Technologies - Research, Innovation, and Vision for the Future, 25-28 January 2015, Can Tho, Vietnam.
- [135] Dai Thanh Nguyen, Thi Minh Trang Pham, Thanh Hai Dang, Ha Anh Tuan Nguyen, Si Quang Le, Quang Minh Bui, Quang Minh Dao, Bao Son Pham, Sy Vinh Le (2015) Building population-specific reference genomes: A case study of Vietnamese reference genome. In: KSE: the 2015 International Conference on Knowledge and Systems Engineering, 8-10 October 2015, Ho Chi Minh city, Vietnam.
- [136] Dinh Chinh Nguyen, Duc Tan Tran, Duc Nghia Tran (2015) Application of compressed sensing in effective power consumption of WSN for landslide scenario. In: Multimedia and Broadcasting (APMediaCast), 2015 Asia Pacific Conference on, 23-25 April 2015, Bali, Indonesia.
- [137] Dinh Duc Nguyen, Duc Tuan Ngo, Phuong Tran, Quoc Quan Tran, Van Quyen Nguyen (2015) Nonlinear dynamic response of imperfect FGM plates subjected to blast load. In: The XII National Conference on Mechanics of Deformed Solid, 6-7 August 2015, Danang, Vietnam.
- [138] Dinh Duc Nguyen, Hong Cong Pham (2015) Thermal stability analysis of eccentrically stiffened Sigmoid FGM plate with metal-ceramic-metal layers based on first-order shear deformation plate theory. In: The XII National Conference on Mechanics of Deformed Solid, 6-7 August 2015, Danang, Vietnam.
- [139] Dinh The Anh Nguyen, Hoang Giang Bach, Anh Vu Trinh, Gia Duong Bach (2015) A Solution to Enhance the Efficiency of the High Power S Band LDMOS Amplifier for Microwave Power Transmission and Wireless Communication. In: VJMW: the 2015 Vietnam-Japan Microwave, 10-11 August 2015, Ho Chi Minh city, Vietnam.
- [140] Duc Nam Nguyen, Quang Vinh Tran, Kiem Hung Nguyen (2015) Mô hình tính toán và kiến trúc mạng tái cấu hình cấu trúc thô cho các ứng dụng điều khiển hiệu năng cao. In: ECIT: Hội thảo Quốc gia 2015 về Điện tử, Truyền thông và Công nghệ thông tin, 10-11 August 2015, Ho Chi Minh city, Vietnam.
- [141] Duy Tan Nguyen, Dinh Viet Nguyen (2015) SCBC: Sector-Chain Based Clustering Routing Protocol for Energy Efficiency in Heterogeneous Wireless Sensor Network. In: ATC: the 2015 International Conference Advanced Technologies for Communications, 14-16 October 2015, Ho Chi Minh city, Vietnam.

- [142] Duy Tan Nguyen, Dinh Viet Nguyen (2015) SSTBC: Sleep Scheduled and Tree-Based Clustering Routing Protocol for Energy-Efficient in Wireless Sensor Networks. In: RIVF: 2015 IEEE RIVF International Conference on Computing Communication Technologies - Research, Innovation, and Vision for the Future, 25-28 January 2015, Can Tho, Vietnam.
- [143] Hong Quan Nguyen, Phuong Thai Nguyen, Thanh Quyen Dang, Van Hiep Nguyen (2015) Automatic detection of problematic rules in Vietnamese Treebank. In: RIVF: 2015 IEEE RIVF International Conference on Computing Communication Technologies - Research, Innovation, and Vision for the Future, 25-28 January 2015, Can Tho, Vietnam.
- [144] Hong-Quan Nguyen, Phuong-Thai Nguyen, Thanh-Quyen Dang, Van Hiep Nguyen (2015) Automatic Detection of Problematic Rules in Vietnamese Treebank. In: 2015: The 11th IEEE-RIVF International Conference on Computing and Communication Technologies (RIVF 2015), 25-28 January 2015, Can Tho, Vietnam.
- [145] Huong Giang Nguyen, Minh Trien Pham (2015) Applying Improved Discrete Particle Swarm Optimization Onto Mesh-Based Network-on-Chip Application Mapping. In: ICDV: the 2015 International Conference on Integrated Circuits, Design, and Verification, 10-11 August 2015, Ho Chi Minh city, Vietnam.
- [146] Kien Cuong Nguyen, Stathis Efstathios, I. Meletisa (2015) Immobilization and characterization of functional groups deposited on gold nanoparticles for biosensor applications. In: UK-Vietnam workshop on Innovation in Chemical Engineering for Sustainable Environment, 9 - 12 March 2015, Hanoi University of Science and Technology, No. 1 Dai Co Viet Street, Hanoi, Vietnam, page 2.4, 2015, United Kingdom.
- [147] Minh Tien Nguyen, Quang Thuy Ha, Thi Dung Nguyen, Tri Thanh Nguyen, Le Minh Nguyen (2015) Recognizing Textual Entailment in Vietnamese Text: An Experimental Study. In: KSE: the 2015 International Conference on Knowledge and Systems Engineering, 8-10 October 2015, Ho Chi Minh city, Vietnam.
- [148] Minh Tien Nguyen, Asanobu Kitamoto, Tri Thanh Nguyen (2015) TSum4act: A Framework for Retrieving and Summarizing Actionable Tweets During a Disaster for Reaction. In: 19th Pacific-Asia Conference, PAKDD, 2015, Ho Chi Minh City, Vietnam.
- [149] Quang Trung Nguyen, The Duy Bui, Thi Chau Ma (2015) An Image based Approach for Speech Perception. In: NICS: 2nd National Foundation for Science and Technology Development Conference on Information and Computer Science, 16-18 September 2015, Ho Chi Minh city, Vietnam.
- [150] Son Nguyen, Hieu Vo, Ngoc Hung Pham (2015) A Correlation-aware Negotiation Approach for Service Composition. In: SoICT: the 2015 Symposium on Information and Communication Technology, 3-4 December 2015, Hue, Vietnam.
- [151] Thi Thanh Van Nguyen, Manh Duong Phung, Anh Viet Dang, Cong Hoang Quach, Quang Vinh Tran (2015) Điều khiển dẫn đường hành vi cho robot di động hai bánh vi sai. In: ECIT: Hội thảo Quốc gia 2015 về Điện tử truyền thông và Công nghệ Thông tin, 10-11 December 2015, Ho Chi Minh city, Vietnam.
- [152] Van Hung Nguyen, Minh Trien Pham (2015) Optimal Design of Circular and Rectangular Patch Antennas at 5GHz using PSO Algorithm. In: VJMW: the 2015 Vietnam-Japan Microwave, 10-11 August 2015, Ho Chi Minh city, Vietnam.

- [153] Viet Dung Nguyen, Abed Meraim Karim, Linh Trung Nguyen (2015) Parallelizable PARAFAC decomposition of 3-way tensors. In: ICASSP: the 2015 IEEE International Conference on Acoustics, Speech and Signal Processing, 19-24 April 2015, Brisbane, Australia.
- [154] Xuan Toan Nguyen, Xuan Dang Dang, Khắc Quỳnh Lê, Đinh Tú Bui, Hữu Đức Nguyễn, Thị Hương Giang Đỗ (2015) Cảm biến từ trường siêu nhạy dựa trên hiệu ứng từ- điện cho việc phát hiện nhanh các hạt từ kích thước nano. In: Hội nghị Vật lý chất rắn và Khoa học vật liệu toàn quốc lần thứ 9, 2015, Hồ Chí Minh city, Vietnam.
- [155] Đinh Tuấn Phạm, Đinh Chính Nguyễn, Văn Vinh Phạm, Văn Lâm Đỗ, Đức Tân Trần (2015) Development of a Wireless Sensor Network for Indoor Air Quality Monitoring. In: ICDV: the 2015 International Conference on Integrated Circuits, Design, and Verification, 10-11 August 2015, Hồ Chí Minh city, Vietnam.
- [156] Đức Hồng Phạm, Anh Cường Lê, Thị Kim Chung Lê (2015) A Least Square based Model for Rating Aspects and Identifying Important Aspects on Review Text Data. In: NICS: 2nd National Foundation for Science and Technology Development Conference on Information and Computer Science, 16-18 September 2015, Hồ Chí Minh city, Vietnam.
- [157] Thị Kim Dung Phạm, Catherine Dubois, Nicole Levy (2015) Towards correct-by-construction product variants of a software product line: GFML, a formal language for feature modules. In: FMSPLE: the 6th Workshop on Formal Methods and Analysis in SPL Engineering, 11 April 2015, London, United Kingdom.
- [158] Văn Cảnh Phạm, Xuan Huan Hoang, Minh Mạnh Vũ (2015) Preventing and detecting infiltration on Online Social Networks. In: The 4th Conference on Computational Social Networks, 4-6 August 2015, Beijing, China.
- [159] Hải-Phong Phan, Xuan-Tu Tran (2015) A Fuzzy-Logic based Voltage-Frequency Controller for Network-on-Chip Routers. In: 2015: the 11th Conference on PhD Research in Microelectronics and Electronics (IEEE PRIME 2015), 29 June - 2 July 2015, Glasgow, Scotland.
- [160] Cao Quyên Trần (2015) Nâng cao tốc độ truyền tin trong một kênh nước biển nông thuộc vịnh Bắc Bộ của Việt Nam dùng điều chế OFDM. In: ECIT: Hội thảo Quốc gia 2015 về Điện tử, Truyền thông và Công nghệ thông tin, 10-11 December 2015, Hồ Chí Minh city, Vietnam.
- [161] Hồng Việt Trần, Văn Vinh Nguyễn, Lê Minh Nguyễn (2015) Improving English-Vietnamese Statistical Machine Translation Using Preprocessing Dependency Syntactic. In: The 2015 Conference of the Pacific Association for Computational Linguistics, 19-21 May 2015, Bali, Indonesia.
- [162] Ngọc Anh Trần, Phương Thái Nguyễn, Thanh Tinh Đào, Hồng Quân Nguyễn (2015) Identifying Reduplicative Words for Vietnamese Word Segmentation. In: 2015: The 11th IEEE-RIVF International Conference on Computing and Communication Technologies (RIVF 2015), 25-28 January 2015, Cần Thơ, Vietnam.
- [163] Ngọc Hà Trần, Xuan Huan Hoang (2015) Một thuật toán tối ưu đàn kiến đóng hàng toàn cục mạng tương tác protein. In: Hội nghị khoa học quốc gia lần thứ 8 Nghiên cứu cơ bản và ứng dụng CNTT (FAIR 2015), 9-10 July 2015, Hà Nội, Vietnam.

- [164] Quang Huy Tran, Duc Tan Tran (2015) Sound Contrast Imaging Using Uniform Ring Configuration of Transducers with 11 Reconstruction. In: ATC: the 2015 International Conference Advanced Technologies for Communications, 14-16 October 2015, Ho Chi Minh city, Vietnam.
- [165] Quang Huy Tran, Duc Tan Tran (2015) Sound contrast imaging using uniform ring configuration of transducers with reconstruction. In: ATC: the 2015 International Conference Advanced Technologies for Communications, 14-16 October 2015, Ho Chi Minh city, Vietnam.
- [166] Quoc Long Tran, Mehrdad Farajtabar, Song Le, Hongyuan Zha (2015) NetCodec: Community Detection. In: Individual Activities 2015 SIAM International Conference on Data Mining, 2015.
- [167] Quoc Quan Tran, Huy Bich Dao, Dinh Duc Nguyen (2015) Research on flutter of double curved thin FGM shallow shells on elastic foundations using Ilyushin nonlinear supersonic aerodynamic theory. In: The XII National Conference on Mechanics of Deformed Solid, 6-7 August 2015, Danang, Vietnam.
- [168] The Hung Tran, Van Hung Nguyen, Anh Minh Hoang (2015) Fast Approximate near Neighbor Algorithm by Clustering in High Dimensions. In: KSE: the 2015 International Conference on Knowledge and Systems Engineering, 8-10 October 2015, Ho Chi Minh city, Vietnam.
- [169] Thi Thao Tran, Thi Thuy Nga Nguyen, Van Truong Vo, Nang Dinh Nguyen (2015) Characterization of organic solar cells made from conjugate polymer and CdSe, CdS quantum dots thin films, Advances in Optics Photonics. In: UNSPECIFIED.
- [170] Trong Hieu Tran, Thi Hong Khanh Nguyen, Quang Thuy Ha, Ngoc Trinh Vu (2015) Argumentation framework for merging stratified belief bases. In: ACIIDS: the 8th Asian Conference on Intelligent Information and Database Systems, 14-16 March 2016, Da Nang, Vietnam.
- [171] Hai Long Trieu, Thanh Quyen Dang, Phuong Thai Nguyen, Le Minh Nguyen (2015) Phrase-based Machine Translation System. In: IWSLT: the 2015 International Workshop on Spoken Language Translation, 3-4 December 2015, Da Nang, Vietnam.
- [172] Anh Vu Trinh, Gia Duong Bach, T.S Lande (2015) Non-Coherent IR-UWB Receiver Front-End for High-Precision Ranging and Localization. In: ICDV: the 2015 International Conference on Integrated Circuits, Design, and Verification, 10-11 August 2015, Ho Chi Minh city, Vietnam.
- [173] Anh Hoang Truong, Ngoc Khai Nguyen (2015) Hệ thống kiểu để tính biên tài nguyên của các chương trình giao dịch lồng nhau và đa luồng. In: Hội nghị nghiên cứu và ứng dụng Công nghệ thông tin 2015, 21-23 October 2015, Hanoi, Vietnam.
- [174] Ngoc Trinh Vu, Van Hien Tran, Hoang Quynh Le, Mai Vu Tran (2015) A Method for Building a Labeled Named Entity Recognition Corpus Using Ontologies. In: KSE: the 2015 International Conference on Knowledge and Systems Engineering, 8-10 October 2015, Ho Chi Minh city, Vietnam.
- [175] Thi Dao Vu, Ngoc Hung Pham, Viet Ha Nguyen (2015) A Method for Automated Test Data Generation from Sequence Diagrams and Object Constraint Language. In: SoICT: the 2015

Symposium on Information and Communication Technology, 3-4 December 2015, Hue, Vietnam.

- [176] Xuan Tung Vu, Truong Hoang (2015) An Improved Type System for Counting Logs of Transactional Multi-threaded Programs. In: PAS: the 4th International Seminar on Program Verification, Automated Debugging and Symbolic Computation, 21-23 October 2015, Beijing, China.
- [177] Han Xiao, Elbarougy Reda, Akagi Masato, Li Junfeng, Thi Duyen Ngo (2015) A study on perception of emotional states in multiple languages on Valence-Activation approach. In: The 2015 RISP International Workshop on Nonlinear Circuits, Communications and Signal Processing.