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43600 UKM Bangi, Selangor Darul Ehsan, MALAYSIA
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Foreword by Dean



Congratulatory wishes to the Editorial Board of INNOVATE 4. The tireless efforts of the editors have assured that the Faculty of Engineering & Built Environment's (FKAB) research endeavours continue to be shared with other academicians in the research world.

This year represents the first year of the 10th Malaysian Plan. Several new research grants especially under the Ministry of Higher Education (MOHE) have been inaugurated for interested researchers to partake. Two research grants, that is, the Exploratory Research Grant Scheme (ERGS) and the Prototype Research Grant Scheme (PRGS) are noteworthy. The introduction of new grants of various themes and pursuits is timely as it not only offers researchers with an enlarged scope for creation and innovation but also empowers more and more academicians especially at the periphery to pit and combine their skills with current researchers. This augurs well for engendering the research mentality and culture in Malaysia.

The research successes that arose from research funding of the Ninth Malaysia Plan should not be laid to waste. It is a benchmark that needs to be improved not unlike a delicious layered cake which requires another higher layer and another for it to achieve the mouth-wateringly delicious final product. So when does this seemingly end? Not until UKM consistently achieves the status of a world-beating research university.

I would also like to personally thank all the researchers in the faculty for their sheer will and doggedness against many odds in building a research culture in FKAB. Your efforts are paving the way for future generations of researchers who probably will not achieve much without your generation's foundation laying exertions. My humble and sincere congratulations!

Thank you.

Editorial Note

Congratulations on the new edition of INNOVATE. This issue which is the fourth in the series is an endeavor by the Faculty of Engineering and Built Environment (FKAB), Universiti Kebangsaan Malaysia (UKM) to continue its tradition to bring out a research bulletin that can serve as a platform of sharing and promoting knowledge among faculty's members.

As a national research university, UKM puts a heavy emphasis on innovative knowledge and high quality publications. INNOVATE is on the mission to inspire and strengthen research culture in FKAB. Although the intention of the editorial team is to bring out regularly a bi-annual bulletin, this has not, however, been possible due to the present of some difficulties. So we have to remain satisfied with this annual publication. Hopefully, we would be able to overcome these difficulties in future. The editorial team would be glad to receive comments and suggestions from the readers with a view to improving the quality of outlook and content of INNOVATE.

Finally, the editorial team would like to thank all those who have made it possible to bring out this issue. Foremost, we thank the contributors who, despite their heavy schedule, could contribute articles for this issue. Your endless efforts and continuing support have enabled us to move forward. We wish you all the best.

• Chief Editor

Contents

Current Research

Design of an RFID Transponder: Employing IPv6 Address and Wi-Fi Protocol	4
Design of a Hardware Controlled Current dq PI Controller for FOC PMSM Drive	5
Mapping of Total Electron Content over Malaysia during Low Solar Activity	6
Mitigating of the Urban Heat Island Effects in Tehran Metropolitan Area	7

Technical Abstract

Adaptive Distance Protection to Prevent False Relay Tripping During Power Swings	8
Human Activity Prediction in Smart Homes Using Finite Order Markov Model and Gaussian Distribution	10
An Assessment of TEC Map over Malaysia using PPP Technique	13

Abstract of PhD Thesis 2010

Crashworthiness Characteristics of Natural Silk/Epoxy Composites	15
Influence of SS316L Powder Particle Size and Shape on Metal Injection Molding Parameters Using Design of Experiment	16
Turning of Ti-6Al-4V Eli Using Carbide Tools under Dry Machining Condition	17
Advanced 2D and 3D Texture for High Efficiency Crystalline Silicon Solar Cells	18
Monitoring and Determine Engine Oil Viscosity Medium Speed Diesel Engine Using Acoustic Emission Technology	19
Wavelets Analysis of Seismic Surface Waves for Evaluation of Soil Dynamic Properties	20
Prediction of Long-Term Settlement on Soft Clay Using Shear Wave Velocity and Damping Characteristics	21
Development of an Intelligent Optimization Simulator Model for High Performance Concrete Mix Design using Artificial Neural Network	22
Non-Invasive, Parametric Estimation of The Arterial Transfer Function between Two Different Anatomical Points in Human Body	23
Vlsi Implementation of Fast and Reliable Identification Technique for UHF Class 0 RFID Tag	24
Transient Stability Assessment and Control of Power Systems Using Computational Intelligence	25
Investigation of Source Couple Logic for Realization of New Pulse Generation Circuit in UWB Technology	26
Development of Multibiometric Speaker Verification Systems with Support Vector Machine Audio Reliability Estimation	27
Design and Analysis of Optical Wavelength Division Multiplexing Networks	28
Perinatal Cardiotocograph Signal Analysis and Classification	29
Design of Long-Wavelength Vertical-Cavity Surface-Emitting Laser (LW-VCSEL)	30
Development of a Multi Scale Processing and Feature Extraction Technique for Weed Image Analysis And Classification	31
Microwave Assisted Drying of Pitaya (<i>Hylocereus</i>) Slices	32
Reduction of Product Deposition in Spray Dryers	33
Non-Volatile Organic Chemicals in the Agricultural Environment: Modeling, Fate and Impacts	34

Awards 2010

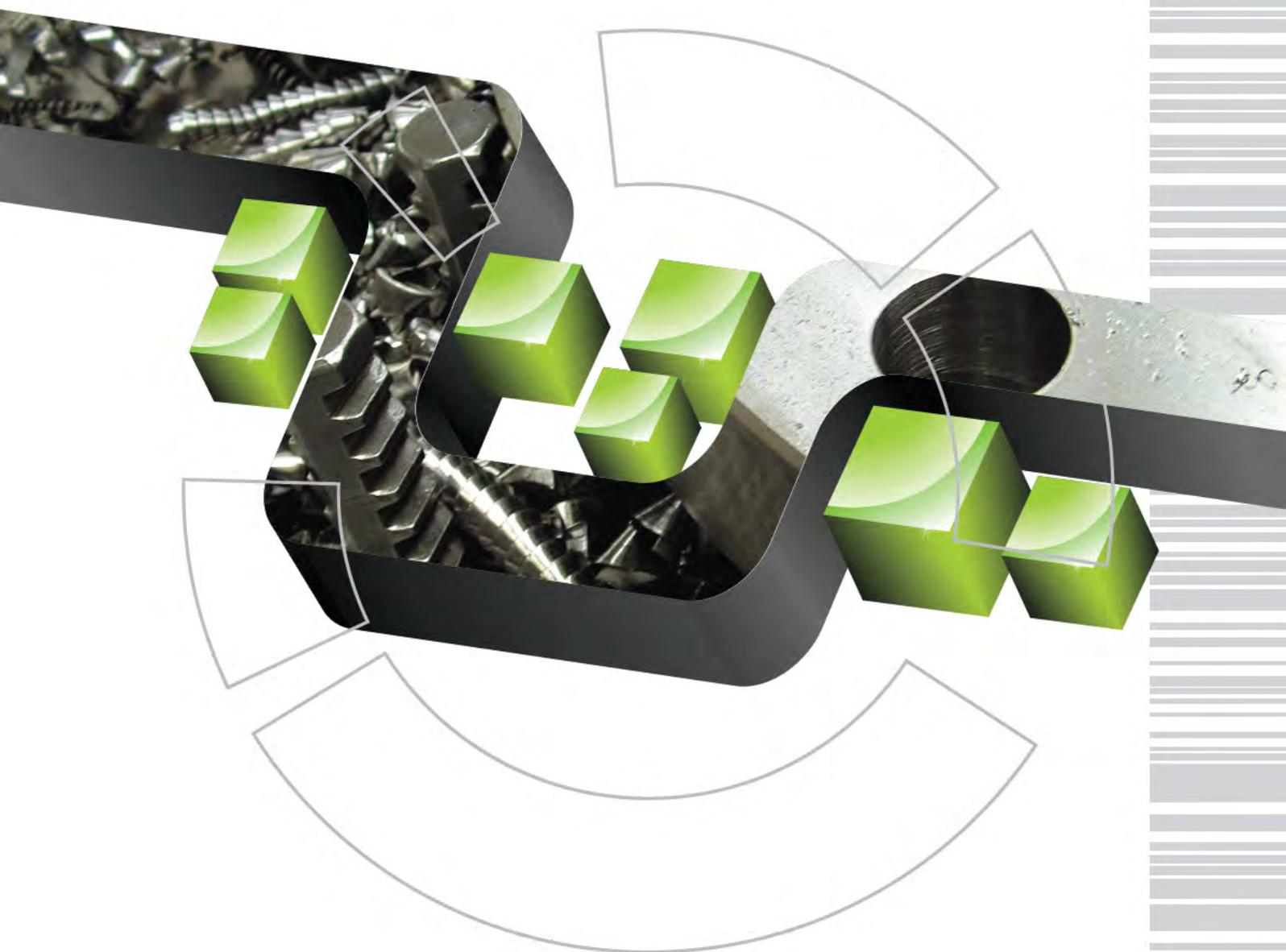
Research Projects 2010

36
40



Current Research

Engineering & Built Environment



Design of an RFID Transponder: Employing IPv6 Address and Wi-Fi Protocol

The concept of internet is changing from the “network of computers” to the “network of things”. To recognize or sense anything a universal identification number is required. Currently, Barcode and RFID (Radio Frequency Identification) systems are being used for object identification which suffers from limited address space and local mobility. Moreover, it is a monopoly business with few vendors, which are trying to dominate the market with proprietary standard of RFID reader. The proposed system will replace the expensive RFID reader with cheap Wireless Network Interface Card (WNIC). In this project, Internet Protocol version 6 (IPv6) address will be used in RFID system which will provide a universal identification number to the objects with seamless global mobility. Instead of proprietary expensive RFID reader, the system will adopt Wireless Network Card which will be benefited by well defined IEEE 802.11b protocol. The Electronic Product Code (EPC) 64 bit will be directly mapped into the EUI-64 portion of IPv6 address. This mapped 128 bits EPC-IPv6 address will be stored in a RFID tag memory. RFID tag circuit will be designed in a way so that at the same time it can communicate with the WNIC through the tag front end antenna. The RFID tag can be consigned to a range of between 3 and 300 feet at 2.4 GHz ISM frequency band. So whenever any RFID tag enters into a Wi-Fi network, it will be recognized by the system containing WNIC. At first, the WNIC will broadcast a message. All RFID tag within the range of Wi-Fi network will receive it. After receiving this message, RFID tag will send the acknowledgement packet. From the acknowledgement packet the WNIC get the RFID tag IP address. After that a computer application will be used to extract the EPC from the mapped EPC-IPv6 address.

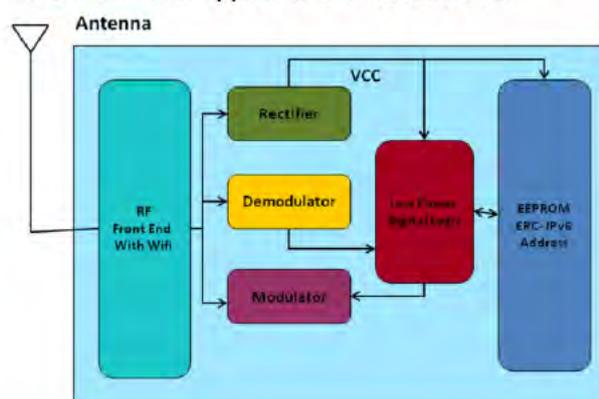


Figure 1. Block diagram of the proposed Tag through Wi-Fi

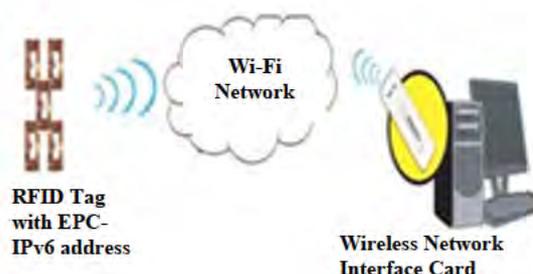


Figure 2. EPC-IPv6 Tag communicate with WNIC through Wi-Fi

As a result of this research, applications employing RFID system related to e-government, e-health, e-commerce will be benefitted with significant cost reduction, physical location detection and globally unique address facility. Hazardous materials management, hospital patient identification, supply chain management systems will be able to maintain in a cost effective way without using the traditional, vendor specific and expensive RFID reader. Hence, using IPv6 in RFID transponder will be a unique solution for Information and Communication Technology (ICT) and smart society to the extent that telecommunication and the Internet have.

For further correspondence kindly contact:

Labonah Farzana Rahman
Associate Prof. Dr. Md. Mamun Bin Ibne Reaz
Professor Dr. Mohd Alauddin Mohd Ali
Department of Electrical, Electronic and Systems Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: +603-89216311 Email: mamun@vlsi.eng.ukm.my

Design of a Hardware Controlled Current dq PI Controller for FOC PMSM Drive

Among all of the various drive systems, a three-phase Permanent Magnet Synchronous Motor (PMSM) is widely used for accurate speed and torque control, greater efficiency, and superior torque to inertia ratio and high power density. The PMSM eliminates a commutator, so it is more reliable than the dc motor. In order to achieve the desired performances of PMSMs, direct control of stator currents is needed. Nevertheless, it is quite unattainable due to the strong coupling and nonlinear natures of the AC motors. Fortunately, this problem has been resolved by the vector control technology, often referred to as Field-Oriented-Control (FOC).

In the vector controlled drive of ac motor, the dq -axis current control plays an important role of determining the overall system performance. Again, due to nonlinear coupling among its winding current and the rotor speed, accurate speed control of a PMSM drive becomes a complex issue. Therefore, the intelligent controllers claim meticulous consideration for high performance PMSM drive systems. By using PI controller exact dq axis reactance parameters can be obtained. Moreover, it is very sensitive to step change of command speed, parameter variations and load disturbances. Relatively simple implementation made PI controller most widely used for PMSM. Hence, real time self-automated intelligent hardware implementation of PI controller as well as FOC is desired.

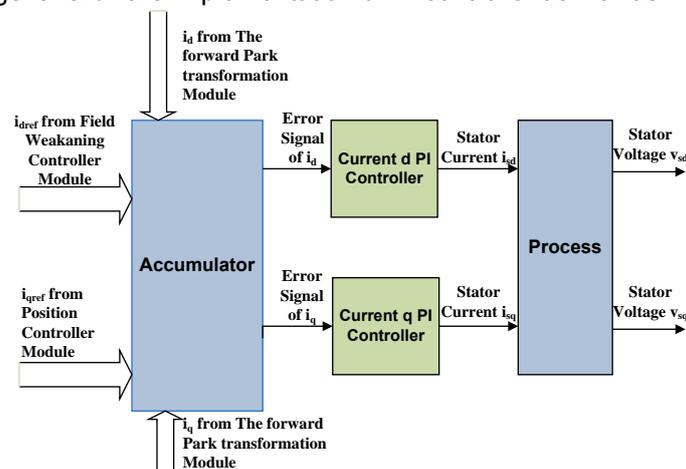


Figure 1. Block diagram of the proposed Controller

The complexities of the servo control algorithm enforce engineers to implement it with software based on DSP. Though it provides flexibility, it fatigues many resources of the CPU. It also suffers from a long period of development. Thus, it is necessary to design an integrated chip without occupying anything of the CPU. This hardware implementation system can get a high-speed level as well as an exciting precision. This research involves in hardware prototyping of current dq PI controller, which is the key element for designing a fully automated real time hardware implementation of FOC-PMSM drive. It also focuses on FPGA realization of the developed current dq PI controller that will replace the expensive software and firmware modules with cheap and speedy single chip controller.

For further correspondence kindly contact:

Mohammad Marufuzzaman
Associate Dr. Md. Mamun Bin Ibne Reaz
Professor Dr. Mohd Alauddin Mohd Ali
Department of Electrical, Electronic and Systems Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: +603-89216311 Email: mamun@vlsi.eng.ukm.my

Mapping of Total Electron Content over Malaysia during Low Solar Activity

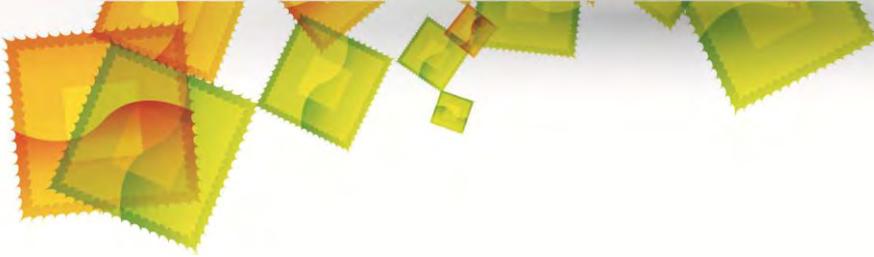
The ionosphere is a layer in the Earth's atmosphere where free electrons exist in sufficient numbers to affect the propagation of electromagnetic waves especially the Global Positioning System (GPS) signals the influence of the Total Electron Content (TEC) and physical phenomenon regarding the Sun-Magnetosphere-Ionosphere-Thermosphere system on satellite and radio communication is constantly changing. The study of the TEC variation in ionosphere and structures is important to ensure the security of radio communication systems, to enhance the currently restricted global ionospheric mapping and accurate space weather forecasting. The main objective of this research is to study the variation of TEC over Malaysia on diurnal, seasonal, geographic location, solar and geomagnetic activity using Precise Point Positioning (PPP) technique. Since the GPS signals are broadcasted in two widely spread L-band frequency channels L1 and L2 consisting of code and phase, it is possible to determine the TEC by employing differencing techniques. To model the regional TEC map, single layer model (SLM), which assumes that all free electrons are concentrated in a shell of infinitesimal thickness at altitude $H = 450$ km above the Earth's surface was used. The PPP method was utilized together with the application of zero difference technique and SLM to generate the TEC map. To achieve this objective, GPS data for the year 2007 obtained from the Department of Survey and Mapping Malaysia (*Jabatan Ukur dan Pemetaan Malaysia*, JUPEM) were used in this research. Results over Malaysia showed that the mean TEC during equinox was higher than solstice, where by 35 TECU was recorded during the equinoxes but only 25 TECU was observed during solstice. Figure 1 shows the TEC map over Malaysia on 7 March 2007 during equinoxes. This research was carried out during solar minimum and quiet geomagnetic conditions. Therefore, the results from this research are a good characterization of ionosphere over Malaysia.



Figure 1. TEC map over Malaysia

For further correspondence kindly contact:

Associate Prof. Ir. Dr. Mardina Abdullah
Siti Aminah Bahari
Department of Electrical, Electronic and Systems Engineering/Institute of Space Science
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216304 Email: mardina@eng.ukm.my/sitiaminahbahari@ukm.my



Mitigating of the Urban Heat Island Effects in Tehran Metropolitan Area

The focus of this study is on the effects of two factors including vegetation cover and albedo of materials on the intensity of the urban heat island, through a case study on the Tehran metropolitan area, Iran. The study aims to identify whether there are relationships among the level of meteorological factors, urban structure factors and the intensity of the UHI as well as to what extent this relationship goes. There are three methodologies followed in this study. Firstly, the methodology to study the severity and impact of UHI on the environmental conditions in Tehran metropolitan area by collecting data from secondary and primary sources of data and by reviewing literature and also to identify the possible causes of UHI in Tehran by analyzing literature critically and achieve classification of the important factors which are caused UHI in Tehran. Secondly, the methodology to measure UHI in air temperature by using weather station networks and UHI in surface temperature by using satellite remote sensing in urban canopy layer (UCL) in micro-scale. Thirdly, the methodology to optimize 6 urban district by using Arc-GIS9.3 in order to mitigate the effects of UHI in Tehran.

This study has found significant evidence of the UHI effect in Tehran, as using Landsat ETM7⁺ image in Erdas Imagine. Then providing NDVI and surface temperature images, overlaying these two images and extracting maximum temperature value for both urban and rural areas. Rural considered as an area with vegetation covers. An explicit indicator of UHI was identified by the 39 °C for urban maximum temperature and 27 °C for rural maximum temperature. Therefore daytime UHI shows 12 °C of difference between urban and rural area in Tehran Metropolitan Area.

For 3D modeling, providing DSM (Digital Surface Model) and DEM (Digital Elevation Model) were necessary. After providing the 3D modeling of 6 urban district, since this study has focused on 2 factors (vegetation covers and albedo of materials), Albedo Map was provided in addition to NDVI for optimizing this district and mitigating UHI effects. Then use RASTER file (DSM and DEM) in the software (ArcGIS). The results shows that by reduction of the amount of vegetation covers and the amount of high albedo materials in urban area, the formation of UHI increase and vice versa. Therefore these two factors (as independent variables) have direct effects on UHI formation (as dependent variable).

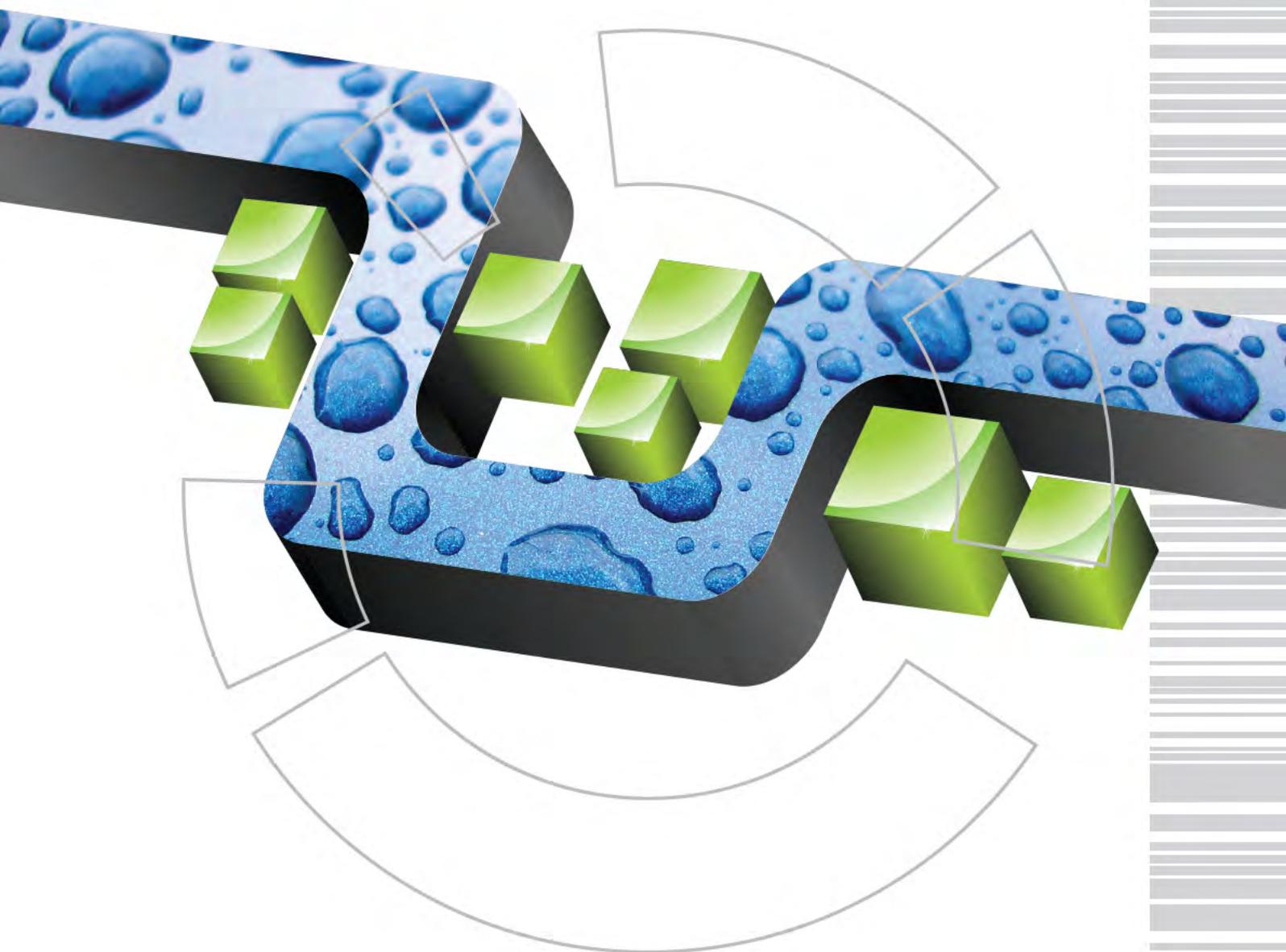
The original contribution of the research work is the development of new theory called "Urban Natural Ventilator" in the central city (6 urban district) in order to mitigate the harmful effects of UHI and improve the existing condition of life quality and move forward sustainability in Tehran urban area.

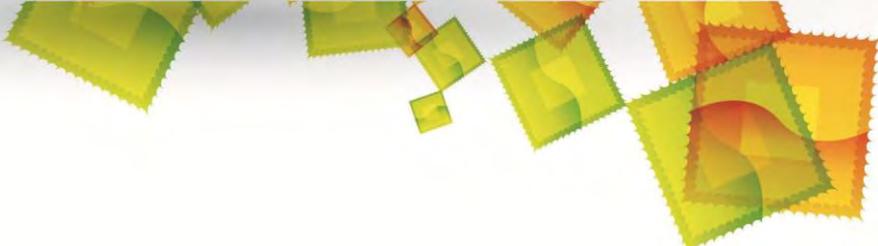
For further correspondence kindly contact:

Sr. Dr. Adi Irfan bin Che Ani
Department of Architecture
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216985 Email: adiirfan@vlsi.eng.ukm.my

Technical Abstract

Engineering & Built Environment





Adaptive Distance Protection to Prevent False Relay Tripping During Power Swings

Ahmad Farid Abidin, Azah Mohamed, Hussain Shareef
Department of Electrical, Electronic and Systems Engineering
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216590 Email: azah@eng.ukm.my

ABSTRACT

This paper presents a new and fast algorithm to prevent distance relay mal-operation during power swings. The algorithm blocks the relay tripping signals during power swing and unblocks the signals if a fault occurs during power swing. The proposed blocking scheme for distance protection incorporates an additional criterion into the conventional relay which is based on the derivative of the line reactive power as seen by the relay. This technique overcomes the shortcoming of conventional power swing detector (PSD) by removing the pre-defined R-X diagram. The conventional PSD has the difficulty in obtaining the timer setting at pre-defined R-X diagram due to varying cycle of power swings. To illustrate the effectiveness of the proposed algorithm, simulations were carried out on the IEEE 39 bus test system using the PSS/E software. Test results show the effectiveness of the proposed scheme in blocking the relay's false trip signals during power swing.

Keywords: Distance relay, fault, power swing, PSD, line reactive power

INTRODUCTION

Distance relay is one of the main protection components that have been used to protect power transmission lines. It operates on the basis of impedance at the point of measurement. The voltage and current are usually used in order to obtain the measured impedance. During a fault, the measured impedance is very low and it can enter the relay setting to initiate tripping signals of associated breakers (Kundur, 1993) (Ziegler, 1999). However, the relay also may send trip signals during power swing due to low measured impedance during such circumstances.

Power swings occur following a system disturbance such as load changes and fault clearance. When a power swing occurs, a change appears in the relative phase angle between two groups of generators. As consequences, the measured voltage, current, apparent impedance, active power, reactive power and angle vary due to oscillations during power swing.

However, during a fault, these quantities change more significantly and hence are frequently used to distinguish between a fault and a power swing to avoid relay's false tripping signals. Many techniques based on aforementioned quantities have been introduced by a number of researchers (Jiao et

al, 2001) (Jonsson et al, 2001) (Su et al, 2007) (Xianining et al, 2006) (Zadeh et al, 2008).

In this study, a new and fast algorithm by using the derivative of the line reactive power has been proposed to block false tripping signals during power swings. In the algorithm, a new criteria based on the abrupt change in the derivative of line reactive power during a fault is incorporated. In order to validate the robustness of the technique, the algorithm has been tested on the IEEE 39 bus system. A comparison of the proposed algorithm with the technique by Jonsson et al. (2001) is also made to ascertain the validity of the proposed algorithm.

RESULTS AND DISCUSSION

One of the fast techniques to discriminate a fault and a power swing employs the use of negative sequence current magnitude and the magnitude of derivative of current angle, $Id\theta/dt$ (Jonsson et al, 2001). However, identical values of $Id\theta/dt$ may appear during fault and fault clearance as the increment of current angle is very substantial in both situations. The distance relay installed in these lines may send false trip signals during fault and fault clearance operation.

Further testing has been made for each affected relay on the IEEE 39 bus test system



to validate the reliability of the I_{d0}/dtl approach as tabulated in Table 1. From Table 1, it can be concluded that the I_{d0}/dtl approach is able to block the relay trip signals during power swing.

However, the I_{d0}/dtl approach is proven to be vulnerable during fault clearance in which, 3 of the relays send the false trip signals to the breaker since the I_{d0}/dtl is identical with fault I_{d0}/dtl values. Therefore, an alternative approach needs to be introduced to avoid such adverse operation.

Table 1: Relay tripping signals using I_{d0}/dtl

Case	Fault	Fault clearance	Power Swing
case 1	trip	trip	block
case 2	trip	trip	block
case 3	trip	trip	block
case 4	trip	block	block
case 5	trip	block	block

The dQ_{line}/dt is then used as a new indicator in order to enhance the capability of the relay to differentiate between a fault, power swing and fault clearance in power systems. The results of each affected relays whilst using the proposed dQ_{line}/dt technique have been tabulated in Table 2. From Table 2, it can be noted that the all the trip signals have been blocked during fault clearance and power swing.

Table 2 Relay tripping signal using dQ_{line}/dt

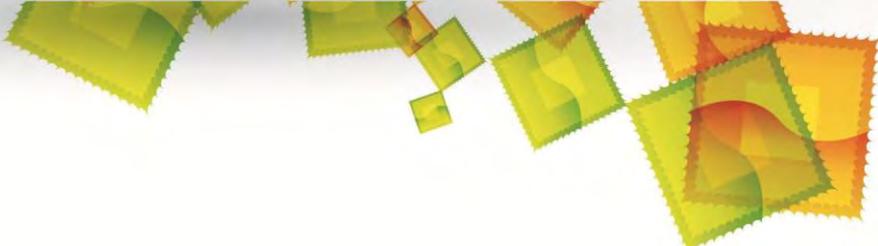
Case	Fault	Fault clearance	Power Swing
case 1	trip	block	block
case 2	trip	block	block
case 3	trip	block	block
case 4	trip	block	block
case 5	trip	block	block

CONCLUSION

The use of dQ_{line}/dt has been proposed as a technique to block the distance relay trip signals during power swing. Time domain simulations were first carried out under the conditions of fault and power swing. The proposed technique has been applied and tested to evaluate its effectiveness in blocking the trip signals during power swing and fault clearance. The results show that the dQ_{line}/dt can effectively block the trip signals during fault clearance and power swing unlike the use of the I_{d0}/dtl .

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Human Activity Prediction in Smart Homes Using Finite Order Markov Model and Gaussian Distribution

M. R. Alam, M. B. I. Reaz, M. A. M. Ali
Department of Electrical, Electronic and Systems Engineering
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216311 Email: mamun@vlsi.eng.ukm.my

ABSTRACT

Smart home is an application of ubiquitous computing where the home environment is monitored by ambient intelligence to provide context aware services. The aim of smart home research is to provide smartness to the dwelling facilities for comfort, healthcare, security, safety and energy conservation. In smart home environment, prediction algorithm plays an important role to automate user interactions with the surroundings. There are two fundamental problems of prediction in smart homes. One is the prediction of next activity that is going to happen and another is the prediction of approximate time of that activity. The aim of this research is the development of algorithms for activity and temporal prediction in smart homes. A novel algorithm named SPEED (Sequence Prediction via Enhanced Episode Discovery), is proposed for sequential activity prediction which utilized dual state properties of home appliances to extract episodes. Classified episodes are processed and arranged in a finite order Markov model. A temporal prediction algorithm is presented to predict the interval between the activities. This algorithm is based on the hypothesis that smart home event interval follows Gaussian distribution. To validate the algorithms, smart home data from MavHome is used. Result shows that, for a fully converged trie the SPEED algorithm exhibits 88.9% prediction accuracy. The temporal interval prediction algorithm shows 90.9% prediction accuracy when verified with a fully converged database. The results show reliable outcomes, which have significant contribution in activity prediction and anomaly detection.

Keywords: Smart home, artificial intelligence, prediction algorithm, activity prediction.

INTRODUCTION

Smart home researches require understanding of human behavior to employ home intelligence. Early projects of this area hardly try to understand psychosomatic nature of human behavior. Those projects simply employed intelligence to the household appliance without considering psychological understanding. However, classification and modeling of human behavior plays an important role to predict residents' activities.

There are two fundamental prediction problems related to residents' activity in smart homes. The first problem is predicting the next activity of the inhabitant which means a smart home should be able to track the user and predict future activities of the residents. Another elementary problem is predicting the time of next activity which depends on temporal interval between the activities. This research solved these two fundamental problems related to human activity prediction in smart homes.

In this research, a new algorithm, named Sequence Prediction via Enhanced Episode Discovery (SPEED), is proposed for sequential prediction which utilized dual state properties of home appliances to extract episodes. Classified episodes are processed and arranged in a finite order Markov model. A method motivated by Prediction by Partial Matching (PPM) algorithm (Cleary & Witten 1984) is applied to select the next activity from the frequencies of variable length episodes.

A new temporal prediction algorithm is presented to predict the occurrence time of user activities. The algorithm is based on the hypothesis that smart homes event intervals follow Gaussian distribution. To predict the starting time of the following activity, it incrementally utilizes mean and standard deviation of previous history which are applied according to the central limit theory of statistical probability. Further analysis validates the hypothesis that temporal interval follows a Gaussian distribution which was only an assumption previously.

RESULTS AND DISCUSSION

The algorithms proposed in this research are tested using practical data found in smart homes. For this purpose MavLab data (MavLab 2003) is used. MavLab is the testbed of MavHome (Youngblood & Cook 2007) at University of Texas, Arlington. The sample consists activities of six inhabitants at MavHome in April 2003.

Figure 1 shows the performances of the algorithms when they are fully converged. SPEED exhibits 88.9% prediction accuracy which is 19.5% better than Active LeZi (Bhattacharya & Das 2002) and 45.3% better than IPAM (Davison & Hirsh 1998). Figure 2 shows the performances of the algorithms when they are partially converged. The result shows that, for a partially converged state, SPEED exhibits 59.1% prediction accuracy which is 12.9% better than Active LeZi and 22.9% better than IPAM.

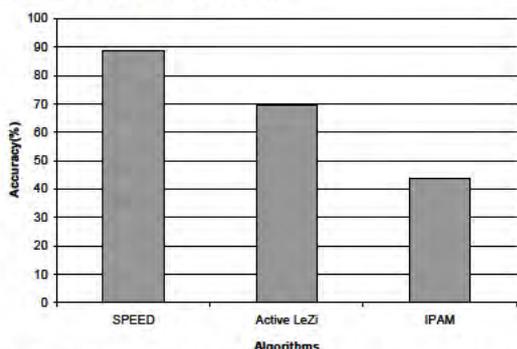


Fig. 1 Performance testing using a fully converged trie

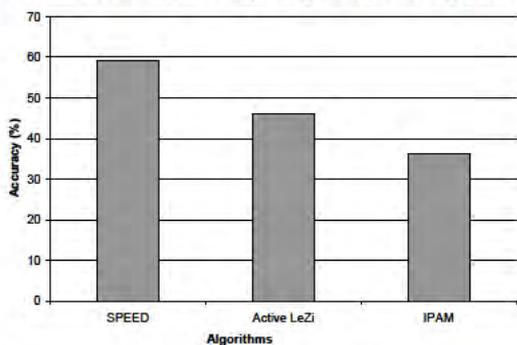


Fig. 2 Performance testing using a partially converged trie

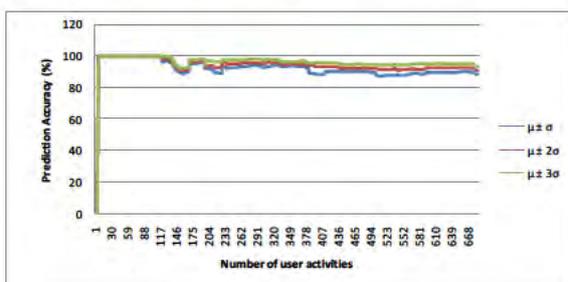


Fig. 3 Relationships between prediction accuracy and μ , σ

Figure 3 illustrates the prediction accuracy of temporal prediction algorithm when the starting times of the activities were predicted between several statistical ranges using a temporal database. When the probability of finding the next activity is assumed between $\mu - \sigma$ and $\mu + \sigma$, the prediction accuracy lies between 80%-90% (μ = mean and σ = standard deviation). The prediction accuracy increases when the predictor estimates the starting point between mean $\mu \pm 2\sigma$. In this case, it shows persistent prediction accuracy between 90%-93%. The performance improves if $\mu \pm 3\sigma$ is utilized to verify it. In this case, the prediction accuracy lies between 93%-95%.

CONCLUSION

This research solves the fundamental problems related to human activity prediction in smart homes. SPEED exhibits 88.9% prediction accuracy when tested with a fully converged trie. It is able to learn the home environment dynamically without any manual configuration. The temporal prediction algorithm exhibits 90.9% prediction accuracy when evaluated with a fully converged temporal database. This research formulated the temporal characteristics of the residents' activity pattern and presented a valid statistical model of activity interval in smart homes.

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An Assessment of TEC Map over Malaysia using PPP Technique

Siti Aminah Bahari¹, Mardina Abdullah², Baharudin Yatim³

¹*Institute of Space Science, Universiti Kebangsaan Malaysia*

²*Department of Electrical, Electronic and Systems Engineering*

Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia

³*School of Physics, Faculty of Science and Technology, Universiti Kebangsaan Malaysia*

43600 UKM Bangi, Selangor, MALAYSIA

Tel: 603-89216860 Email: sitiaminahbahari@ukm.my

ABSTRACT

We assess the use of Precise Point Positioning (PPP) technique within the Bernese GPS Software (BGS) to determine Total Electron Content (TEC) map over Malaysia. In this study, Global Positioning System (GPS) data from the Department of Survey and Mapping Malaysia network on 27 – 29 September 2007 were used. In PPP technique, the un-differenced code observations were smoothed by the phase observations resulting in the use of carrier-smoothed code observations to map the TEC. We analyzed the PPP by comparing our set of TEC map with those produced using double difference technique. Double differences carrier phase measurement technique has been used at the Centre for Observation Determination in Europe (CODE) in producing daily maps of the Earth's ionosphere on a regular basis since January 1, 1996. The result proved that PPP technique can contribute to the same level of accuracy by using DD technique. Besides the main purpose of the PPP to perform a precise point positioning at a cm-level, the extraction of TEC information can also be done. The statistics of the comparison for mean TEC of PPP, DD with the mean TEC from CODE show a good agreement with the accuracy claimed by IGS for its ionosphere maps which is 2 to 8 TECU for the final maps. The TEC from PPP and CODE are correlated with coefficient value of 0.98 – 0.99.

Keywords: Spherical harmonics, TEC, GPS.

INTRODUCTION

Global Positioning System (GPS) nowadays allows to measure positions in real time with an accuracy of a few centimeters (Warnant et al., 2007). Such a level of accuracy can be reached after the removal or mitigation of different error sources. At the present time, the effect of the ionosphere on the propagation of GPS signals is the main factor which can strongly limit the accuracy and the consistency of high accuracy GPS applications. In return, GPS has become one of the important tools to study the ionosphere. The ionosphere which is located 50 to 1500 kilometers (km) above the Earth's surface is known as dispersive medium (Schaer et al., 1996). Total Electron Content (TEC) is the main parameter in the ionosphere which is measured to estimate the impact of the ionosphere to the signal transmitted by GPS satellite to the receiver on the Earth.

The TEC is usually expressed in TEC units (TECU), where one TECU equals to 10^{16} electrons per square meter contained in a cylinder aligned along the line of sight with a cross section of one square meter (Dach et al.,

2007). Prediction of communication failures and radio interference additionally requires accurate information on TEC variations (Ha et al., 2005).

The general double difference (DD) technique has been used at CODE in producing daily maps of the Earth's ionosphere on a regular basis since January 1, 1996 (Schaer, 1997). With the new Bernese GPS Software (BGS) version 5.0, precise point positioning (PPP) technique is now available to produce ionosphere maps. PPP is known as a valuable tool for providing an accurate position anywhere on Earth, also for investigating many geophysical processes at the millimeter level. PPP technique is widely used within positioning communities, but it is less well known among ionospheric mapping groups.

'Modified' Single Layer Model (MSLM) was used in describing the deterministic component of the ionosphere (Dach et al., 2007). The ionosphere was approximated by a spherical shell at a fixed height of 450 kilometres (km) above the Earth's surface (Schaer et al. 1996). The TEC of the ionospheric layer was calculated by using

spherical harmonic expansion which was then inserted into the geometry-free linear combinations.

This paper aims to assess the use of PPP technique in the BGS to determine TEC map. GPS observation data on 27 – 29 September 2007 collected by the Department of Survey and Mapping Malaysia was used to create TEC maps. Fifty stations from Malaysia's region were included in the analysis of the TEC. The dense world-wide GPS network provided high TEC resolution. The comparison with the TEC map obtained using DD technique and CODE was made in order to assess the ability of PPP technique in mapping the TEC. Mapping accurate TEC is important for GPS single-frequency users in order to gain an accurate position by applying an accurate map. For the purpose of navigation, TEC map will help in determining the optimum path, which is time and cost saving.

RESULTS AND DISCUSSION

Table 1 shows a correlation coefficient and Table 2 shows the Root Mean Square Error (RMSE) of the comparison for mean TEC of PPP, DD with the mean TEC from CODE. The correlation between the mean TEC from PPP and CODE indicate a reasonable correlation, with coefficient value of 0.98 – 0.99 during the analysis date. The numbers shown in Table 2 are in agreement with the accuracy claimed by IGS for its ionosphere maps which is 2 to 8 TECU for the final maps. This is a good result in terms of agreement of solutions, given the level of accuracy provided by IGS maps.

Table 1. Correlation coefficient between TEC from PPP, DD with CODE

Date (September 2007)	Technique	
	PPP	DD
27	0.98	0.91
28	0.99	0.99
29	0.98	0.97

Table 2. RMSE between TEC (PPP, DD) with CODE

Date (September 2007)	Technique	
	PPP	DD
27	3.92	3.96
28	4.54	5.14
29	6.27	5.32

CONCLUSION

This study has shown the ability of PPP technique in producing an accurate TEC map over Malaysia. A correlation coefficient and the statistical comparison of mean TEC from PPP with the TEC from CODE show a good agreement with the accuracy claimed by the IGS.

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Abstract of PhD Thesis

Engineering & Built Environment





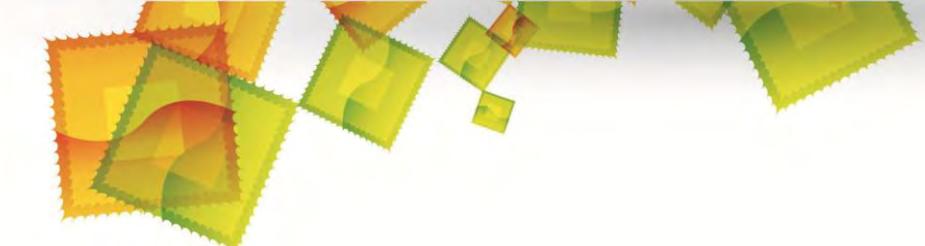
Crashworthiness Characteristics of Natural Silk/Epoxy Composites

by
Simin Ataollahi Oshkovr (P36295)
Doctor of Philosophy in Mechanical and Materials (Ph.D)

This study focused on the evaluation of crashworthiness characteristics of natural silk/epoxy square tube energy-absorbers which can be retrofitted in vehicle structures to improve the safety of passengers during accidents. Composite laminate specimens were subjected to static axial compression load and evaluated for energy absorption capability experimentally. Specimens were in the form of square cross-sections measuring 80mm x 80mm x 80mm and a radius curvature of 5mm. The variables in the experiment were the depths of the tubes built 50mm, 80mm and 120mm respectively and the thicknesses of the walls, consisting of laminates of silk/epoxy of 12, 24 and 30 plies, corresponding to equivalent wall thicknesses of 1.7mm, 3.4mm and 4.2mm respectively. The parameters measured were the total absorbed energy (E_{total}), and the crash force efficiency (CFE), E_{total} measures the amount of energy that the structure can withstand without failing and thus is a measure of its strength, whilst CFE gives a quantitative indication of the mode of failure of the composites. The mode of failure was observed using photography. In the axial compression tests all the specimens exhibited catastrophic failure. Specimens with 50 and 80 mm depth and 12 plies failed with Type 1 failure, which was initiation at the edges followed by buckling and catastrophic failure. The rest exhibited Type 2 failure, which was failure initiated at the mid of the tubes which then proceed to overall buckling and then catastrophic failure. Results showed that the highest value of E_{total} (10.3kJ) were obtained for the specimen with 30 silk/epoxy laminates and 50mm depth, whilst the maximum value for CFE (0.30) is obtained from specimen with 12 layers silk/epoxy laminates and 120mm depth. The results imply that geometries play a significant role in energy absorbance capacity of the composites, i.e the thicker and shorter composites were able to absorb more energy. The conditions of test obtained experimentally were simulated using Dytran a non-linear finite element explicit analysis to mimic the behaviour characteristics of the crashworthiness. The results from the finite element analysis were validated against the experimental results and a good agreement between two approaches was observed i.e. average errors of E_{total} (6.1%) and CFE (9%) were obtained. The simulation depicted catastrophic failures similar to experimental i.e. Types 1 and 2 failure in the specimens in the resulting geometries. This agreement builds confidence in the future use of non-linear finite element for the design of silk/epoxy composite structure subjected to crash loading in energy-absorbing applications such as in the automotive as well as in the aircraft industries.

For further correspondence kindly contact:

Professor Dr. Che Husna Azhari (Main Supervisor)
Department of Mechanical and Materials Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216511; Fax: 603-89259659; Email: mek@vlsi.eng.ukm.my



Influence of SS316L Powder Particle Size and Shape on Metal Injection Molding Parameters Using Design of Experiment

by
Khairur Rijal Jamaludin (P37854)
Doctor of Philosophy in Mechanical and Materials (Ph.D)

The Metal Injection Moulding (MIM) process is suitable for producing relatively small and complex components that require high strength and cost viability. This process, carried out in large batches, produces high density, complex and accurate shaped parts. This study attempts to optimise the processing parameters for each stage of the process using the optimisation process based on a Design of Experiment (DOE) technique, the Taguchi Method. The analysis of variance (ANOVA) is performed in order to evaluate the significance of each variable and its contribution to the quality characteristic. The green part quality characteristics such as defect free, higher green strength, green density and the final density after sintering are results obtained from the optimisation process. Water and gas atomised stainless steel powder (SS316L) in mono-modal and bimodal particle size distributions were used in this study. The binder system used is the composite binder consisting of polyethylene (PEG) and polymethyl methacrylate (PMMA). Prior to the injection moulding of the green parts, rheological investigation of the feedstocks was performed in order to obtain the suitable rheological properties before optimising the remaining processing parameter. This study exhibits that the method of metal powder production as well as the particle size distribution influences the processing parameter. The high level of significance of powder loading, mould temperature, holding pressure, interaction between injection pressure and temperature, as well as the interaction between injection pressure and powder loading to the green part quality characteristics at $\alpha = 0.01$ was demonstrated by the water atomised powder in bimodal particle size distributions. However, for the gas atomised powder, the mould temperature, injection rate as well as the interaction between injection pressure and temperature is significant. In addition, for the water atomised powder with mono-modal particle size distribution, the mould temperature and holding pressure are significant for the fine powder. However, lower significant level, $\alpha = 0.025$ was obtained for coarse powder where the holding time and the interaction of the injection and mould temperature are the significant parameters. The optimisation of the injection and sintering parameters made in this study has enabled to improve the sintered density of the fine mono-modal gas atomised powder compact to 99.88 % of the theoretical density, while the sintered density of the fine mono-modal water atomised powder compact improved to 98.75 % of the theoretical density. In addition, the sintered density of the gas atomised powder compact in bimodal particle size distribution also improved to 99.94 % of the theoretical density while the water atomised powder compact under the same particle size distribution improved to 98.66 % of the theoretical density. The study results showed a better sintered density as compared to the previous studies and it is demonstrated that the optimisation of the moulding and sintering parameter with the Taguchi Method has enabled to improve the green part's mechanical properties as well as the sintered density that was close to SS316L theoretical density.

For further correspondence kindly contact:

Professor Dr. Norhamidi Mohamad (Main Supervisor)
Department of Mechanical and Materials Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216500; Fax: 603-89259659; Email: hamidi@vlsi.eng.ukm.my



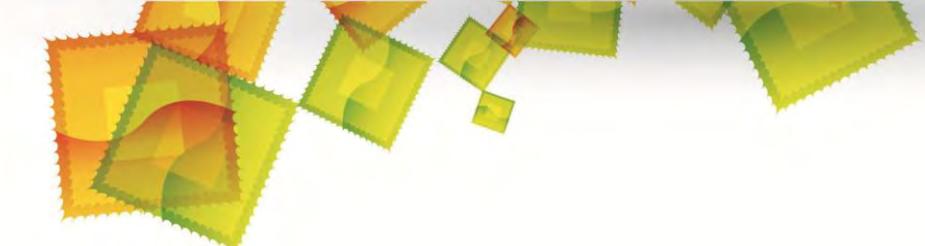
Turning of Ti-6Al-4V Eli Using Carbide Tools under Dry Machining Condition

by
Gusri Akhyar Ibrahim (P33980)
Doctor of Philosophy in Mechanical and Materials (Ph.D)

Titanium alloys are used extensively in aerospace, automotive, biomedicine, chemical, and petroleum industries because of their very high strength-to-weight ratio at elevated temperature, fracture resistant, and superior resistance to corrosion. However, they are difficult to machine due to high temperature strength, low modulus of elasticity, low thermal conductivity and high chemical reactivity. The objective of this research is to investigate tool performance and surface integrity when turning Ti-6Al-4V ELI titanium alloy using carbide tools under dry cutting condition. Machining trials were conducted based on Taguchi Method design of experiment with orthogonal array design $L_{27} (3^{13})$. There were four factors at three levels; cutting speed of (55, 75 and 95 m/min), feed rate of (0.15, 0.25 and 0.35 mm/rev), depth of cut of (0.10, 0.15 and 0.20 mm) and tool grade of (K313, KC9225 and KC5010). Flank wear was measured using an optical microscope and surface roughness was measured using surface roughness tester. The flank wear and surface roughness were recorded at each pass of machining until VB reached 0.3 mm. Results revealed that the maximum tool life was 154.43 min and the optimal condition for tool life was reached at cutting speed of 55 m/min, feed rate of 0.15 mm/min, depth of cut of 0.10 mm and cutting tool grade of K313. The most significant factors affecting tool life were cutting speed and tool grade, which contributed 21.18% and 38.33% respectively. Generally, wear increased sharply at the initial stage, steadily at second stage and extremely at the final stage. The various wears that occurred during machining were abrasive, adhesive, fracture, chipping, flaking and coating delamination for coated tool. In addition, the lowest surface hardness value was 0.52 μm and the optimal condition for surface roughness was reached at cutting speed of 95 mm/min, feed rate of 0.15 mm/rev, depth of cut of 0.10 mm and tool grade of KC922. The most significant factors affecting surface roughness were feed rate and tool grade which contributed 47.15% and 38.88% respectively. Work hardening of the deformed layer occurred beneath the machined surface causing hardness to increase by 18.93% than the average hardness of the base material. However, softening effect of material occurred at these levels which were probably due to the over-aging of titanium alloy as a result of very high cutting temperature. A 1.8 μm in thickness of white layer or plastically deformed layer on the machined surface was found when cutting at speed of 95 m/min, feed rate of 0.35 mm/rev and depth of cut of 0.10 mm and tool grade of KC9225. Nevertheless, it shows some sub-surface alteration such as micro-pits, deformation of feed marks and re-deposited of titanium. The surface topography produced has a strong correlation to the surface roughness as a result of the feed rate factor. In addition, changes in the orientation of microstructure are observed beneath the machined surface due to high temperature and tool depression.

For further correspondence kindly contact:

Professor Dr. Che Hassan Che Harun (Main Supervisor)
Department of Mechanical and Materials Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216511; Fax: 603-89259659; Email: chase@eng.ukm.my



Advanced 2D and 3D Texture for High Efficiency Crystalline Silicon Solar Cells

by
Fariborz Jahanshah (P35002)
Doctor of Philosophy in Mechanical and Materials (Ph.D)

Texturing of the frontal surface of silicon solar cells will increase the efficiency. The weak absorption characteristics of silicon solar cells require that advanced texturing methods be developed. This will increase light trapping, reduce reflection, and enhance internal diffractive scattering. Chemically based texturing processes involving alkalis and acids have been used in most conventional method of texturing silicon wafers followed other processes involving junction formation, anti-reflective coating and etch isolation. The chemical texturing process will produce pyramid liked structures for photon absorption. In this study, a new and innovative 2D and 3D textures were developed. The objectives of this study were to investigate theoretically and experimentally, and optimize these 2D and 3D advanced textures for enhancing the silicon solar cell efficiency. The theoretical background has been developed from the physics of semiconductor devices and wave optic phenomena in diffraction grating. The SILVACO software was used to simulate the I-V characteristics. The wave optic phenomena were incorporated using the editing facility in SILVACO as input to the software. This would enable SILVACO to incorporate advanced texturing and diffraction grating for simulation of the physical response of the light-trapping effect, the I-V curves and the efficiency of the solar cells with 2D and 3D textures. These enable us to optimize cell performance without executing costly and time-consuming experimental works. The actual 2D and 3D textures of the solar cells have been developed using DRIE. The p-n junction has been developed by doping using the furnaces. The nitride antireflective coating was formed using the PECVD. The edge isolation of the cells has been conducted using the XeF_2 . The front and back contacts have been constructed using screen printing technique. Experimental results have demonstrated that an absolute enhancement of more than 15% for the textured cells compared to the conventional solar cell. An increase in the short circuit current and open circuit voltage have also been observed for the 2D and 3D textures. Simulation results show absolute efficiency increase of 17% and 21% for 2D and 3D textured structures in comparison with bare silicon solar cells, respectively. Comparisons of the simulation results have an exhibited excellent agreement with the experimental data. It has been found that 3D texturing has better solar cell with short-circuit-current density (J_{sc}) of 12.03 mA/cm^2 and open-circuit-voltage (V_{oc}) of 0.49 V comparing to other 2D textured cell (J_{sc} : 11.13 mA/cm^2 and V_{oc} : 0.47 V) and planer silicon solar cells (J_{sc} : 9.65 mA/cm^2 and V_{oc} : 0.48 V). Using nitride anti-reflection coating in the planer silicon solar cells, it has been predicted that the solar cells with 2D and 3D textured surfaces would substantially get even higher conversion efficiency due to effective light confinement effect in these surface structures by 19% and 24% respectively. Besides improving the cell efficiency, this new process will also lead to more dry and wet less process thus reducing the amount of chemicals used.

For further correspondence kindly contact:

Professor Dato' Dr. Kamaruzzaman Sopian (Main Supervisor)
Department of Mechanical and Materials Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216511; Fax: 603-89259659; Email: ksopian@vlsi.eng.ukm.my



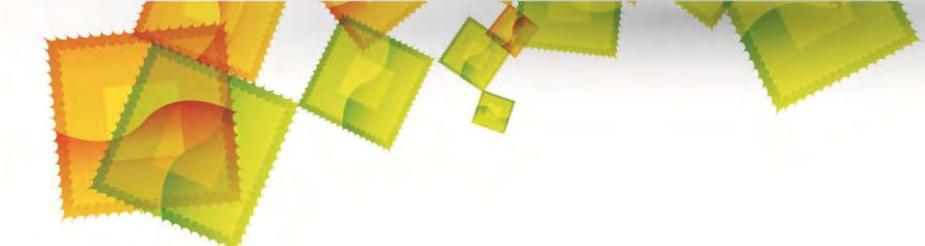
Monitoring and Determine Engine Oil Viscosity Medium Speed Diesel Engine Using Acoustic Emission Technology

by
Othman Bin Inayatullah (P33976)
Doctor of Philosophy in Mechanical and Materials (Ph.D)

The engine lubrication system is one of the most essential factors in engines life span and it is easily be specified through the viscosity of the engine oil. However, the monitoring and determination the engine oil viscosity through the process of oil analysis method proves uneconomical and ineffective. Apart from that, the relationship between the viscosities and in-service age of the engine oil still not analytically proven. Objective of this research to develop engine oil viscosity monitoring and determining system based on acoustic emission (AE) technology. This research introduces two new developed models on viscosity based on mathematical equations. The first model is the Mathematical Viscosity Model (η_{math}) which is developed for determining the viscosity by calculations. The η_{math} influenced by the temperature and in-service age. The second is the AE Viscosity Model (η_{AE}) which η_{AE} value is specified through AE energy (E_{AE}). The E_{AE} is obtained through the AE signal analysis which measures when the piston is sliding on the layer of engine oil. In this research conducted in 3 stages. The early stage is determining the suitability and effectiveness location of the AE sensor. This study conducted by using the AE technology with a wide band (WD) sensor in frequencies range of 0.1MHz to 1MHz. The second stage, the study focuses on the viscosity of the different engine oil but in same grade. This study conducted on single cylinder 4 stroke diesel engine with 2 different types of engine oil. In this study, AE signal's observation had done at temperature 40°C to 55°C by 5°C at each interval and the in-service age set from 0 to 100 hours at intervals of every 10 hours. Apart from that, the real viscosity value (η) in 35°C to 60°C at 5°C increases at the in-service age is determined through the Rheology Viscometer Analysis with the Haake NV Sensor. Through this analysis, the temperature factor value (k_s), time factor (k_m) and the viscosity of the fresh lubrication oil value at 35°C is achieved and applied into the η_{math} model. The viscosity analysis is done by using the ASTM software (η_{ASTM}) based on the theory of the Newtonian Viscosity which is used as a comparison to seek the difference between the Newtonian and non Newtonian lubricant. The final stage in this research is an industrial study with the intention of looking at the ability of the AE technology in monitoring and determining the engine oil viscosity used in a 3 tonne Handalan 2 of the ATM vehicle. Through this research, η_{math} model is the mathematical equation which connects change of fresh oil viscosity by influence of temperature and in-service age including k_s and k_m . On the other hand, η_{AE} model is an empirical equation which connects engine oil viscosity with E_{AE} . Both these new developed models can be applied in the monitoring and determination of the viscosity of the engine oil by further calculations and by checking on line. Generally, η_{AE} an average error less than another namely 0.005%, η_{math} is 0.53% and η_{ASTM} is 3.74%. These research findings also prove that the viscosity of the engine oil undergoes changes with in-service age as well as the difference in the product used. The difference of the viscosity in the different products is expected to be influenced by the formula of the mixture of the engine oil additive. Finally outcome from this research project either a laboratory and field study can be use in tabulation and maintenance of the engine oil economically and effectively.

For further correspondence kindly contact:

Assoc. Professor Dr. Nordin Jamaluddin (Main Supervisor)
Department of Mechanical and Materials Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216509; Fax: 603-89259659; Email: nordin@eng.ukm.my



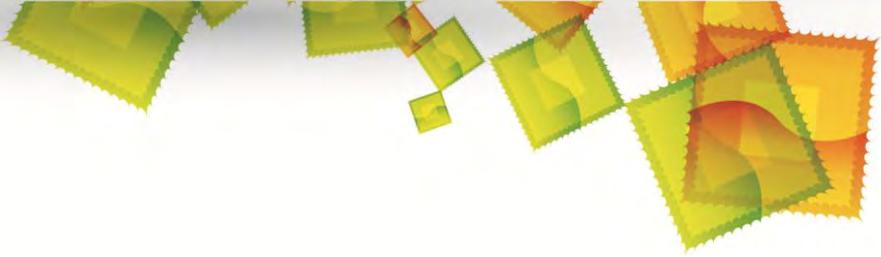
Wavelets Analysis of Seismic Surface Waves for Evaluation of Soil Dynamic Properties

by
Sri Atmaja Putra Jatining Nugraha Nasir Rosyidi (P35255)
Doctor of Philosophy in Civil and Structural Engineering (Ph.D)

An important step in seismic surface wave methods in geotechnical investigation is to generate the dispersion curve of phase velocity and attenuation of the layered soil media. Subsequently, an inversion algorithm is performed to determine the soil dynamic properties. Bias in the dispersion curve usually occur due to poor spectral characteristics and simplistic signal processing based on Fourier transforms (FT). A new technique for interpreting the localized seismic wave energy events, called the continuous wavelet transform filtering (CWTF) of Gaussian derivative (DoG), is proposed. The CWT spectrogram was used to improve time-frequency resolution of surface wave signals. The use of CWTF technique for determining the correct phase spectrum of the dispersion curves was verified through theoretical and experimental analysis. In this study, a new method which is called as the continuous wavelet spectrum analysis of surface waves (CWSASW) method, for calculating the phase, group velocity and attenuating dispersion curve simultaneously based on CWT DoG was also developed. By inversion of these curves, the soil shear modulus and damping ratio profile can be acquired. The value of shear wave velocity and shear modulus of soft clay, sandy and sedimentary residual soil profile obtained from the interpretation of this method compared reasonably well with the SASW and CSW method. Soil field and laboratory tests were also conducted at same locations of the surface waves test. Good correlations of soil stiffness profile between field tests and the CWSASW method were obtained. However, the value of soil stiffness obtained from surface waves measurement is higher than the soil field tests due to the fact that the surface wave measurements were performed at very low strain level. For complex profile, i.e. a pavement structure, the CWSASW provided better results for obtaining the stiffness profile compared to the conventional surface wave methods. A good agreement between the FWD and CWSASW test was also acquired for the pavement stiffness profile. The results of study also indicated that the material attenuation coefficient increases with material stiffness decreases. In addition, GoD CWT analysis was used to generate the Fourier spectrum ratio and spectral acceleration curves for ground response analysis from earthquake records. Significant improvement in time-frequency response was then obtained for analyses of soil behaviour due to earthquake motion. Thus significant improvement was made in the interpretation of seismic surface waves waveform based on time-frequency analysis of GoD CWT. This study provides contribution in advancing the surface wave measurement techniques for evaluation of soil dynamic properties.

For further correspondence kindly contact:

Professor Dr. Mohd Raihan Taha (Main Supervisor)
Department of Civil and Structural Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216200; Fax: 603-89216147; Email: drmrmt@vlsi.eng.ukm.my



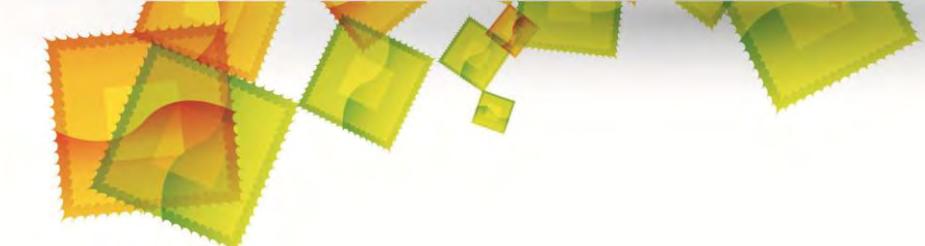
Prediction of Long-Term Settlement on Soft Clay Using Shear Wave Velocity and Damping Characteristics

by
Mohamad Nor Bin Omar (P30603)
Doctor of Philosophy in Civil and Structural Engineering (Ph.D)

Ground settlement is a common problem in areas of soft clay deposits found widespread throughout the coastal areas of Malaysia. This problem is mainly due to large deformation of the very soft clay material of the subsurface under long-term loading of engineering superstructures. As such a fast, reliable and relatively simple method of predicting settlements and deformations on soft clays is needed. This research explores the state of the art application of using the seismic method to predict long-term settlement of a loaded pad on a soft clay site at Klang, Selangor. Seismic tests of the Spectral Analysis of Surface Wave (SASW) and Continuous Surface Wave (CSW) were initially conducted at selected locations of the study area to obtain the shear S-wave soil profiles. Calculation of the predicted long-term settlement was carried out using the shear wave velocities obtained from the seismic tests and damping from the plate load tests using the seismic formula proposed by Abbiss (1986) based on the generalised viscoelastic time-dependent strain of materials. The results from the seismic method and the traditional methods of Terzaghi (1925), Skempton (1957) and Coduto (1994) were compared for a duration of 10 months to the actual monitored total settlement of a loaded skip tank. The settlement predictions using the seismic method were found to be considerably closer to the actual settlement observed. The difference between the calculated long-term settlement using the seismic equation in the SASW and the CSW tests and the actual settlement was found to be smaller compared to those of the traditional methods. The average difference for the traditional methods was found to be more than 350% while the average difference for the seismic method was about 50%. A revised equation of the seismic method was then proposed to improve on the prediction accuracy. This revised equation was able to reduce the long term settlement prediction difference to an average of 10%.

For further correspondence kindly contact:

Professor Dr. Mohd Raihan Taha (Main Supervisor)
Department of Civil and Structural Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216200; Fax: 603-89216147; Email: drmrt@vlsi.eng.ukm.my



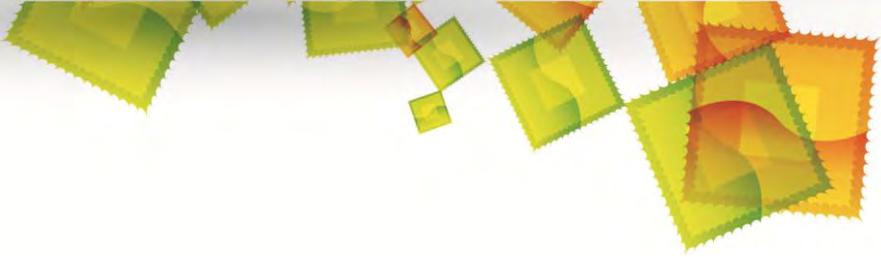
Development of an Intelligent Optimization Simulator Model for High Performance Concrete Mix Design using Artificial Neural Network

by
Maslina Jamil (P38384)
Doctor of Philosophy in Civil and Structural Engineering (Ph.D)

High performance concrete (HPC) is a highly complex material which involves many variables and includes various mineral and chemical admixtures which make modelling its behaviour a very difficult task. The important factors in determining the quality of HPC are its strength, durability and workability. In order to achieve the required strength, durability and workability, a right proportion of materials such as water, cement, fine aggregate, coarse aggregate, air-entraining agent, superplasticizer and mineral admixture as binder need to be identified. Since the types and amounts of admixtures might have a great influence on the strength characteristics, durability and workability of HPC mixtures, a different approach is needed for determining the mix proportions of HPC instead of conventional method. To date, most of the methods of mix design of HPC were based solely on trial and error which involved large numbers of mixing and testing. As the cost of materials and labour increase, optimizing HPC mix proportions is more desirable. Moreover, the present mix design methods involved numerous calculations, design charts and tables look-up are seemed to be tedious and lengthy. Furthermore, the complex properties and behaviour of HPC are hard to model with traditional mathematical tools. So, the purpose of this study is to develop a simpler and generalized HPC mix design method using artificial neural network (ANN) techniques. This study is aimed at demonstrating the possibilities of adapting ANN in the mix design prediction problem and prediction of HPC performance. Thus the developed intelligent optimization simulator model has to perform two functions. The system has to predict the amounts of mixing materials in HPC based on the specified strength and workability and other factors that can affect the HPC mixes. Another function is to find the strength and workability based on the amounts of mixing materials and other factors, which is more like reversing the first function. The development of the intelligent optimization simulator model for HPC mix design involved two phases which were development of neural network simulator model and HPC mix design intelligent system. Training and testing the network will start immediately prior to the completion of the simulator development and data preparation. A procedure for developing neural network models using back propagation networks is presented, neural network parameters are investigated and some issues related to development process are described to facilitate the development of efficient application. The developed ANN model by using the back propagation architecture has demonstrated its ability in training the given input and output patterns. The findings of this study shows that the application of ANN is capable of providing solutions to the civil engineering problem, particularly in designing the high performance concrete mixes.

For further correspondence kindly contact:

Professor Dr. Muhammad Fauzi Mohd Zain (Main Supervisor)
Department of Architecture
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216453; Fax: 603-89252546; Email: fauzi@eng.ukm.my



Non-Invasive, Parametric Estimation of the Arterial Transfer Function between Two Different Anatomical Points in Human Body

by

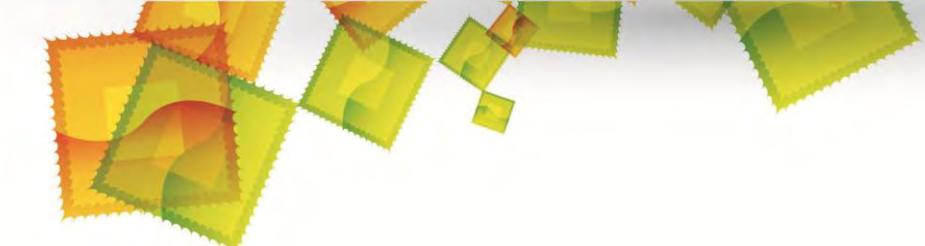
Kalaivani A/P Chellappan (P30600)

Doctor of Philosophy in Electrical, Electronic and Systems Engineering (Ph.D)

Cardiovascular health is currently assessed by a collection of hemodynamic parameters, many of which can only be measured by invasive methods often requiring hospitalization. The objective of this research is to establish a non-invasive approach of evaluating the vascular health index by using photoplethysmogram (PPG). PPG waveform were recorded at two anatomical sites (right and left index fingers) from 183 subjects with at least one cardiovascular risk and 163 control subjects free from cardiovascular risk factors. The recorded waveforms were pre-processed to remove any drift, noise and outliers. Two different approaches were established in achieving the targeted result: (i) Hemodynamics Modeling, and (ii) Empirical Data Modeling. Piecewise Linear Analytical Modeling and Electrical Analog Modeling made of finite-element technique are the two different approaches for Hemodynamics Modeling. In Piecewise Linear Analytical Modeling, the ARX (Auto-Regressive with eXogenous input) coefficients were mathematically derived from Electrical Lumped Parameter Model (ELPM) using transfer function. The Electrical Analog Model was explored by modeling the upper limb human arterial system as ELPM. The proposed four segments arterial system associated with the modified ten-element Windkessel Model established the ELPM. Synthesized and simulated left ventricular pressure signal has been established as input to the ELPM, which generates the peripheral arterial pulse that has high similarity ($P < 0.001$) to recorded PPG waveform by the aid of PSpice. The ELPM output was validated against the recorded PPG waveform considering the following factors, (a) ageing, (b) effect of exercise, and (c) cardiovascular risk. Referencing the result of validation, the behavior of compliance, resistance and inertance has been identified in different arterial segment due to the investigated factors, which highly comply with established physiological theory. A pair of PSpice simulated upper limb PPG waveforms underwent a parameter estimation method that provides the best fit between left and right. The extracted data was kept for statistical analysis. The Empirical Data Modeling was initiated by similarity-studies on the PPG waveform components and characteristic in classifying the following factors, (a) ageing, (b) effect of exercise, and (c) cardiovascular risk. These analyses have been the basis for the single pulse selection representing fitness (PF) of a subject, which was used as benchmark to establish the vascular index equation through Multiple Linear Regression Modeling. A repeatability and variability study was conducted on ten randomly selected subjects in further establishing the single pulse usage that produces repeatability coefficient, $CR = 93.22 \pm 1.18$ and variability coefficient, $CV = 6.18 \pm 1.51$. A linear parametric model (ARX440) was investigated by the aid of system identification tools on the empirical data as an alternative method to establish the vascular index. In this model, the input consisted of the right index finger PPG waveform whereas the left index finger PPG waveform formed the output. The extracted ARX parameters underwent a series of statistical analysis followed by classification using Principal Component Analysis (PCA). The classified parameters were selected for Multiple Linear Regression Modeling to establish a vascular index equation. The PF model was selected in establishing the vascular index since the corresponding Akaike Information Criterion (AIC) value was small compared to both ARX models.

For further correspondence kindly contact:

Professor Dr. Mohd Alauddin Mohd Ali (Main Supervisor)
Department of Electrical, Electronic and Systems Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216302; Fax: 603-89216146; Email: mama@vlsi.eng.ukm.my



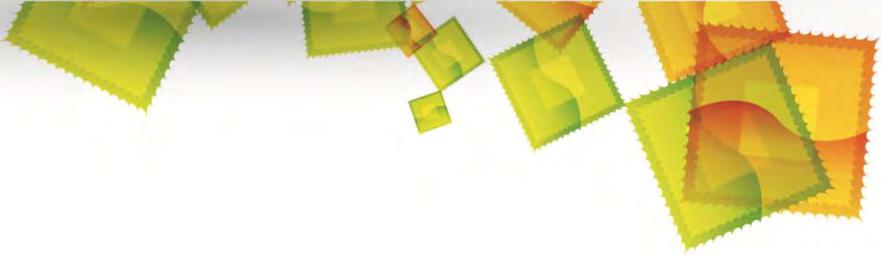
VLSI Implementation of Fast and Reliable Identification Technique for UHF Class 0 RFID Tag

by
Jahariah Bte Sampe (P33977)
Doctor of Philosophy in Electrical, Electronic and Systems Engineering (Ph.D)

The Radio Frequency Identification (RFID) system is an automatic identification technology of choice over other existing technologies. Nowadays, the ability to identify many objects simultaneously is crucial for more advanced applications such as to identify objects in the warehouse and at the supermarket. These applications require an efficient identification technique which can identify many objects at one time without longer delay. Meanwhile, one of the main issues during the identification process is the tags collision which occurs when all these tags simultaneously respond to the reader commands. Therefore the research objectives are to minimize the number of collisions and to optimize the tag features. The proposed Faster and Reliable Identification Technique (FDACA) is contention-limited and Reader-driven technique. The proposed FDACA adapted the Frame Slotted Aloha (FSA) during the transmission and adapted Binary Tree with Synchronous Time Division Multiplexing (TDM) at the reader. Our novel approach in reducing the collision probability is established using the modified frame structure with the optimum size of four rows and variable columns. Then packets from the preselected group of tags are sent into this frame. Next this frame is transmitted back to the reader, column by column. These four incoming packets are identified starting from the smallest to largest values at the reader. It is shown that the optimum frame size equals to twice tags number for the collisions probability of 10%. Therefore the frame transmission rate must be increased in order to enlarge the frame size and thus reducing the collisions probability. Moreover, FDACA minimizes the identification time in the existing technique for the UHF Class 0 RFID tag. This technique has small delay and allows a large number of tags to be identified. The proposed FDACA architecture is the integration of the error detection scheme and the anti-collision technique which satisfies this requirement. It speeds up the identification time because only error free tags are identified and acknowledged. This architecture also shortens the packet length and this requires a small Signal to Noise Ratio (SNR). It enables producing of the tag with small, simple, low cost and low power features. Furthermore this architecture allows the tag to employ the simplest coding scheme of Non Return Zero (NRZ). The proposed architecture has been designed based on VLSI design technique using Verilog HDL and synthesized using Xilinx Synthesis Technology (XST). It has been simulated using Modelsim at four simulation levels. Then this architecture has been verified in real time using the Field Programmable Grid Array (FPGA) VirtexII and the Logic Analyzer. Finally, it has been resynthesized using Application Specific Integrated Circuit or ASIC technology (0.18 μm Library, Synopsys Compiler and tools) for System-on-Chip (SoC) verification.

For further correspondence kindly contact:

Professor Dr. Masuri Othman (Main Supervisor)
Department of Electrical, Electronic and Systems Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216323/6300/6312; Fax:603-89216146; Email: masuri@vlsi.eng.ukm.my



Transient Stability Assessment and Control of Power Systems using Computational Intelligence

by

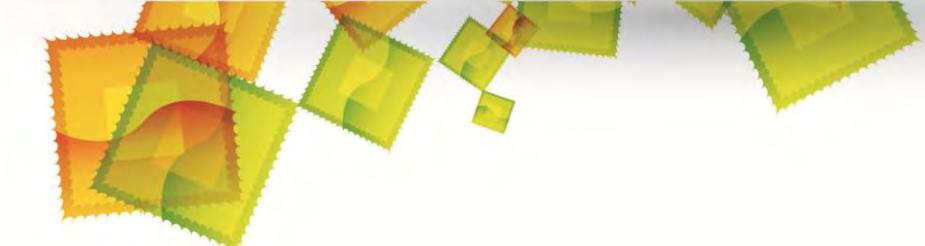
Noor Izzri Abdul Wahab (P33974)

Doctor of Philosophy in Electrical, Electronic and Systems Engineering (Ph.D)

Dynamic security assessment of power systems is important due to the continuing growth in interconnection and increased operations which may cause system to be in highly stressed conditions. Transient stability assessment (TSA) is part of dynamic security assessment which involves evaluation of the dynamic behaviour of power systems when subjected to severe contingencies. An important consideration in TSA is to formulate a transient stability index which is used to assess the stability of power systems and to rank the severity of the contingencies. In this research, a new transient stability index called as the Area-based Centre of Inertia-referred Transient Stability Index is proposed. The index is defined for each area of a power system and it is derived based on the fact that the generators in each area are coherent and can be represented by a single large machine with the same inertia and generation. By using the proposed index, the TSA process can be made faster because there is no need to assess all the generators' rotor angles. For the purpose of developing on-line TSA, computational intelligence techniques have been considered due to its ability to perform parallel data processing, high accuracy and fast response. Two new computational intelligence techniques, namely, probabilistic neural network and least squares support vector machine have been applied to classify the transient stability status of power systems. Feature selection and extraction are also considered while implementing the probabilistic neural network and least squares support vector machine so as to speed up the training of the neural network without affecting its accuracy. The feature selection method is based on data similarity via correlation analysis to reduce the input features and the feature extraction method is based on the principle component analysis. For the purpose of transient instability control, under frequency load shedding is implemented by using the proposed transient stability index to determine when the system load should be shed. All the developed techniques in TSA are verified by testing on the IEEE 9-bus test system, IEEE 39-bus test system and a large practical 87-bus power system. Results proved that the proposed index provides very useful information for tracking the instability areas in a power system. By using the index, there is no need to assess all the generators rotor angles in a system and hence it helps to speed up the transient stability assessment of a large power system. In terms of classification results, the probabilistic neural network and least squares support vector machine give faster and more accurate TSA as compared to using the multi layer perceptron neural network. The probabilistic neural network is proven to be superior than the least squares support vector machine in terms of its accuracy in classifying transient stability status of the power systems with classification accuracies of 97 % and 95%, respectively. The development of new and accurate techniques for TSA and control of power systems are proven useful in enhancing the stability of power systems.

For further correspondence kindly contact:

Professor Dr. Azah Mohamed (Main Supervisor)
Department of Electrical, Electronic and Systems Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216103; Fax: 603-89216146; Email: azah@vlsi.eng.ukm.my



Investigation of Source Couple Logic for Realization of New Pulse Generation Circuit in UWB Technology

by

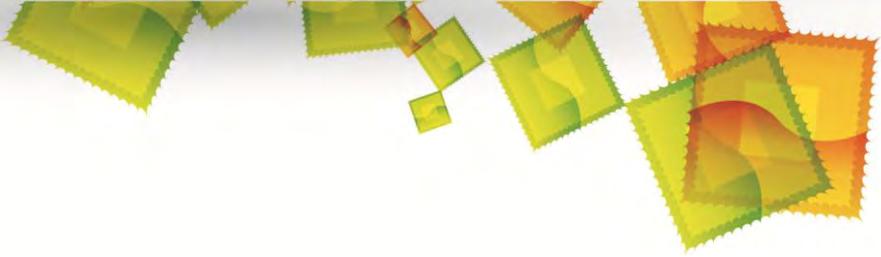
Mohamed Abdussalam Azaga (P31339)

Doctor of Philosophy in Electrical, Electronic and Systems Engineering (Ph.D)

Significant advances have been made in high data rate circuit designs for communications and personal area network (PAN). Thus many new applications such as UWB, Wi-Fi, and WiMax have been realized. The Source Couple Logic (SCL) is one of promising circuit design technique due to its capability for high speed, low power consumption, and low-noise compared to the conventional CMOS logic. Additionally, it is insensitive to IC process variations, which make it suitable for digital/mixed-signal design in sub-nanometer technologies. The design and characterization of pulse generator and microstrip band pass filter with emphasis on low-power consumption and immune to digital noise in mixed signal environment is the main subject of this thesis. They are intended for UWB application since UWB is going to be a new standard for very high-speed short-distance data communication in the future. In this work, detail investigation of SCL design, operation and characteristic are explained. The SCL performance in improving of the frequency bandwidth is explored. This includes the analysis of ring oscillator and jitter. A pulse generation circuit (PGC) is designed, simulated, and the results show its output complied with the UWB standard specifications. The design of band pass filter (BPF) to shape the generated UWB monocycle pulse is also carried out in this project. It is based on the microstrip BPF that uses coupled half-wave resonators with a pass window complies the Federal Communication Commission (FCC) UWB power spectral density mask. The pulse generation circuit and Source Couple Logic inverter layouts have been implemented using several techniques to investigate the performance and the effects of parasitic effect. The analysis has been done by using physical simulation method, with the results obtained comply with UWB standardization. Three models of PGCs and four SCL inverter layouts have been fabricated. MIMOS 0.35 μ PDK were used in all designs, simulations, layout, physical simulations, and extraction. The measurements of different PGCs and SCL inverter models in the prototyping chip have been conducted, and the result shows that the simulated and prototyping were comparable and complied with the UWB standards.

For further correspondence kindly contact:

Professor Dr. Masuri Othman (Main Supervisor)
Department of Electrical, Electronic and Systems Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216323/6300/6312; Fax:603-89216146; Email: masuri@vlsi.eng.ukm.my



Development of Multibiometric Speaker Verification Systems with Support Vector Machine Audio Reliability Estimation

by

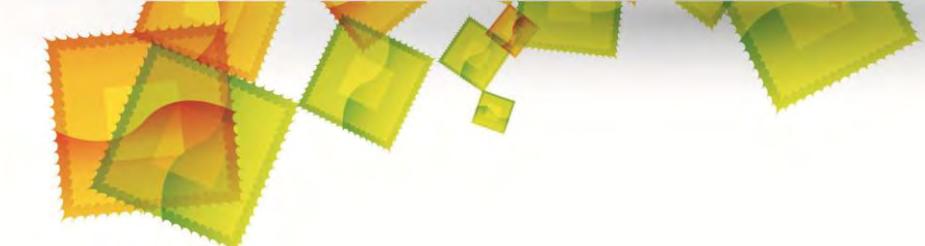
Dzati Athiar Ramli (P36183)

Doctor of Philosophy in Electrical, Electronic and Systems Engineering (Ph.D)

Biometric speaker verification systems use behavioral and physiological information of speech signal to authenticate an individual for identity claim. Performances of these systems are good in clean conditions but their reliability drops severely in noisy environments. Implementation of multibiometric systems using audio and visual experts is one of the solutions to this limitation. In this study, weighting for fusing the audio and visual expert scores is proposed to be adapted corresponding to the current environment. Frequent approach uses fixed weighting but this is inappropriate if the systems are executed in uncertain conditions. For this purpose, an indicator system using Support Vector Machine (SVM) for current speech signals reliability estimation is developed. The effectiveness of the proposed adaptive weighting has been experimented in two types of multibiometric systems that employ lipreading image as visual expert. The first multibiometric system uses SVM as classifier and Principal Component Analysis (PCA) technique for visual features extraction. Mel Frequency Cepstrum Coefficient (MFCC) and Linear Predictive Coding (LPC) are evaluated individually as audio features to this system. For the second multibiometric system, classification based on Unconstrained Minimum Average Correlation Energy (UMACE) filters has been introduced and region of interest (ROI) of lip image has been used as visual features. Since UMACE filters utilize 2D image representation, a modified version of speech signal namely cepstrumgraphic and spectrographic are experimented individually as audio features to this system. This study proves that multibiometric systems using adaptive weighting are always superior compared to multibiometric systems using fixed weighting. Apart from that, this study also found that the performance of multibiometric system using SVM as classifier with PCA and MFCC features outperforms others. Equal Error Rate (EER) percentage for this system at 10dB Signal to Noise Ratio (SNR) is observed as 39.865% for audio only system, 5.016% for the system using fixed weighting and 0.268% for the system using adaptive weighting.

For further correspondence kindly contact:

Professor Dr. Aini Hussain (Main Supervisor)
Department of Electrical, Electronic and Systems Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216312; Fax: 603-89216146; Email: aini@eng.ukm.my



Design and Analysis of Optical Wavelength Division Multiplexing Networks

by

Yasin M. Karfaa (P28388)

Doctor of Philosophy in Electrical, Electronic and Systems Engineering (Ph.D)

Wavelength Division Multiplexing (WDM) is the technology of transmitting multiple independent data streams independently on a single fiber using different light wavelengths. In all optical networks based on WDM, a high-speed network without signal regeneration can easily be deployed. Although the cost of the specified physical impairment is the topic of many conducted studies, combined factors that affect the WDM networks performance using various types of fiber was not their concern. These impairments include linear crosstalk, Amplified Spontaneous Emission (ASE) noise, and nonlinear effects. The objective of this study is to design and analyze the performance of the optical WDM networks, in the presence of combined physical impairments. A theoretical analysis is conducted to design and model the optical WDM network representing Optical Cross-connect (OXC) and Array Waveguide Grating (AWG) router impairments, and network non-linear effects. The OXC is equipped with wavelength converter based on XPM in a single mode fiber (SMF) and Mach-Zehnder interferometer (MZI) in a point-to-point network, for the case of one node, and multiple nodes respectively. The study focus on the ASE and wavelength converter noises, besides the homodyne crosstalk due to the AWG router. For the optical fiber nonlinearities studies, three nonlinear effects which are Four-Wave Mixing (FWM), Cross-Phase Modulation (XPM), and Stimulated Raman Scattering (SRS) for four types of fibres, namely SMF, Dispersion Compensation Fiber (DCF), Non-Zero Dispersion Fiber (NZDF) and Non-Zero Dispersion Shifted Fiber (NZDSF) have been investigated. Following the physical impairment, a network contention resolution and routing study also has been carried out. Some important key parameters that are used to evaluate networks performance are Bit Error Rate (BER), linear and nonlinear crosstalk power, power penalty, number of transmitted channels, channel spacing, transmitted and received power, and number of nodes. A novel expression for the ASE, Interferometric Intensity Noise due to Wavelength Converter (IINWC) and Relative Output Noise (RON) have been derived and numerically evaluated. From the analysis, it is found that there is an accumulation of noise from the ASE and wavelength converter as a channel traverses through OXCs resulting in a receiver sensitivity of up to -13.1 dBm for 20 OXCs. The ASE noise is dominant at the receiver as the interferometric intensity noise is insignificant by comparison. The linear crosstalk in AWG produces power penalty that increases almost linearly with the node size to maintain a BER of 10^{-9} for the bit rate less than 40 Gbps. The power penalty for the channel spacing of 50 GHz is approximately 2 dBm due to XPM. The power penalty due to SRS is 0.25 dB and 3 dB for the fiber length of 80 km and 120 km respectively at a BER of 10^{-9} . For the FWM, the noise power in NZDF and NZDSF is 1 dB higher than that for SMF and DCF when the input power is -19 dBm and it increases with the input power. It can be concluded that the combined factors due to the physical impairment are quite significant and can not be neglected when designing an efficient and cost effective optical WDM network. This is further strengthening by the network contention resolution and routing study.

For further correspondence kindly contact:

Professor Dr. Mahamod Ismail (Main Supervisor)
Department of Electrical, Electronic and Systems Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216312; Fax: 603-89216146; Email: mahamod@eng.ukm.my



Perinatal Cardiotocograph Signal Analysis and Classification

by

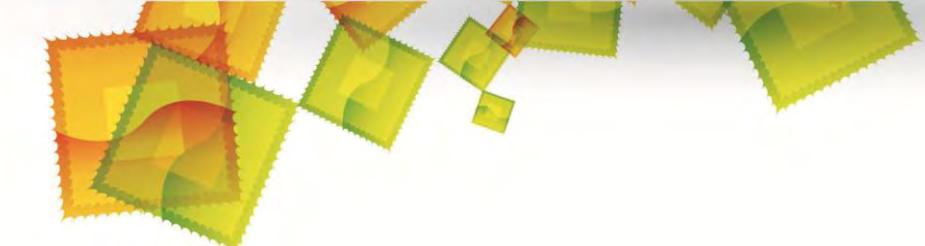
B. Niranjana Krupa (P39556)

Doctor of Philosophy in Electrical, Electronic and Systems Engineering (Ph.D)

Fetal heart rate (FHR) has been used to indicate fetal well-being for the last 160 years. However, only in recent times continuous FHR monitoring has been possible. There are two main non-invasive approaches for FHR recording: first is the classical ultrasound Doppler (USD) method and second is the extraction of FHR from a mixed abdominal electrocardiogram (ECG) signal. The disadvantages of the second approach are that it is sometime impossible to extract the fetal ECG from the recording and identification of fetal RR intervals is time consuming. Cardiotocogram (CTG) is a combination of the USD (for FHR) and an external pressure transducer for recording uterine activity (UA). This guarantees FHR signals under all circumstances and is an indispensable tool for fetal surveillance. Ever since its introduction in everyday clinical practices there has been a drastic reduction in child mortality. However, there are many problems related to the presence of unavoidable artifacts such as missing beats and high frequency noise. Additionally, the analysis of CTG tracings which is still being done manually by obstetricians leads to a high degree of inter-observer and intra-observer variability. Hence, in this work a new approach for the CTG signals enhancement and computerized interpretation is proposed. In the signal enhancement process, the missing beats are eliminated with the help of a recursive algorithm and the high frequency noises are removed by using empirical mode decomposition (EMD) method and a partial reconstruction method, which employs a statistical t-test to determine the noise order. The results are compared with those of conventional filters and the quantification was done based on three obstetricians ratings on the visual quality of 15 enhanced signals. This confirmed the better performance of the proposed method with a score of 3.8 out of 5. For the computerized interpretation of CTG signals, firstly, an application was developed to extract the basic features of FHR, such as: baseline, variability, accelerations and decelerations according to the International Federation of Obstetrics and Gynecology (FIGO) guidelines. A scoring system was introduced to classify the CTG signals as normal, abnormal and pathological based on the Kubli score guidelines. The results obtained for 15 signals were compared with the visual interpretation (VI) results by two obstetricians using the Bland Altman statistical method which produced agreeable results with the line of equality lying within the 95% confidence interval. Introduction of the scoring system made the classification process more systematic and specific. Secondly, an unconventional FHR classification system independent of the basic FHR features was developed where a new feature extraction method based on EMD was introduced. The features extracted were used as input to the support vector machine (SVM) with radial basis function (RBF) kernel, where 90 FHR signals were classified as either 'normal' or 'at risk'. The performance of the method was confirmed with the help of cross-validation accuracy and application of different statistical methods on two non-overlapping training and testing data sets and using the mutually agreed VI results of two obstetricians as reference. This resulted in a geometric mean (G_M) (derived from sensitivity and specificity, Kubat) of 94.9 for the training set and 81.6 for the testing set and the Kappa values obtained showed a good agreement between the VI and SVM classifier. The results obtained imply that the proposed methods for CTG signal enhancement and computerized FHR signal interpretation are promising. With extensive validation these can be used in providing home care facilities for pregnant women with minimum intervention from medical experts.

For further correspondence kindly contact:

Professor Dr. Mohd Alauddin Mohd. Ali (Main Supervisor)
Department of Electrical, Electronic and Systems Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216312; Fax: 603-89216146; Email: mama@eng.ukm.my



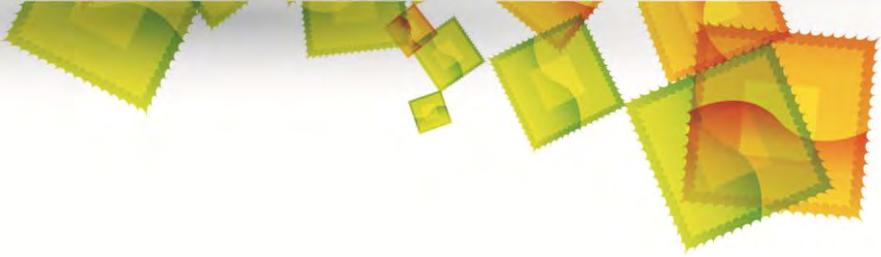
Design of Long-Wavelength Vertical-Cavity Surface-Emitting Laser (LW-VCSEL)

by
Kumararajah A/L Pandiah (P22741)
Doctor of Philosophy in Electrical, Electronic and Systems Engineering (Ph.D)

Vertical-cavity surface-emitting lasers (VCSELs) are alternative semiconductor laser diodes to edge-emitting lasers (EELs) to be utilized in fiber-optic communication systems such as the *Gigabit Ethernet* and *Fiber Channel*. VCSELs are advantageous because they have a small form factor, low power consumption, output a circular optical beam, allow on-wafer testing and have a lower packaging cost compared to conventional lasers. The development of long-wavelength VCSELs (LW-VCSELs) at wavelengths, $\lambda=1.31\ \mu\text{m}$ and $\lambda=1.55\ \mu\text{m}$ where data transmission in fiber optics have the lowest dispersion and optical losses, is crucial in increasing data transmission speed and to reduce implementation cost of fiber-to-the-home (FTTH) access networks. The objective of this research is to design, characterize and to optimize a LW-VCSEL model operating at $\lambda=1.55\ \mu\text{m}$ using a combination of industrial-based numerical software, Silvaco and Taguchi statistical method. The chosen LW-VCSEL model contains a multi-quantum-well (MQW)-based active cavity from $\text{In}_{(1-x)}\text{Ga}_{(x)}\text{As}_{(y)}\text{P}_{(1-y)}/\text{InP}$ which is bonded to $\text{Al}_{(1-x)}\text{Ga}_{(x)}\text{As}/\text{GaAs}$ -based distributed Bragg reflectors (DBRs). Etching of the top DBR layers produces an air-post design which provides current confinement and selection of appropriate DBR layer quantities produces a bottom-emitting VCSEL. The MQW active region comprises of six 5.5 nm-thick wells separated by 8 nm-thick barriers whereas the p-type top DBR layer has 30 periods with a thickness of $\lambda/4$ each and 28 periods of n-type bottom DBR mirrors; both forming the reflectors of the LW-VCSELs. The developed model achieved lasing power of 4.9 mW, modal gain of $25\ \text{cm}^{-1}$, peak wavelength of $1.5\ \mu\text{m}$, threshold current $<0.8\ \text{mA}$. The quantum well/barrier material $\text{In}_{(1-x)}\text{Ga}_{(x)}\text{As}_{(y)}\text{P}_{(1-y)}$ used has a mol fraction (QW) and barrier mol fraction (QWB) of $x_{\text{QW}}=0.24$, $y_{\text{QW}}=0.82$, $x_{\text{QWB}}=0.52$ and $y_{\text{QWB}}=0.82$ and achieved spectral linewidth of 40 MHz; thus producing a device in par with experimental devices developed in the past. Continuous wave operation was achieved up until 80°C at a bias current of 15 mA. Three new analytic functions which relate the MQW parameters to the spectral linewidth were developed. Taguchi orthogonal array statistical methodology (L_9) was utilized in a novel attempt to optimize the virtual LW-VCSEL model. The selected design factors are the MQW quantity, their thicknesses, the device diameter and the air-post diameter. Noise factors such as the operating temperature and bias voltage were included. The effects of these factors and noise on four crucial output parameters of the LW-VCSEL which are the peak wavelength (λ_0), spectral linewidth ($\Delta\lambda$), optical emission power (P_0) as well as the temperature stability ($\Delta P_0/^\circ\text{C}$) was analyzed critically. As a summary, all objectives of this research were achieved and it provides a benchmark in the development of numerical and statistical models of optoelectronic devices based on III-V materials.

For further correspondence kindly contact:

Professor Dr. Sahbudin Hj. Shaari (Main Supervisor)
Department of Electrical, Electronic and Systems Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216312; Fax: 603-89216146; Email: sahbudin@eng.ukm.my



Development of a Multi Scale Processing and Feature Extraction Technique for Weed Image Analysis And Classification

by

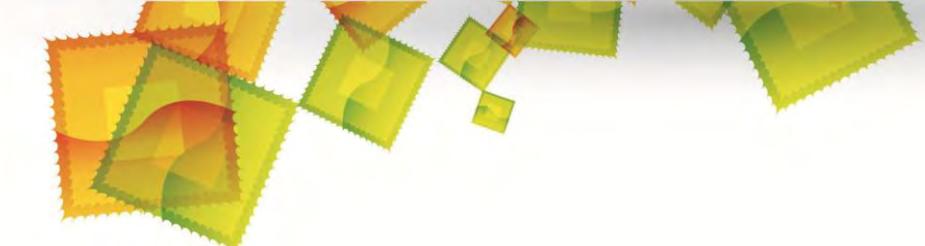
Kamarul Hawari Bin Ghazali (P34801)

Doctor of Philosophy in Electrical, Electronic and Systems Engineering (Ph.D)

The digital image processing (DIP) field has received worldwide research interests due to the massive use of the technology in various applications in our daily lives today. This is made possible due to the advancement in the computing technology that drives and enables the DIP field to advance rapidly, too. Various products employing DIP have been developed and applied in many fields such as the bio-medical, security systems, biometrics, agriculture etc. Consequently, a research has been conducted to develop, implement and test a computer algorithm that is robust and able to differentiate weed types effectively. The developed algorithm is to be used in a vision based intelligent system to weed out weeds in the palm oil plantation fields. The use of such intelligent system is meant to reduce the dependency on human labor, reduce cost of herbicide usages through selective spraying method, and to adopt and practice precision and environmentally friendly agriculture approach. Therefore, the main objective of this research is to develop a new, robust and effective image processing and feature vector extraction technique for use with weed images that is able to produce unique feature vector representation to simplify the weed recognition and classification task without the use of complex classifiers. This research has considered several well-known techniques such as the Fast Fourier Transform (FFT), Wavelet Transform (WT), Grey Level Co-Occurrence Matrix (GLCM) and the Difference of Gaussian (DoG). In this thesis, a new technique inspired based on the human vision system has been proposed and implemented, that is, the multiscale image processing and feature vector extraction technique. The use of the multiscale concept is expected to address the common problems in real-time image processing, namely lighting effects. The research methodology involves three main phases, namely 1) the database collection and pre-processing of the recorded weed images phase, 2) the processing and feature vector extraction phase which is the main research focus and 3) testing and validation phase of the effectiveness of the extracted feature when subjected to the weed classification task. The results obtained proved that the extracted feature vectors using the proposed multiscale technique successfully classify weed images as either broad or narrow leaf category with 99.46% accuracy as compared to FFT (82.2%), DoG (92%) and WT (94.8%). Additionally, a test was also carried out using a dataset of bad images that consists of synthetically added noise and mixed weeds to test for robustness of the extracted feature vector. Once again, the multiscale image processing and feature vector extraction technique superceeds the other techniques with the highest percent classification (98.5%). In conclusion, this research has successfully developed a new, image processing and feature vector extraction technique that is effective and also robust using the multiscale concept.

For further correspondence kindly contact:

Professor Ir. Dr. Mohd Marzuki Mustafa (Main Supervisor)
Department of Electrical, Electronic and Systems Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216100; Fax: 603-89216146; Email: marzuki@eng.ukm.my



Microwave Assisted Drying of Pitaya (*Hylocereus*) Slices

by

Mariam Firdhaus Mad Nordin (P37148)

Doctor of Philosophy in Chemical and Process Engineering (Ph.D)

Freshly harvested Pitaya (*Hylocereus*) fruits are highly perishable even under refrigerated conditions. Its shelf-life can be extended by drying. Hot air drying is the most common drying method employed for food materials. However, major drawbacks are long processing times and changes in product quality. It has been demonstrated that the combination of microwave energy to drying systems could greatly reduce drying time and result in better end product quality. The main purpose of this study was to investigate the potential benefit of using microwave assisted systems for drying pitaya fruit slices. The experiments were conducted at two locations namely the Universiti Kebangsaan Malaysia (Malaysia) and McGill University (Canada). Because of their respective availability, two different cultivars of pitaya were used in this study. The trials conducted at Universiti Kebangsaan Malaysia (Malaysia) consisted of drying locally grown Costa Rica Pitaya (*Hylocereus costaricensis*) in a convective hot air dryer and in a microwave drying system. The trials performed at McGill University (Canada) were done using Red Pitaya (*Hylocereus undatus*) imported from Vietnam and the slices fruits were dried in a microwave assisted hot air dryer and in a microwave assisted vacuum drying systems. In all cases, the experiments were carried out to measure the effects of operating conditions on drying kinetics and quality attributes of fruit slices. Quality parameters measured included: changes in color, water activity, shrinkage, rehydration ratio, texture, structure, acid ascorbic content and visual market quality. Results from microwave trials showed that the lowest power density (1.8 W/g) yielded better results than the highest values (6.6 W/g). The predicted drying times to reach 10% moisture content (MC) varied from 14 to almost 340 minutes and they were inversely related to the applied power levels. Results from the other experiment revealed that the optimum condition to dry pitaya slices in hot air oven was at temperature of 64.4°C with 45.6% relative humidity (RH). Under this condition, the model yielded a predicted drying time of about 1342 minutes which was much longer than those observed in systems using microwave energy. This clearly indicated the benefit of using microwave for drying purposes. The second part of the work was carried out at McGill University. The conditions for microwave assisted hot air drying trials were optimized using the three process parameters namely: the microwave power density (W/g), the thickness (mm) of pitaya slices and the drying temperature (°C) of the product. Results indicated that the optimum conditions to dry pitaya slices were at a temperature of 55°C with an initial microwave power density of 1 W/g and a slice thickness of 7.5 mm. Under these conditions, it took about 964 minutes to reduce the moisture content to 10% dry basis. Slices dried under optimum conditions were then compared to slices of same thickness dried at the same temperature with hot air and no microwave power. It was demonstrated that the main contribution of microwave energy was in drying time and it took about 2050 minutes to dry the slices to the same final moisture content. Modifications were made to the microwave assisted hot air dryer to make it work under vacuum. In this system, the process parameters investigated were the slice thickness and product temperature. All trials were performed at the same initial power density of 1 W/g of fresh produce. Results showed that the optimum condition for drying pitaya slices under combined microwave and vacuum was at a temperature of 60°C and a slice thickness of 5 mm. Under this condition, drying was uniform, the overall appearance of dried pitaya was excellent and the predicted drying time to reach 10% MC was only 179 minutes.

For further correspondence kindly contact:

Professor Ir. Dr. Wan Ramli Wan Daud (Main Supervisor)

Department of Chemical and Process Engineering

Faculty of Engineering and Built Environment

Universiti Kebangsaan Malaysia

43600 UKM Bangi, Selangor, MALAYSIA

Tel: 603- 6405/7078; Fax: 603-89216148; Email: wramli@vlsi.eng.ukm.my



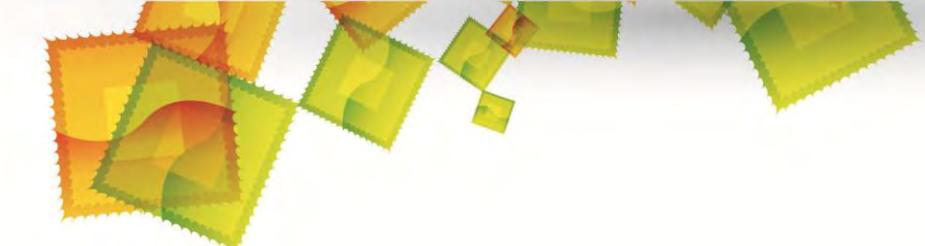
Reduction of Product Deposition in Spray Dryers

by
Woo Meng Wai (P37224)
Doctor of Philosophy in Chemical and Process Engineering (Ph.D)

Deposition of particles onto the internal wall of a spray dryer is a prevalent problem in this technology. Such deposition reduces the operation yield and to certain extends causes product quality problems or safety hazards. The first objective of this research project is to experimentally determine suitable operation practice for the spray dryer and to explore the possibility of deposition reduction by wall surface energy manipulation. The second objective is to evaluate and develop suitable computational fluid dynamics (CFD) simulation techniques to model the deposition process with the purpose of making it a predictive tool to control deposition. For the first objective, a quick optimization method, based on systematic elimination of product dripping and caking, was developed as a guide for small scale batch spray dryer operators. The developed method was then used to determine suitable operating conditions for the pilot scale dryer available for this research project using sucrose-maltodextrin feed solution. Experiments were undertaken on the pilot scale dryer to gauge the possibility in reduction of particle deposition by using a lower internal wall surface energy. It was found that lower wall surface energy resulted in less particle deposition. However, analysis on the deposition mechanism revealed that this reduction in deposition is only significant if the particle is rubbery; which is dependent on the operating condition of the dryer. In the first part of the modeling work, two droplet drying models, Reaction Engineering Approach (REA) and Characteristic Drying Curve (CDC), were evaluated based on single droplet drying experiments and in a CFD simulation. It was found that the models are very sensitive to the different initial moisture used, which will be an important aspect to account for in future application of these models. A new correlation was also introduced to extend the REA model for surface moisture calculation which will subsequently affect prediction of the particle rigidity. This will be very important as particle deposition is essentially a surface dependent phenomenon. In the second part of the modeling work, evaluation was undertaken on the suitability of steady or transient simulation of the spray dryer. It was found that the air flow stability of a spray dryer, with or without swirl, can be explained by the jet impingement feedback mechanism. The steady and transient regime was found to be strongly dependent on the geometry and operating conditions. The third part of the modeling work collated the preceding work in a parametric study of important factors in modeling particle deposition. It was found that particle deposition prediction is very sensitive to the near turbulence conditions. However, in all the simulations, although realistic trend was predicted, excessive deposition fluxes were predicted. It was postulated that such over-prediction was due to the inability of the model to capture the effect of collision dynamics on deposition. In the final part of the project, a new amorphous particle-wall impaction model was developed based on rheological characteristics. The key features of this model is the ability to capture both particle rigidity and impact condition in the predicting the collision outcome. Preliminary assessment of this model showed realistic qualitative behavior and the model has the potential to be extended to particle-particle collision.

For further correspondence kindly contact:

Professor Ir. Dr. Wan Ramli Wan Daud (Main Supervisor)
Department of Chemical and Process Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603- 6405/7078; Fax: 603-89216148; Email: wramli@vlsi.eng.ukm.my



Non-Volatile Organic Chemicals in the Agricultural Environment: Modeling, Fate and Impacts

by

Mohammad Ahmad Najib Batiha (P35212)

Doctor of Philosophy in Chemical and Process Engineering (Ph.D)

Modeling the fate and transport of non-volatile organic chemicals (NVOCs) in the agricultural environment have yet to be established despite of the large number of fate and transport studies have been carried out worldwide on different types of chemicals on various scales and environments. This work is aimed to provide a simple techniques and a general methodology for predicting how NVOCs behave in such environments, where they accumulate, how long they persist, and how this lead to environmental health exposure. It develops, describes, and illustrates the framework and procedures for calculating the fate of NVOCs in an agricultural environment and their relative ecotoxicological risk. In the first stage of this work, a multimedia equivalence-based mass balance model of the fate and transport of NVOCs in the agricultural environments at steady-state conditions was introduced, which is a modified version of the Equilibrium Criterion (EQC) model for type 2 chemicals (i.e., NVOCs) have been introduced by Donald Mackay and co-authors in 1996. The EQC model has considered only four environmental compartments, namely, the air, water, soil, and sediment. To allow its application to agricultural environment, the EQC model was modified in this work to include a new compartment and it is suggested to be called by EQC-2V, where 2 and V represent the type 2 chemicals and the vegetation compartment, respectively. The vegetation compartment was described by two sub-compartments consisting of the above-ground plant (AGP) and roots. In the second stage, the EQC-2V model was applied to Cameron Highlands region of Malaysia, and run with an illustrative emission rate of 1 kg/h into air for three commonly used pesticides in the region, namely, mancozeb, spinosad, and chlorosulfuron. The model application was aimed to validate the EQC-2V model results by comparing them with the original EQC model results. The differences in the compare results due to the effect of vegetation on the overall chemical fate were theoretically justified. The estimated EQC-2V application results indicated that the AGP captures 99.9% of introduced NVOCs (i.e., of 100% or 1 kg/h) and transfers them to the ground below due to the slight degradation losses of 0.0001% and the non-volatility property of the evaluated chemicals. Root uptake of chlorosulfuron accounted for the highest removal process from soil while degradation of spinosad in the soil is the major loss mechanism. Leaching to groundwater loss for mancozeb is about 2-fold greater than that of degradation, which together accounted the major removal process from soil. From the estimated results of mass distribution, vegetation compartment accumulates 0.04, 0.5 and 2.02% of the mancozeb, spinosad and chlorosulfuron, respectively. It was important to extend the steady-state EQC-2V model to unsteady-state conditions, therefore, in the third stage; a multimedia model at dynamic conditions was introduced, which was suggested to be called by Multimedia Agricultural Model (MAM). The MAM considered five environmental compartments to include the air, water, soil, sediment and vegetation. As the movement of chemicals in the environment is closely associated with the movement of air, water and organic matter, MAM calculates the complete steady-state mass budgets for the air, water and particulate organic carbon between the model compartments. The MAM compartments were connected by advective and intermedia transport processes. The mass balances for each of the compartments result in a system of five differential equations, solved numerically to yield estimates of concentrations, masses, transport fluxes, and reaction rates as a function of time. All the equations required for MAM calculations were provided. In the fourth stage, the ecotoxicological risk associated with the selected pesticide usage in the Cameron Highlands region was assessed by applying the ecological relative risk (EcoRR) approach. The estimated results showed that under simulation conditions, the application of selected pesticides has low ecotoxicological risk. In the last stage of this work, to generalize the present work and to give a general fate and risk assessment methodology making it easy to apply to any chemical in any Malaysian region, the developed EQC-2V model was combined with the EcoRR approach in a software that is called by the Multimedia Agricultural Fate and Risk Assessment Model (MAFRAM), which was written in Visual basic 6.0 language. It divides the agricultural environment into two main zones, which are on- and off-farm zones. Each environmental zone is divided into six compartments, namely the air, water, soil, sediment, above-ground plants and roots. It also allows the user to specify the evaluation type, whether to evaluate chemical fate only or chemical fate and risk assessment. The



emission can be assumed to take place into each surface compartment in which result of various emission scenarios can be explored. The MAFRAM is useful for comparing and establishing the general features of a new or existing chemical's fate and its relative risk in any agricultural environment using chemical-physical and environmental properties, and biota data. The main results of the MAFRAM include the inter-compartmental transport and transfer rates, the primary loss mechanisms, chemical concentration, amount, residence time and the rank of ecotoxicological risk in each environmental compartment in addition to several secondary results.

For further correspondence kindly contact:

Professor Dr. Abdul Amir Hassan Kadhum (Main Supervisor)
Department of Chemical and Process Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216411; Fax: 603-89216148; Email: amir@eng.ukm.my

Awards2010

Engineering & Built Environment



Bio Inno Awards
1st – 3rd November 2010, Kuala Lumpur Convention Centre

No.	Researchers	Research Title	Award
1.	Abdul Wahab bin Mohammad, Adrianus Grobben, Mazrul Ramzi bin Mokhtar, Abdul Ghani Kumar bin Abdul Aziz, Nor Hazwani bt Suhimi	Novel Intensified Process For Production Of Gelatine and Hydrolyzed Collagen From Agricultural Resources	Silver

21st International Invention, Innovation & Technology Exhibition (I.TEX 2010)
14th -16th May 2010, Kuala Lumpur Convention Centre

No.	Researchers	Research Title	Award
1.	Burhanuddin Yeop Majlis, Mitra Damghanian <i>(In collaboration with the Institute of Microengineering and Nanoelectronics)</i>	Enhanced MEMS Single Print Sensor Structure	Gold
2.	Siti Kartom Kamarudin, Achmad Fauzie, Norhafiz Hashim, Azran Mohd Zainoodin, Sariah Basri, Wan Ramli Wan Daud, Zahira Yaakub <i>(In collaboration with the Fuel Cell Institute)</i>	DMFC for Hybrid Handphone Charger	Gold
3.	Azimin Tazilan, Khairymazalee Yusri, Cheow Siu Leong, Shahrul Anizan, Mohd Yusoff Othman, Mohamad Yusof Sulaiman, Nowshad Amin, Saleem Zaidi, Kamaruzzaman Sopian, Mohd Khairunaz Mat Desa <i>(In collaboration with the Solar Energy Research Institute)</i>	ecSIGHTING™ : Safety Apparels with Green Mobile Solar Energy	Gold
4.	Siti Salasiah Mokri, Mohd Syuhaimi Ab. Rahman, Kasmiran Jumari, Suria Che Rosli, Zurita Zakaria, Mastang Tanra, Faridah Jaafar	Wireless CATV Tester Unit (WCTU)	Silver



5.	Mohd Syuhaimi Ab. Rahman, Mohd Hadi Guna Safnal, Mohd Hazwan harun, Latifah, Kasmiran Jumari	Low-cost Solution for WDM Multimode Transmission in Small-World Communication	Silver
6.	Kamaruzaman Mat, Mastang, Mohamad Najib Mohamad Saupe, Mohd Syuhaimi Ab. Rahman	Multi Access Detection System (MADS) for optical line monitoring in industrial environments	Silver
7.	Jaharah A. Ghani, Mohd zaki Nuawi, Che Hassan Che Haron, Muhammad Rizal	Low Cost Cutting Tool Wear Monitoring-NeoMoMac 1	Silver
8.	Kasmiran Jumari, Ng Boon Chuah, Aswir Premadi, Siti Asma Che Aziz, Siti Rahayu Hassan, Mohd Syuhaimi Ab. Rahman	Effectiveness Data Communication Solution For Fiber-To-Every-Office (FTEO)	Silver
9.	Kamaruzzaman Sopian, Roonak Daghig, Dr. Mohd Hafidz Ruslan, Adnan Ibrahim, Zafri Azran Abdul majid, Goh Li Jin, Mohd Huzmin Mohd Salleh <i>(In collaboration with the Solar Energy Research Institute)</i>	Multifunction Solar Assisted Heat Pump System	Silver

**Malaysia Technology Expo (MTE 2010)
4th -6th February 2010, Putra World Trade Centre (PWTC) Kuala Lumpur**

No.	Researchers	Research Title	Award
1.	Kamaruzaman Sopian, Cheow Siu Leong, Khairymazalee Yusri, Nurul Salwa, Shahrul Anizan, Mohd Khairunaz, Azimin Tazilan, Nowshad Amin, Saleem H. Zaidi <i>(In collaboration with the Solar Energy Research Institute)</i>	Back Contact Solar Cell for Shading- Screen Devices	Gold and The Best Award
2.	Mahamod bin Ismail, Dr. Keeratpat Singh, Shahrizal Sulaiman, Kasmiran Jumari, kamaruzaman Mat	Intelligent Mobile Locater "iMobiloc"	Gold



3.	<p>Kamaruzaman Sopian, Khairymazalee Yusri, Cheow Siu Leong, Nurul Salwa, Shahrul Anizan, Mohd Huzmin, Mohamad Yusof Sulaiman, Mohd Yusof Hj Othman, Azimin Tazilan, Nowshad Amin, Saleem H. Zaidi</p> <p><i>(In collaboration with the Solar Energy Research Institute)</i></p>	Multipurpose Flexible Solar Cell	Gold
4.	<p>Roszilah Hamid, Abdul Khalim Abdul Rashid, Kamarudin Mohd Yusof, Sagar Das</p>	An Intelligent Defect Identification Algorithm for Plate Structures	Silver
5.	<p>Abu Bakar Mohamad</p> <p><i>(In collaboration with the Fuel Cell Institute)</i></p>	MEA Fabrication for Fuel Cell using Casting Technique	Silver
6.	<p>Zahira Yaakob, Muhammad Ansor Nasution, Siti Kartom Kamarudin, Wan Ramli Wan Daud</p> <p><i>(In collaboration with the Fuel Cell Institute)</i></p>	Electrocoagulation System for Hydrogen Production and Palm Oil Mill Effluent Treatment	Silver
7.	<p>Siti Kartom Kamarudin, Wan Ramli Wan Daud, Zahira Yaakob, Abu Bakar Mohamad, Norhafiz Hashim, Mismisuraya Meor Ahmad, Sahriah Basri, Azran Mohd Zainoodin, Achmad Fauzie, Umi Azmah Hasran, Haslina Ahmad, Syakiroh Ismail</p> <p><i>(In collaboration with the Fuel Cell Institute)</i></p>	Direct Methanol Fuel Cell as Renewable Energy Power Resources for Small Portable Application	Silver
8.	<p>Mohd Alauddin Mohd Ali, Mohd Syuhaimi Ab. Rahman, Muhammad Rosli Abdullah</p>	Telemedicine System for On-Line medical Check-up with mobile communication support	Bronze
9.	<p>Amiruddin bin Ismail, Deprezon Syamsunur, Riza Atiq O.K Rahmat, Othman A.Karim</p>	Expert System For Highway Geometric Design (ES-HGDesign)	Bronze
10.	<p>Taib Iskandar bin Mohamad</p>	Spark Plug Fuel Injector	Bronze



11.	Ahmad Rasdan Ismail, Mohd Zaki Nuawi, Mohd Jailani Mohd Nor, Mohd Nizam Ab. Rahman, Abdul Rahim Bahari, Nur Farhana Amaruddin, Mohd Radzi Abu Mansor	ROCUVA (Real-Time Occupational Vibration Analyzer)	Bronze
12.	Zaki Nauwi	Wireless Monitoring Machining Performance Mo-Mac3	Bronze
13.	Norbahiah Misran, Mohammed Nazmus Shakib, Mohamaad Tariqul Islam <i>(In collaboration with the Science Space Institute)</i>	Stacked Folded Patch feed Antenna for Ultrawideband Application	Bronze

Research Projects 2010

Engineering & Built Environment





ScienceFund
Funded by Ministry of Science, Technology and Innovation

No.	Researcher	Research Code/Project Title	Amount Approved (RM)
1.	Prof. Dr. Azah Mohamed	03-01-02-SF0649 Grid Connected Photovoltaic Generation System With Efficient MPPT and Converter Control	177,500.00
2.	Assoc. Prof. Dr. Jaharah Bt. A Ghani	03-01-02-SF0647 Development Of Flow Cost Cutting Tool Wear Monitoring System In Machining Process	131,000.00
3.	Dr. Mandeep Singh A/L Jit Singh	01-01-02-SF0670 Development Of Tropospheric Scintillation Algorithm For Satellite Broadcast Applications	52,400.00
4.	Assoc. Prof. Dr. Ir. Zamri Chik	01-01-02-SF-0681 Development of a Wireless Network System of Electrical Conductivity for Soil Measurement	124,000.00

Brain Gain Malaysia (BGM)
Funded by Ministry of Science, Technology and Innovation

No.	Researcher	Research Code/Project Title	Amount Approved (RM)
1.	Prof. Dr. Mohd. Alauddin Bin Mohd. Ali	MOSTI/BGM/R&D/20 The Design And Fabrication Of Frid Transponder Employing IPV6 Addressing And IEEE 802.11 Standard	191,400.00
2.	Prof. Dr. Ahmad Kamal Ariffin Bin Mohd Ihsan	MOSTI/BGM/R&D/31 Fatigue crack growth simulation and safety evaluation of pressure vessel of power plant	137,000.00



**ScienceFund
Funded by Ministry of Algriculture**

No.	Researcher	Research Code/Project Title	Amount Approved (RM)
1.	Prof. Ir. Dr. Abdul Wahab Mohammad	05-01-02-SF1021 Nanofractionation of Coconut Milk for Production of Value-added Bioproduct	206,240.00

**Fundamental Research Grant Scheme (FRGS)
Funded by Ministry of Higher Education**

No.	Researcher	Research Code/Project Title	Amount Approved (RM)
1.	Assoc. Prof. Dr. Zulkifli Mohd Nopiah	UKM-KK-06-FRGS0090-2010 Classification of Fatigue Feature Segments Using Multi-Objective Evolutionary Algorithm	47,200.00
2.	Assoc Prof. Dr. Shahrum Abdullah	UKM-KK-03-FRGS0112-2010 Mechanical Joints Reliability Assessment Using Theory of Critical Distance (TCD)	44,000.00
3.	Prof. Dr. Azah Mohamed	UKM-KK-03-FRGS0111-2010 Protection Strategies of Transmission and Distribution Networks with Distributed Generation for a Self-Healing Smart Power	44,000.00
4.	Prof. Dr. Muhammad Fauzi Mohd Zain	UKM-KK-03-FRGS0113-2010 Non-Cement Concrete Composite Binder (NCCCB) from Malaysia's Industrial Byproducts and Biogenic Wastes	43,200.00
5.	Prof. Dr.-Ing. Nik Abdullah	UKM-KK-03-FRGS0114-2010 Coupled Thermo-Mechanical Analysis of Shear Localization In Bulk Metallic Glasses	40,000.00



		UKM-KK-03-FRGS0115-2010	
6.	Prof. Ir. Dr. Abdul Wahab Mohammad	Study On Mechanism of Fouling and Rejection Durig Membrane Filtration of Glycerin-Rich Solution ad their Effects on Optimum Process Performance	48,000.00
7.	Prof. Ir. Dato' Dr. Hassan Basri	Waste Bin Monitoring System Using Image Sensor through GSM and GIS	48,000.00
8.	Assoc Prof. Dr. Nurina Anuar	Penguraian AOX Secara Biologi Dari Air Sisa Industri Kertas Kitar Semula	44,000.00
9.	Assoc Prof. Dr. Shahrum Abdullah	Development of Fatigue failure Classification Index Using Statical-Based Pattern Recognition Parameters	48,000.00
10.	Assoc Prof. Dr. Siti Rozaimah Sheikh Abdullah	Determination of phytoremediation Mechanisms of Hydrocarbon from Petroleum based Industry Wastes	52,000.00
11.	Assoc. Prof. Dr. Mariyam Jameelah Ghazali	Corrosion Resistance Performance of submerged Nanostructured Ceramic Coated Metallic Components I Tropical Seawaters	40,000.00
12.	Encik Noorhisham Tan Kofli	Biosorption Mechanism for Heavy Metals Removal in Drinking Water Treatment System	40,000.00
13.	Encik Kamarulzaman Mat	Multi Access Detection (MADS) Module for Optical Signal Monitoring in Fiber-to-the Home Network	44,000.00
14.	Ms. Fazida Hanim Hashim	An Adaptive Online Algorithm for Smart Home Sequence Prediction Using Higher Order Markov Model and Probabilistic	40,000.00
15	Encik Khairul Anuar Mohd Nayan	Ground Response Analysis of Soils Column by Dynamic Loadings	44,000.00



16.	Encik Mohd Yazmil bin Md Yatim	UKM-KK-03-FRGS0125-2010 Partial Interaction in Composite Plate Girders	44,000.00
17.	Encik Shahrizan Bin Baharom	UKM-KK-03-FRGS0126-2010 Experimental Study of Composite Beams with Openings in Metal-Ribbed Decking Slab	48,000.00
18.	Ms. Wan Mimi Diyana Bt Wan Zaki	UKM-KK-03-FRGS0127-2010 A New Hybrid Framework of Differential Optical Flow and Multi-Scale Techniques for real Motion Video	52,000.00
19.	Dr. Hussain Shareef	UKM-KK-02-FRGS0193-2010 Modelling and Characterization of Harmonics from Light Emitting Diode (LED) Lighting Systems for Power Quality Improvement	47,730.00
20.	Prof. Dr. Abdul Amir H. Kadhum	UKM-KK-02-FRGS0194-2010 Phosphorus Pentasulfide as Inhibitor for Acid Medium Corrosion	49,880.00
21.	Prof. Dr. Kasmiran Jumari	UKM-KK-02-FRGS0195-2010 The Efficient Technique of New Photonic Device Study and Fabrication Through Optical Integrated Design Platform	43,860.00
22.	Prof. Dr. Rakmi Abdul Rahman	UKM-KK-02-FRGS0196-2010 Ozone Bubble Size and Resedent Time Effect on Production of Dicarboxylic Acid from Palm Oil	50,400.00
23.	Prof. Ir. Dr. Mohd Sobri Takriff	UKM-KK-02-FRGS0197-2010 Mechanism of Heat Transfer in Oscillatory Flow in Battled Column	42,140.00
24.	Assoc Prof. Dr. Dzuraidah Abd. Wahab	UKM-KK-FRGS0198-2010 Development of a Design for Remanufacturing Index for End-Of-Life Recovery of Locally Manufactured Automotive Components	55,040.00
25.	Assoc Prof. Dr. Masturah Markom	UKM-KK-FRGS0199-2010 Supercritical Anti-Solvent Particulation of Nano-Doped Titanium Dioxide for Enhanced Performance of Dye-Sensitized Solar Cell	48,590.00



		UKM-KK-FRGS0200-2010	
26.	Assoc Prof. Dr. Meor Zainal Meor Talib	Development of Model for Prediction of Fouling Index for Reverse osmosis (RO) Membrane	46,440.00
		UKM-KK-FRGS0201-2010	
27.	Dr. M.A. Hannan	New Algorithmn for Machine Model with FACTS Devices and its Controller for Limiting First Swing Stability of a Large Power System	46,010.00
		UKM-KK-FRGS-0202-2010	
28.	Assoc Prof. Dr. Mohd Nizam Ab. Rahman	Development of Green Value Chain Model in Aerospace Manufacturing Companies	38,000.00
		UKM-KK-FGRS0203-2010	
29.	Dr. Nik Lukman Nik Ibrahim	Simplified Daylighting Formulas for Taxonomies of Window Shading Elements	51,600.00
		UKM-KK-07-FRGS0217-2010	
30.	Assoc Prof. Dr. Nowshad Amin	Investigation on Novel Indium Sulfide (InS) Buffer Layer Grwon By Physical Vapor Deposition for High Efficiency CIGS Thin Film Solar Cells	76,000.00
		UKM-KK-07-FRGS0216-2010	
31.	Ms. Izzamarlina Asshaari	Development of a Pattern Recognition Algorithm for Fatigue Features Classifications	84,400.00
		UKM-KK-02-FRGS0219-2010	
32.	Dr. Rizauddin Ramli	Robust Path Generation Strategy fir 30Axis CNC Milling Machine by Genetic Algorithm	67,500.00
		UKM-KK-05-FRGS0218-2010	
33.	Ms. Nooraini Hamzah	Kajian Teori Kelewatan dan Kegagalan Pelaksanaan Projek RMK9 di bawah KPT	40,000.00
		UKMTOPDOWN-KK-02-FRGS0002-2010	
34.	Assoc Prof. Dr. Mohd. Syuhaimi	Manual Pengurusan Penyelidikan	108, 000.00



**Innovation Grant (Research University Grant)
Funded by Ministry of Higher Education**

No.	Researcher	Research Code/Project Title	Amount Approved (RM)
1.	Prof. Madya Dr. Mohd Syuhaimi Bin Ab Rahman	UKM-IF-1-10-007 Low-Cost Optical Fiber Splitter: Innovative In-Vehicle Entertainment Network and In-House Applications	75,000.00
2.	Encik Mohamad Hanif Bin Md Saad	UKM-IF-1-10-011 Intelligent Project Management System for Small and Medium Enterprise (SME)	53,000.00

**Arus Perdana (Research University Grant)
Funded by Ministry of Higher Education**

No.	Researcher	Research Code/Project Title	Amount Approved (RM)
1.	Prof. Dr. Andanastuti Muchtar	UKM-AP-NBT-14-2010 Development of Nanostructured Materials for Dental Applications	350,000.00
2.	Prof. Ir. Dr. Mohd. Marzuki Bin Mustafa	UKM-AP-PI-13-2010 Zero Waste Palm Oil Mill-Carbon Sink Technology	350,000.00
3.	Prof. Dr. Muhammad Fauzi Bin Hj. Mohd. Zain	UKM-AP-TK-06-2010 Advanced Flexible Façade System for Low Energy and Intelligent Building	300,000.00
4.	Assoc Prof. Dr. Md. Mamun Bin Ibne Reaz	UKM-AP-ICT-20-2010 A Smart FRID System for e-Health and e-Commerce related Applications employing IPv6 and IEEE 802.11 protocol	340,000.00

**Geran Galakan Penyelidikan Universiti-Industri (Research University Grant)
Funded by Ministry of Higher Education**

No.	Researcher	Research Code/Project Title	Amount Approved (RM)
1.	Asoc Prof. Dr. Zahira Binti Yaakob	UKM-HEJIM-INDUSTRI-02-2010 Penghasilan Biofuel terbaharu dari Jatropha Curcas L	10,000.00



2.	Dr. Siti Aminah Bt. Osman	UKM-HEJIM-INDUSTRI-07-2010	35,000.00
		Development of A New Isolation System for Vibration Control of Cable-Stayed Bridges under Dynamic and Seismic Loading	
3.	Prof. Dato' Ir. Dr.Hassan Basri	UKM-HEJIM-INDUSTRI-08-2010	60,000.00
		Renewable Energy from UKM's Solid Waste: Anaerobic Treatment of Organic waste Component to Produce Bio Gas and Generate Electricity for the university campus	
4.	Dr. Nangkula Utaberta	UKM-HEJIM-INDUSTRI-09-2010	30, 000.00
		Growing and tranformable steel house: evaluating the use of steel as flexible structural framework of terrace housing design in Malaysia	
5.	Prof. Dr. Abu Bakar Bin Mohamad	UKM-HEJIM-INDUSTRI-20-2010	30, 000.00
		Rawatan air sisa industri kertas kitar semula menggunakan biologi	
6.	Assoc Prof. Dr.Mohd Syuhaimi Bin Ab Rahman	UKM-HEJIM-INDUSTRI-21-2010	30, 000.00
		Development of virtual optoelectronic design platform - towards the efficient process of optical and optoelectronic device fabrication	
7.	Assoc Prof. Dr.Nurina Bt. Anuar	UKM-HEJIM-INDUSTRI-22-2010	30, 000.00
		Development of chemically defined serum free media for mamalian cell cultivation in biopharma industry	
8.	Assoc Prof. Dr. Siti Rozaimah Bt. Sheikh Abdullah	UKM-HEJIM-INDUSTRI-23-2010	30, 000.00
		Biopolishing of final palm oil mill effluent to meet discharge standard	

**Geran Galakan Penyelidikan Universiti-Komuniti (Research University Grant)
Funded by Ministry of Higher Education**

No.	Researcher	Research Code/Project Title	Amount Approved (RM)
1.	Dr. Nasharuddin Bin Zainal	UKM-HEJIM-KOMUNITI-05-2010 Pembangunan Modul pembelajaran Mikropengawal kepada Pelajar-Pelajar Sekolah Menengah	25,000.00



2.	Prof. Dr. Rakmi Bt. Abd. Rahman	UKM-HEJIM-KOMUNITI-18-2010 Pengkomposan Sisa di Pasar Besar Kajang oleh MPKJ	25, 000.00
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**Geran Penyelidikan Tindakan Strategik (Research University Grant)
Funded by Ministry of Higher Education**

No.	Researcher	Research Code/Project Title	Amount Approved (RM)
1.	Assoc Prof. Dr. Dzuraidah Binti Abd. Wahab	UKM-PTS-001-2010 Keberkesanan Penaksiran Melalui Peperiksaan Dalam Pembuktian Pencapaian Hasil Pembelajaran Program Kejuruteraan Mekanikal	7,000.00
2.	Prof. Dr. Ja' Afar Bin Sahari @ Shaari	UKM-PTS-002-2010 Penilaian "Engineering Common Sense" Di Kalangan Pelajar Prasiswazah Kejuruteraan Mekanikal	7,500.00
3.	Assoc Prof. Dr. (Ph.D) Hafizah Bt. Husain	UKM-PTS-003-2010 Memperkasa Integriti Mahasiswa: Penambahbaikan Kualiti Berterusan Sistem Pengukuran Kemahiran Generik (SPKG) UKM	7,140.00
4.	Dr. Nangkula Utaberta	UKM-PTS-004-2010 Evaluating Critique Session As An Assessment Tool In Architecture A Casa Study Analysis 2nd Year Studio At Architecture Department Of UKM	14,200.00
5.	Assoc Prof. Dr. Siti Rozaimah Bt. Sheikh Abdullah	UKM-PTS-005-2010 Pemantapan Profesionalisme Jurutera Proses Melalui Projek Bersepadu (Open Biding)	14,280.00
6.	Ms. Hamimi Fadziati Binti Abdul Wahab	UKM-PTS-006-2010 Kesarjanaan Pengajaran Dan Pembelajaran: Penambahbaikan Kualiti Berterusan Kaedah Pengukuran & Penilaian	7,140.00
7.	Assoc Prof. Dr. Zulkifli Bin Mohd Nopiah	UKM-PTS-007-2010 Enhancing The Teaching And Learning Process In Engineering Mathematics Course Through Cooperative Learning Problem-Based Learning	14,290.00
8.	Assoc Prof. Ir. Dr. Zamri Bin Chik	UKM-PTS-008-2010 Kebolehpasaran Dan Pencapaian OBE Bagi Graduan Program Jabatan Kejuruteraan Awam & Struktur, FKAB	14,280.00



9.	Prof. Dr. Ahmad Kamal Ariffin Bin Mohd Ihsan	UKM-PTS-009-2010 Beban Notional Ahli Akademik Terhadap Proses P&P Dan Penyelidikan	14, 200.00
10.	Prof. Dr. Azami Bin Zaharim	UKM-PTS-010-2010 Penambahbaikan Kualiti Berterusan (CQ) Ke Atas Pengukuhan Inovasi Pengajaran Dan Pembelajaran Bagi Tujuan Akreditasi Di FKAB	300, 000.00
11.	Assoc Prof. Dr. Mohd Syuhaimi Bin Ab Rahman	UKM-PTS-082-2010 Strategi Memperkasakan Penyelidikan Jalur Lebar Ke Arah Mempromosikan UKM Ke Peringkat Global Produk-Produk UKM - Dasar Pandang Ke China	25,000.00
12.	Dr. Norngainy Binti Mohd Tawil	UKM-PTS-083-2010 The Development Of New System For Commercial Housing Affordability And Sustainability (CHAS) In Malaysia	25, 000.00
13.	Sr. Dr. Adi Irfan Bin Che Ani	UKM-PTS-084-2010 The Development Of Green Campus Index (GCI) As A Green Rating Tool For Assessing The Performance Of Sustainable Campus	30, 000.00
14.	Assoc Prof. Dr. Shahrum Bin Abdullah	UKM-PTS-085-2010 Integration Of Intercultural Personality Study For Engineering Student Mobility Between UKM-UDE	85, 000.00
15.	Ms. Shahrom Binti Md Zain	UKM-PTS-096-2010 Keberkesanan Aktiviti Kitar Semula di UKM	60, 000.00
16.	Ms. Irfana Binti Kabir Ahmad	UKM-PTS-097-2010 Development Of A Prototype Automated Soting System For Municipal Solid Waste Using Electrical Capacitance Volume Tomography System (ECVT)	35, 000.00
17.	Dr. Edgar Scavino @ Omar Edgar	UKM-PTS-099-2010 Development Of A Smart Remote Vision System For The Identification Of Security Breaches In UKM Laboratories	25, 000.00
18.	Prof. Ir. Dr. Riza Atiq Abdullah Ok Rahmat	UKM-PTS-100-2010 Pemantauan Dan Penambahbaikan Projek-Projek PTS Di UKM	86, 000.00

**Geran Pemacu (Research University Grant)
Funded by Ministry of Higher Education**

No.	Researcher	Research Code/Project Title	Amount Approved (RM)
1.	Prof. Dato' Dr. Kamaruzzaman Sopian	UKM-GPP-PPKK-5-2010 Development of Strategies for The Applications of Renewable Energy in The Organisation Islamic Conference (OIC) Countries	130, 000.00
2.	Prof. Ir. Dr. Riza Atiq Abdullah Bin O.K. Rahmat	UKM-GPP-PPKK-6-2010 Pemantapan Pengajaran dan Pembelajaran UKM Pasca 40 Tahun	40, 200.00

Funded by External Agencies or Internal Funds

No.	Researcher	Research Code/Project Title	Source of Funding	Amount Approved (RM)
1.	Prof. Madya Dr. Noor Ezlin Ahmad Basri	PKT4/2010 Research on Household Waste Arisings in Malaysia	National Institute for Environmental Studies, Onogawa Tsukuba, Japan	19,000.00
2.	Dr. Adi Irfan Bin Che Ani	PKT3/2010 Pembangunan Sistem Pemeriksaan Dan Laporan Keadaan Bangunan (Build-Ir)	Program Penyelidikan Geran MIDA/ISM 2010 (Pertubuhan Juruukur Malaysia)	60, 000.00
3.	Prof. Madya Dr. Andanastuti Muchtar	PKT2/2010 The Establishment of UKMInternational Office at UDE and Network Extension of UKM-UDE Double Degree Programme	Duisburg Essen University	150,000.00
4.	Dr. Mandeep Singh Jit Singh	PKT1/2010 Performance and Reliability of radio Frequency Identification (RFID)	Senstech Sdn. Bhd.	250,000.00
5.	Assoc Prof. Dr. Noor Ezlin Bt. Ahmad Basri	UKM-HEJIM(KM)-CIMB-03/2010 Promoting Green Lifestyle to UKM Community	CIMB	217,590.00



6.	Ar. Nurakmal Abdullah @ Goh Tuo Ho	UKM-PERMATA-4-2010 Kesan Pembangunan Persekitaran Luar Bilik Darjah Berasaskan Ekosistem Seimbang ke atas Kesejahteraan Pelajar Pintar Cerdas	650,000.00
7.	Encik Mazlan Bin Mohd Tahir	UKM-PERMATA-6-2010 Kepuasan Pelajar Terhadap Penggunaan Perpustakaan dan Sistem Bersepadu Kompleks PERMATApintar Negara	227,710.00
8.	Dr. Rizauddin Bin Ramli	UKM-PERMATA-11-2010 Perkembangan Kreativiti dan Inovasi Pelajar Pintar Cerdas melalui Teknologi	958,400.00



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Tel : 603-8921 6451 / 6454

Fax : 603-8925 2546

E-mail : pghpkt@vlsi.eng.ukm.my