# INNOVATIVE SOLUTIONS FOR ENGINEERING AND TECHNOLOGY CHALLENGES

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*Innovative Solutions for Engineering and Technology Challenges*

**Innovative Solutions for Engineering and Technology Challenges**

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### Abstract

This paper outlines the methodology in modelling the hydrological processes involving a novel product innovated by UNIMAS researchers, named StormPav. This product is meant as permeable pavement with a function of on-site stormwater detention. The features of StormPav are unique of other products available in the market. Using a well-known freeware - USEPA's SWMM software, this author explores the possibility to represent the product in SWMM, and subsequently presents an initial hydrological modelling to aid the design of the prototype.

## REVIEW IN FORMULATING THE STANDARD FORM OF CONTRACT FOR INDUSTRIALIZED BUILDING SYSTEM (IBS) CONSTRUCTION APPROACH IN MALAYSIA.

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### Abstract

Industrialised Building System (IBS) is the common term used to represent the prefabrication concept in Malaysia. Based on previous research being done locally and internationally, it is certain that using IBS offers huge benefits in terms of cost, time, productivity and quality. The Malaysian construction industry has been urged to use innovative construction techniques. It is being highlighted under the present Construction Industry Transformation Programme 2016 - 2020 (CITP). These initiatives illustrate the Malaysia government's commitment in addressing the IBS agenda. Although some efforts have been taken to enhance the IBS adoption in Malaysia, various contract issues have emerged to become major concern amongst the IBS players that have led to delays, disputes, payment and cash flow issues in their projects. Formulating a dedicated standard form of contract for IBS construction approach is necessary to address the concerns. Therefore, the aim of the main research is to formulate the standard form of contract for IBS projects that will assist authorities and IBS industry players in mitigating the issues and challenges from the contractual perspectives. However, this paper will only present the literature reviews and findings from a preliminary survey conducted to establish pertinent contractual issues and challenges on the subject matter.

# ENGINEERING BEHAVIOR OF CONCRETE WITH RECYCLED AGGREGATE

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## Abstract

Concrete is extensively used as construction materials in Malaysia. Concrete contributes suitable feature for construction industry for instance durability, adequate compressive strength, fire resistance, availability and is economic as compared to other construction materials. Depletion of natural resources and disposal of construction and demolition waste remarkably claim environmental threat. In this paper, the engineering behavior, durability, and concrete microstructure of recycled concrete aggregates (RCA) on short-term concrete properties were investigated. The studied concrete at design mix proportion of 1:0.55:2.14:2.61 (weight of cement: coarse aggregates :sand :water) used to obtain medium-high compressive strength with 20%, 50%, and 100% of RCA. Results show that for the same water/cement ratio, RCA replacement up to 50% still achieved the targeted compressive strength of 25 MPa at 28 curing days. Addition, at similar RCA replacement, the highest carbonation depth value was found at 1.03 mm which could be attributed to the pozzolanic reaction, thus led to lower carbonation resistance. Scanning electron microscopy microstructure shows that the RCA surface was porous and covered with loose particles. Moreover, the interfacial transition zone was composed of numerous small pores, micro cracks, and fissures that surround the mortar matrix. On the basis of the obtained results, recommendable mineral admixtures of RCA are necessary to enhance the quality of concrete construction.

# STUDY ON CONCRETE CONTAINING RECYCLED AGGREGATES IMMERSED IN EPOXY RESIN

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## Abstract

In recent decades, engineers have sought a more sustainable method to dispose of concrete construction and demolition waste. One solution is to crush this waste concrete into a usable gradation for new concrete mixes. This not only reduces the amount of waste entering landfills but also alleviates the burden on existing sources of quality natural concrete aggregates. There are too many kinds of waste but here constructions waste will be the priority target that should be solved. It could be managed by several ways such as recycling and reusing the concrete components, and the best choice of these components is the aggregate, because of the ease process of recycle it. In addition, recycled aggregates and normal aggregates were immersed in epoxy resin and put in

concrete mixtures with 0%, 5%, 10% and 20% which affected the concrete mixtures properties. The strength of the concrete for both normal and recycled aggregates has increased after immersed the aggregates in epoxy resin. The percentage of water absorption and the coefficient of water permeability decreased with the increasing of the normal and the recycled aggregates immersed in epoxy resin. Generally the tests which have been conducted to the concrete mixtures have a significant results after using the epoxy resin with both normal and recycled aggregates.

Keywords: *Recycled aggregate, normal aggregate, epoxy resin*

## Paper No: EC070

### THE EFFECT OF BINDER AND WASTE GRANULAR MATERIALS ON THE SHEAR STRENGTH AND SHEAR RESISTANCE OF DREDGED MARINE SOILS

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### Abstract

Dredged marine soil (DMS) is considered as weak and soft problematic soil. It is possible to give this type of soil a second life if only its geotechnical properties are improved. Infusing soil with solidification agent is the common practice of soil improvement. This study uses binder and waste granular material (WGM) such as cement, bottom ash (BA) and palm oil clinker (POC). The aforementioned materials are capable to fortify the poor features of the soil. Series numbers of soil bed samples were tested for its shear strength and shear resistance. Test results show that the mentioned soil parameters were corresponded with each other. In short, geo-waste and biomass materials are possible to be reused instead of being discarded.

Keywords: *Dredge marine soil, bottom ash, palm oil clinker, shear strength, shear resistance*

## Paper No: EC071

### CONSOLIDATION OF DREDGED MARINE SOILS WITH SINGLE AND DOUBLED DRAINAGE

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### Abstract

Large volume of dredged marine soils (DMS) were produced in Malaysian waters during construction or maintenance the port structures. DMS have poor engineering properties and consider as geo-waste materials. The samples were essentially high water content, limited strength and excessive compressibility. The main purpose of this study was to examine the suitability and effectiveness of DMS compressibility characteristics of DMS with different type of drainage (singly and doubly). It shows that the doubly drained can hasten the consolidation than single drainage. Dredged marine soil was remoulded at high water content and allowed to settle. Thus, the settlement of soil particles along the column can be expected.

# AN EVALUATION OF SIGNAL METERING APPLICATION TO MITIGATE ROUNDABOUT'S UNBALANCED FLOW CONDITIONS: A CASE STUDY IN KUCHING

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## Abstract

Signal metering is usually used to reduce the impacts of dominant flow at roundabouts. While some roundabouts in Kuching are experiencing this phenomenon, signal metering strategy has not been deployed to mitigate this problem. This study aims to evaluate the impacts of signal metering in improving the problematic roundabout's performance due to unbalanced flow condition. A case study was conducted at a selected roundabout in Kuching to examine the impacts of signal metering strategy on the roundabout capacity. The data was analysed by using SIDRA Intersection 4.0 by which the results before (base condition) and after the implementation of signal metering strategy were compared. The results indicated that use of signal metering has a significant impacts in improving the capacities and the queue lengths of the controlling approach ($t(6) = 3.610$, $p = 0.011 < 0.05$). However, due to excessive traffic flow demands occurred at roundabout for the time intervals studied, the application of signal metering system yielded negative benefits for the metered approach and worsen the overall performance of the studied roundabout. The results provide good insights on the application of signal metering to improve roundabout performance due to unbalanced flow conditions provided that the traffic demands do not exceed the recommended range for an effective application.

Keywords: *roundabout capacity, unbalanced flow pattern, signal metering, queue length, average delay*

# 1D COMPRESSIBILITY OF DMS TREATED WITH CEMENT-GGBS BLEND

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## Abstract

Great quantities of dredged marine soils (DMS) have been produced from the maintenance of channels, anchorages and for harbour development. DMS have the potential to pose ecological and human health risks and it is also considered as a geowaste. Malaysia is moving towards the sustainability approach and one of the key factors to achieve it is to reduce waste. Thus, this geowaste should be generated as a new resource to substitute soil for civil works such as for land reclamation and backfilling. This shows the improved settlement of consolidation in treated DMS. DMS is referred to as a cohesive soil which includes clayey silt, sandy clay, silty clay and organic clay. This type of soil has low strength and high compressibility. The objectives were achieved through literature review analysis and also laboratory test which was one dimensional oedometer test. On the other hand, treated DMS with more ground granulated blast furnace slag (GGBS) gives a lower settlement compared to specimen with higher percentage of cement in a treated soil. Thus, this shows that cement content can be reduced in soil solidification when GGBS is added. The optimum binder ratio found was 3:7 where 3 is cement and 7 is GGBS.

## SUITABILITY OF COCONUT SHELL CONCRETE FOR PRECAST COOL WALL PANEL – A REVIEW

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### Abstract

The cost for producing concrete has been increasing steadily. Therefore, the demand for using agricultural waste as a replacement or admixture inside concrete is also increasing gradually. Many researchers are doing research on agricultural waste such as palm oil, corn cobs, rice husks and coconut shells. Agricultural waste is increasingly being utilized in cement, concrete and other construction materials and provides numerous indirect benefits such as reduction in land fill cost, saving energy and protecting the environment from possible pollution. The aim is to produce concrete with improved properties at a lower cost and to maintain environmental sustainability. In this review paper, the suitability of coconut shell for concrete cool wall panels will be the main focus. Coconut shells can be used as aggregates in concrete. The characteristic properties of coconut shell concrete such as workability, bulk density, compressive strength, flexural tensile, water absorption and thermal performance were reviewed in this paper. This paper attempts to answer whether coconut shell is suitable to be used in concrete to produce a concrete cool wall panel in order to reduce heat transfer inside a building.

## TRMM SATELLITE ALGORITHM ESTIMATES TO REPRESENT THE SPATIAL DISTRIBUTION OF RAINSTORMS

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### Abstract

On-site measurements from rain gauge provide important information for the design, construction, and operation of water resources engineering projects, groundwater potentials, and the water supply and irrigation systems. A dense gauging network is needed to accurately characterize the variation of rainfall over a region, unfitting for conditions with limited networks, such as in Sarawak, Malaysia. Hence, satellite-based algorithm estimates are introduced as an innovative solution to these challenges. With accessibility to dataset retrievals from public domain websites, it has become a useful source to measure rainfall for a wider coverage area at finer temporal resolution. This paper aims to investigate the rainfall estimates prepared by Tropical Rainfall Measuring Mission (TRMM) to explain whether it is suitable to represent the distribution of extreme rainfall in Sungai Sarawak Basin. Based on the findings, more uniform correlations for the investigated storms can be observed for low to medium altitude (>40 MASL). It is found for the investigated events of Jan 05-11, 2009: the normalized root mean square error (NRMSE = 36.7 %); and good correlation (CC = 0.9). These findings suggest that satellite algorithm estimations from TRMM are suitable to represent the spatial distribution of extreme rainfall.

# A COMPREHENSIVE REVIEW ON THE EFFECTIVENESS OF EXISTING NOISE BARRIERS COMMONLY USED IN THE RAILWAY INDUSTRY

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## Abstract

Nowadays, advanced development and sophisticated new technology have led to various types of environmental pollution such as water, air, land, thermal pollution and so on. Recently, however, noise pollution is becoming one of the major threats to the world especially in urban areas where it adversely affects the quality of life of the public. In Malaysia, the Department of Environment has identified that the average transportation noise levels in major cities in peninsular Malaysia are 71.6 dB (A) and 70.4 dB (A) during the day and night respectively. The noise is usually emitted by airplanes, trains, vehicles, motorcycles, trucks and etc. Even though rail transport requires less energy and emits less hazardous substances, it has contributed to noise pollution issues and several health hazards among urban inhabitants such as deafness, nervous breakdowns, mental disorder, heart troubles, high blood pressure, headaches, dizziness, inefficiency and insomnia. Therefore, many studies attempt to reduce noise pollution by applying noise barriers at noise polluted areas via various approaches. This paper aims to explore the effectiveness of noise barriers using noise absorption performance due to several factors such as type of absorbent materials, material thickness, density, porosity and design. This research has found that the thicker the specimen and the denser the absorbent material, the better the sound absorption performance. Besides that, barrier design also plays a major role in determining its effectiveness, where the effectiveness of noise barriers should be high and long enough to break the line-of-sight between the sound source and the receiver. There are several methods that can be used to measure the effectiveness of noise barriers such as the Adrienne Method (in-situ measurement method) and impedance tube method (laboratory measurement method) to measure the acoustic absorption. Nevertheless, the impedance tube measurement method provides the most precise results with the least measurement uncertainty as it only required small samples of the material.

# ESTIMATION OF SHEAR WAVE VELOCITY USING 1-D MULTICHANNEL ANALYSIS OF SURFACE WAVES (MASW) AND SHEAR MODULUS OF PEAT

Kasbi Basri[1], Adnan Zainorabidin[2], Mohd Idrus Mohd Masirin[3], Mohd Jazlan Mohd Said[4] and Mohamad Niizar Abdurahman[5]

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## Abstract

In geotechnical earthquake engineering problems, dynamic soil properties determination is a critical task. Shear wave velocity (Vs), and shear modulus (G) are fragments of dynamic soil properties. This study focused

on the peat shear wave velocity determination using 1-D multichannel analysis of surface waves, the in-situ density using the peat sampler and the shear modulus estimation using empirical formula. The study was conducted at Parit Nipah, Johore and Penor, Pahang as it contains a large composition of peat. The result of the study indicates that, the peat shear wave velocity ranged from 30.4 m/s to 43.8 m/s for Parit Nipah and 43.4 m/s to 105.8 m/s for Penor. While the peat density ranged from 1.00 g/cm$^3$. to 1.24 g/cm$^3$. for Parit Nipah and 0.72 to 1.36 g/cm$^3$. for Penor. The peat shear modulus, Gmax for Parit Nipah ranged from 736.0 kPa to 2589.6 kPa and 1474.7 kPa to 11265.0 kPa for Penor. The results indicate that the peat shear wave velocity was affected by the changes in peat soil density, while the peat density was governed by the depth. The peat shear modulus value was directly proportional to the peat shear wave velocity. Finally, the slight variation in results obtained might be due to the heterogeneity of peat.

**Paper No: EC095**

# CONCEPTUAL MODEL FOR SYSTEMATIC CONSTRUCTION WASTE MANAGEMENT

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## Abstract

Development of the construction industry generated construction waste which can contribute towards environmental issues. Weaknesses of compliance in construction waste management especially in construction site have also contributed to the big issues of waste generated in landfills and illegal dumping area. This gives sign that construction projects are needed a systematic construction waste management. To date, a comprehensive criteria of construction waste management, particularly for construction project in developing countries such as Malaysia is still not systematically defined. Therefore, construction waste management needs further investigation. This paper aims to explain a concept model for systematic construction waste management in the Malaysian construction industry. The methodology of this paper is through literature and previous research focusing on current practices of construction waste management, the barriers of construction waste management implementation and the additional factor for implementing systematic construction waste management in order to develop a conceptual model. Findings from this study will help to find out the elements required to implement systematic construction waste management in Malaysian construction industry. This action seems significant to the participants in prioritizing construction waste management more systematically. The implementation also will increase the awareness and better understanding of the construction players of the importance of construction waste management in construction projects.

# BIOCLIMATIC HOME COOLING DESIGN FOR ACCEPTABLE THERMAL COMFORT IN MALAYSIAN CLIMATE

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## Abstract

This study investigates the applicability of hydronic radiant cooling system charged with night cooled water in combination with Earth Tube Heat Exchanger (ETHE) to cool down a residential building in Malaysia. Through the use of building simulation program it is possible to design an environmentally friendly or bioclimatic building where sustainability has become crucial element in building development. The hybrid system takes advantage of the readily available heat sink source such as the night sky and cooler ground to passively cool down a residential building. The annual simulation using Energy Plus program shows that 95% of the time the building occupant could expect an indoor operative temperature of not more than 28.5°C . The hybrid system was able to meet the thermal comfort standard set by ASHRAE Standard 55 and ISO 7730. The hybrid system was also able to improve the base case operative temperature of 33.5°C to 28.5°C. Simulation on energy spent shows that as much as 95% energy could be saved by using the hybrid system. This level of saving is not impossible as renewable night cooled chill water was used to charge the indoor radiant cooling system in place of an energy guzzling air conditioning compressors.

# THE EFFECTIVENESS EM MUDBALL AND BANANA PEELS FOR TEXTILE WASTEWATER TREATMENT

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## Abstract

Textile industrial activities known as a higher consumer of water that involved several processed daily to maintain the quality of fabric that contribute to the water pollution. Wastewater produced from the textiles could lead to the presence of heavy metal contaminant. Meanwhile, heavy metal is one of the contaminants in wastewater and must be overcome with the appropriate treatment process. To overcome the heavy metal issue, the absorption method by organic waste could be used. Effective microorganism (EM) mudballs and banana peels is a method for threating wastewater quality from textiles effluent. EM is a medium that is able to improve water quality without altering the design area while the banana peels act as a nutrient to microorganism growth and have a potential to removed heavy metal contaminant that produced from textiles wastewater. Method that used to carry out this study are through the laboratory experimental for all consider parameters. The result was obtained shows that EM mudball itself are capable to reduce the concentration of BOD and COD as much as 84% for BOD with the value reduced to 37 mg/L and 90% for COD with the value reduced to 89 mg/L. The effectiveness of banana peels added to the EM mudball could be seen by the 70% of banana peels are well mixed with the EM mudball have the potential to reduce the concentration of BOD, COD and heavy metal contaminant in textiles wastewater as much as 81% for BOD (43 mg/L), 90% of COD (87 mg/L), and 86% of Zink ($Zn^{2+}$) with the value is 0.065 mg/L. From the comparison of result with the standard.

## OIL AND GREASE (O&G) REMOVAL FROM COMMERCIAL KITCHEN WASTE WATER USING CARBONISED GRASS AS A KEY MEDIA

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### Abstract

Oil and grease (O&G) are usually found in kitchen waste water. O&G are poorly soluble in water and can cause serious problems during the wastewater treatment. Adsorption is a fundamental process in the treatment of kitchen waste water and very economical. Activated carbon is the most effective adsorbent for this application. Therefore, the aim of the current study is to determine the potential of four materials (i.e. sand, gravel, carbonised grass (CG) and clay powder) as filter media for O&G removal. The CGs were originated from "Elephant Grass" and it is a fast growing plant with significant potential as carbon. The clay acts as a magnet, drawing the oil molecules out of the water and causing them to attach to the surfaces of the clay. In the current study, two filters were developed with different media materials to get the best percentage removal. Filters 1 and 2 were filled with sand, gravel and CG, and sand, gravel, CG and powder clay, respectively. Three samples were taken during peak hour between April and May 2016. The initial O&G concentration varied from 101.37 mg/l to 248.30 mg/l and the final concentration varied from none to 22.57 mg/l for both filters. The percentage removal (%) of O&G were between 90.9 and 97.3 (Filter 1) and between 94.3 and 100 (Filter 2). Overall, both filters could efficiently remove O&G in the waste water and the quality of the carbonised grass proved to be as good as carbon produced from other traditional sources.

## CRITICAL FACTORS IN SECURING FINANCE FOR PFI PROJECTS IN MALAYSIA

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### Abstract

The Private Finance Initiative (PFI) is seen as an alternative procurement method for developing public infrastructure projects. The PFI scheme requires the private sector investment in public infrastructure projects. The private sector faces challenges in securing capital, and fulfilling financial requirements with attractive terms and conditions, which are cost-effective. This paper aims to explore the sources of financing available for PFI projects and to understand critical factors affecting financing requirements for PFI projects in Malaysia. Structured questionnaires were distributed to licensed financial institutions in Malaysia. The results show that the two financing options available in Malaysia are conventional and Islamic financing, and most financing facilities offered are term loan and Istina respectively. The analysis indicates that project risks, project viability, and the company's financial strength are among the most critical factors that the financiers consider before granting any financing for the PFI projects. The findings may be valuable to the PFI key players, particularly in enhancing ways to securing finances.

## PRODUCTION AND CHARACTERISATION OF ULTRAFINE SIZE PALM OIL FUEL ASH (POFA) ORIGINATED FROM BAU, LUNDU PALM OIL MILL

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### Abstract

This paper presents the production and characterisation of ultrafine size palm oil fuel ash (POFA) from Bau, Lundu. A laboratory scale production by using electric powder grinder has been carried out. The raw POFA obtained from the palm oil mill was first grinded by using Los Angeles abrasion machine, then POFA is sieved using 150 µm sieve before burning in furnace at 500ºC. The burned POFA was then grinded by using electric powder grinder to obtain the ultrafine sized. The characterisation of ultrafine sized POFA in the form of cement paste were analysed through several experiments such as Particle Size Analyzer (PSA), nitrogen sorption by using BET method, Fourier Transform Infrared Spectroscopy (FT-IR) and Scanning Electron Microscopy (SEM) with Energy Dispersive Spectroscopy (EDS).

Keywords: *production, characterisation, ultrafine size palm oil fuel ash (POFA)*

## A REVIEW ON IMPLICATION OF MATERIAL MANAGEMENT TO PROJECT PERFORMANCE

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### Abstract

Material management is an important element in project management as materials contribute a major portion to total project cost. It also plays a key role because of the successes of every construction project rely on having proper resources. Thus, it gives implication on project performance. Despite the importance of material management to project performance, there are limited numbers of research available related to this topic. Therefore, the aim of this paper is to identify the effects factors of material management on project performance. Literature from books, journal articles and conferences papers related to this topic are reviewed. In conclusion, exploring the implication of material management towards project performance will benefit construction players in improving the efficiency of material management in order to minimize the impacts on construction projects performance.

## SCREENING OF GEOMECHANICAL RISKS FOR MALAYSIAN DEVELOPMENT FIELD

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### Abstract

Deeper drilling and exploitation of difficult reservoir is the new trend in oil and gas industry. Geomechanics study has, therefore, become a new requirement particularly for oil and gas field development. However, a complete geomechanics study is limited with the number of experts, time consuming and not a straightforward task. Therefore, there is an urgent need of a quick geomechanics screening criterion to be used as a standard guideline to evaluate the high level geomechanical risks and suitable analysis can be recommended for the identified development fields. The aim of this paper is to propose a screening criterion for geomechanical risks study based on four key parameters, drilling, depletion, injection and storage and sand production. The screening approach is designed based on Risk Assessment Matrix (RAM) risk screening where the likelihood is based on a set of scores developed to specific questions. The consequence for each failure scenarios is assessed based on educated estimation of the impact towards people, asset, environment and reputation. Recommendations for geomechanical study are made based on the severity of each failure category on the RAM risk matrix. Fourteen development fields in offshore Peninsular Malaysia, offshore Sarawak and offshore Sabah are selected for the assessment. Based on results, fields in offshore Sarawak and Sabah have higher potential for geomechanical issues mainly because of their geological settings and formation characteristics. A set of geomechanical study is proposed for each individual field for prudent management of potential geomechanics risk associated with the depletion and EOR injection scheme planned for the fields.

## EFFECTIVENESS OF MANGROVE FOREST AS COASTAL PROTECTION ALONG THE WEST COAST OF NORTHERN PENINSULAR MALAYSIA

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### Abstract

The effectiveness of mangrove forest as coastal protection was evidenced during Indian Ocean Tsunami (IOT) on 24th December 2004. This paper presents the assessment on the characteristics and distribution of the mangrove forest along three northern states (Perlis, Kedah and Perak) affected by IOT 2004. At each site, the characteristics of individual tree were recorded including their species, height and diameter at breast height (DBH). A total of 52 matured trees were sampled that encompassing four species; A. marina (n=21), A. alba (n=7), R. mucronata (n=20) and R. apiculata (n=4) were found with A. marina as the dominant species. The zonation of mangrove forest along the northern states revealed that Avicenniacea inhabits the frontal area. The field survey also discovered that mangrove forest along the states was generally insufficient to protect the coastal area from future tsunami. There were several rehabilitation programs that had been implemented, but not all replanting efforts were successful. Outcomes from this research provided invaluable findings for the optimum replanting scheme to ensure acceptable level of protection along Malaysia's coastline.

# APPLICATION ON BUILDING INFORMATION MODELLING (BIM) IN DESIGN AND BUILD (D&B) PROJECTS IN MALAYSIA

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## Abstract

Design and Build (D&B) is one of the most suitable type of project delivery method that being used in implementing BIM. However, there is a lack of documented evidence to show on how BIM is being implemented in D&B project. This paper is aimed to explore on the current practices of BIM in D&B projects in the Malaysian construction industry. A literature review was done to explore on application on BIM in construction projects and D&B project concept. Furthermore, semi-structured interviews with construction players were conducted as a primary data for this paper. The interviews were conducted with construction players that currently involved and have experienced in D&B BIM projects. Findings for this paper revealed that the process of BIM in D&B projects is much similar with activities in D&B conventional project. The differences were by the used of BIM software, the process of developing project design into a 3D model and the involvement of BIM related designation in the project. In addition to that, the process of BIM in D&B has been highlighted in this paper.

Keywords: *Building Information Modelling (BIM), Design and Build (D&B), Current Practices, BIM Uses, Construction Players, Malaysia*

# GLOBAL WARMING POTENTIAL OF A RESIDENTIAL BUILDING CONSTRUCTION IN MALAYSIA USING THE LIFE CYCLE ASSESSMENT (LCA) APPROACH

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## Abstract

Building industry consumes substantial natural resources and produces considerable greenhouse gas emission. This paper presents a life cycle assessment approach to assess global warming potential (GWP) of a residential building in Malaysia. The results show that building element that uses a cement-based material such as concrete contributed the highest GWP in comparison to other materials. In the construction phase, temporary timber formwork has the highest GWP. The results also show that the semi-detached house has higher GWP per m2 compared to flats. The findings from this research can serve as the benchmark for LCA for buildings in Malaysia.

# DIMENSIONALITY ANALYSIS OF TECHNICAL COMPETENCY FOR MALAYSIAN CONSTRUCTION MANAGERS

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## Abstract

Gap has been found regarding the provision slated for construction managers in Malaysia's construction industry. Non-existence of term of reference for construction manager's competency profile are dictated as a major hindrance. Therefore, a comprehensive research was dedicated to unfold the rudimentary by focusing on their technical competency as a central phenomenon. In this instalment, further deliberation will emphasise on the subsequent works which leads to establishment of technical competency of construction manager (TCCM). Here the question of 'How?' lingered to the authors, especially when 'dimension' is being considered. Therefore, the authors only reported on the issue of dimensionality in this paper through analysis by using Rasch model since it is the utmost concerned for prior central phenomenon in hand. In short, interestingly, Rasch analysis outlaid quite different perspective especially on items PR9 (Knowledge of Lean Construction), PR8 (Knowledge of Constructability), and PR7 (Knowledge of Value Engineering). Those items represent the current knowledge on construction concepts which considered important to be equipped by the construction manager. Finally, the authors posited that all items were to be retained until further analysis of significance are conducted through classical test theory, in order to confirm the removal of construction managers' technical competency item(s).

Keywords: *dimensionality analysis, Rasch model, technical competency, construction manager*

# WORKABILITY AND COMPRESSIVE STRENGTH FOR CONCRETE WITH COCONUT SHELL AGGREGATE

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## Abstract

This study was conducted to investigate the compressive strength and workability of concrete added with coconut shells. Comparisons were made between conventional concrete with concrete mix coconut shell. In this study, the concretes were mixes with coconut shell by percentage of weight concrete which is 0%, 5%, and 10%. The coconut shell has been crushed first, then it was sieved, to get the optimum size which, that retained on the 5mm sieve and passing 10mm sieve. Experimental tests conducted in this study are slump test and compressive test. The results from this study are workability of concrete added with 0% and 5% of coconut shell has medium degree of workability compared to concrete added with 10% that has low workability. For the compressive strength, the concrete added with 5% and 10% of coconut shell has lower strength compared with normal concrete.

# PROPERTIES OF CONCRETE MIXES WITH CARWASH WASTEWATER

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## Abstract

The rapid growth of the car wash industry today results in the need for wastewater reclamation. Thus, this paper aims to investigate the effect of using car wash wastewater on concrete properties in terms of mechanical properties. The basic characteristics of wastewater were investigated according to USEPA (Method 150.1 & 3 00.0) while the mechanical properties of concrete with car wash wastewater were compared according to ASTM C1602 and BS EN 1008 standards. In this research, the compressive strength, modulus of elasticity and tensile strength were studied. The percentages of wastewater replaced in the concrete mix ranged from 0% up to 40%. In addition, the results also suggest that the concrete with 20% car wash wastewater achieved the highest compressive strength and modulus of elasticity compared to other compositions of wastewater. Moreover, the results also recommended that concrete mixed with car wash wastewater has better compressive strength compared to conventional concrete.

# THE EFFECT OF AGGREGATE CONDITION DURING MIXING ON THE MECHANICAL PROPERTIES OF OIL PALM SHELL (OPS) CONCRETE

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## Abstract

One of the key characteristics affecting the properties of OPS concrete is the saturation condition of the coarse aggregates used during mixing. In this current study, the effect of different aggregate saturation conditions during mixing on the slump, compressive, flexural and splitting tensile strength of OPS concrete was investigated. Three aggregate saturation conditions were employed, namely saturated-surface-dry (SSD), air-dry (AD) and sun-dry (SD). The results revealed that the SD mix had a higher slump value than AD mix and SSD mix. On the other hand, SSD mix registered better compressive, flexural and splitting tensile strength compared to the AD and SD mix. This suggests that the use of SSD aggregates is more effective in producing higher strength concretes which could be credited to the internal curing provided by the SSD aggregates.

# DRAINED AND UNDRAINED TRIAXIAL COMPRESSION TESTS ON CEMENT STABILIZED TROPICAL FIBROUS PEAT OF SARAWAK

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## Abstract

Peat is classified as one of the major type of problematic soils due to its high water content, high compressibility and low shear strength characteristics. The research site investigated in this paper is in Matang, Kuching. Studies have been carried out on strength evaluation of stabilized tropical fibrous peat samples under short and long term performance conditions. Ordinary Portland cement (OPC) was used as the stabilizing agent. Cement stabilized peat samples were prepared with cement content of 25% and 50% by weight of dry soil and cured for 7 and 28 days. These stabilized samples were tested to study their shear strength characteristics by performing triaxial compression tests in isotropic consolidated undrained (CIU) and isotropic consolidated drained (CID). Reduction factor for the effective friction angle of cement stabilized peat that was obtained in CIU and CID tests were in the range of 0.81 to 0.97. The effective drained cohesion of the untreated peat has a reduction factor of 0.5 from the undrained cohesion. While the ratio between CID and CIU tests results for effective cohesion of cement stabilized peat has an average additional factor of 2.44. Relationship between the secant modulus of elasticity (E50) and peak shear strength (q) from CIU and CID tests is also established in this study. Values of reduction factor highlighted in this work may be used to estimate values of effective friction angle and cohesion from undrained test performed on cement stabilized peat. This is an interesting work for researchers and practitioners to understand the engineering behaviour of cemented tropical peat.

Keywords: *tropical peat, cement stabilized peat, shear strength, triaxial compression test, soil improvement.*

# WEB CONTENT ANALYSIS ON SUSTAINABLE CAMPUS OPERATION (SCO) INITIATIVES

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## Abstract

The purpose of this paper is to identify and analyse the current practices implemented in global universities for achieving sustainability throughout campus operations. This study adopted a web content analysis method where 30 international green universities' websites have been thoroughly examined to identify common initiatives implemented to achieve sustainability through campus operations. The findings are ranked based on the implementation of these initiatives by participating universities. From the websites reviewed, as much as 31 initiatives have been identified as common initiatives frequently implemented by green universities to achieve sustainability in campus operations. It was found that the common initiatives frequently implemented by most of the universities include 'Provide bin with clearly marked signs to increase the number of recycling items', and 'Generate electricity on campus by establishing power generation plants' with 87% and 83% respectively. This paper fills the gap by presenting the investigation of sustainability initiatives from some of the major green universities internationally. It is suggested that higher education institutions, particularly Malaysian universities, initiate or manage their implementation of sustainable campus operation (SCO) initiatives based on the findings of this research.

# FIRE REACTIONS OF ULTRA-HIGH PERFORMANCE FIBRE REINFORCED CONCRETE DUE TO HEATING AND COOLING

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## Abstract

This study investigated the performance of ultra-high performance fibre reinforced concrete (UHPFRC) at elevated temperatures. The specimens were exposed to high temperatures, specifically 200, 400, and 600°C, for 2h. The fire resistance performance of the specimens was classified on the basis of their compressive strength, spalling, and weight loss; residual strength after heating was also examined. Results showed that UHPFRC processes excellent fire resistance in terms of flame spread and fire growth. While strength loss was not significant at low temperatures, the specimen subjected to high temperature spalled severely and showed deterioration because of heat.

**Paper No: EC002**

## DESIGN AND ANALYSIS OF 15 NM MOSFETS

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### Abstract

We present the design and analysis of 15 nm NMOS transistors, fabricated on three different substrate materials -- namely silicon, indium nitride and indium arsenide. Close inspection on the I-V characteristic curves reveals that the saturation voltage and current of the indium arsenide transistors are significantly higher than the other two counterparts. We attribute this result to the high mobility of carriers in indium arsenide substrate. It is also observed that the breakdown voltages of the indium arsenide transistors are also one of the highest. The breakdown behaviour shows that transistors fabricated on indium arsenide substrate renders reasonably high robustness. Due to high channel length modulation effect, it could also be seen that current variation between saturation and breakdown currents is the highest in the conventional silicon transistors. Our analysis suggests that indium arsenide could be an alternative substrate material in the design and fabrication of nano-scale MOSFETs. For devices which may require high power consumption (and therefore high current and voltage), indium arsenide can also be considered as an appropriate substrate material.

**Paper No: EC003**

## COMPARISON BETWEEN DOUBLE STRANDED DNA WITH RESTRICTION ENZYMES AND SINGLE STRANDED DNA WITH PRIMERS FOR SOLVING BOOLEAN MATRIX MULTIPLICATION

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### Abstract

Boolean matrix multiplication is the basis for most computing algorithms and is widely used in many fields. In this paper, we compare and discuss two methods to solve Boolean matrix multiplication with DNA computing. The first method utilizes double stranded DNA sequences with Restriction Enzymes meanwhile the second method utilizes single stranded DNA sequences with primers. We prove that while both methods are able to solve the Boolean matrix multiplication problem, these two methods differ in their performance and output results. We compare the advantages of the latter method in terms of easier sequence designs and more efficient analysis of results.

# IMPROVING SPECTRAL EFFICIENCY IN SPACE COMMUNICATIONS USING SRRC PULSE-SHAPING TECHNIQUE

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## Abstract

This paper proposes an improved spectral efficiency in space communications using square root raised cosine (SRRC) pulse-shaping technique. The proposal is necessitated by the global shortage of bandwidths confronting the wireless communication system. The major contribution of this technique is its ability to reduce the channel bandwidth and eliminate inter-symbol interference and spectral seepages with ease. This is achieved by tightly constraining wider channel bandwidths in a given frequency spectrum using SRRC pulse-shape filtering, thus eliciting more channels, higher data rates per channel and more users in the system. To authenticate the rationality of the proposed technique, MATLAB simulations are carried out under varying SRRC filter roll-off factors. The proposed technique is capable of achieving 43.76% channel bandwidth improvement, which is close to an ideal case of 50%. This is a great achievement in band-limited communication system. It is envisioned that this technique will be very helpful to designers of high performing and bandwidth efficient space communication system.

Keywords: *Inter-symbol interference, pulse-shaping, raised cosine filter, spectral efficiency, square root raised cosine filter.*

# EMISSION DISPATCH PROBLEM WITH CUBIC FUNCTION CONSIDERING TRANSMISSION LOSS USING PARTICLE SWARM OPTIMIZATION

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## Abstract

In this research, we have exploited particle swarm optimization (PSO) technique for solving the emission dispatch problem. We have used cubic function, instead of quadratic function, to solve emission dispatch problem to make the system more robust against nonlinearities of actual power generator. PSO with cubic function reveals better results by optimizing less emission of hazardous gases, transmission losses and showing robustness against nonlinearities than simplified direct search method (SDSM).

## WEB-BASED CAREER PATH MODEL FOR HUMAN RESOURCE MANAGEMENT

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### Abstract

Career path modeling and management are essential for building appropriate business strategies to attract and maintain valuable human assets in an organization. The increase of data volume due to globalized employment has increased the challenge to utilize scattered and abundant data which are collected from time to time. In order to ensure efficient top to bottom communication in an organization, this paper proposes a web-based software tool for career path modeling. It aims to assist employees from different departments to seek advice in terms of their career advancement opportunities, and support managerial decision from the human resource professionals. The proposed model is developed with the consideration of several aspects, i.e., change of job position, department, gender, attended training courses, available mentor, as well as professional and academic qualifications. The concept of cloud computing is adopted to ensure the accessibility of the model from different web-browsers so that employees have the flexibility to obtain career advancement information anytime and anywhere.

Keywords: *Career Path Model, Cloud Computing, Human Resource*

## ARROW-BOT: A TEACHING TOOL FOR REAL-TIME EMBEDDED SYSTEM COURSE

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### Abstract

This paper presents the design of a line following Arduino-based mobile robot for Real-Time Embedded System course at Universiti Tun Hussein Onn Malaysia. The real-time system (RTS) concept was implementing is based on rate monotonic scheduling (RMS) on an ATmega328P microcontroller. Three infrared line sensors were used as input for controlling two direct current (DC) motors. A RTS software was programmed in Arduino IDE which relied on a real-time operating system (RTOS) of ChibiOS/RT library. Three independent tasks of software functions were created for testing real-time scheduling capability and the result of temporal scope was collected. The microcontroller succeeded to handle multiple tasks without missed their dateline. This implementation of the RTOS in embedded system for mobile robotics system is hoped to increase students understanding and learning capability.

Keywords: *Arduino-based Robot; Educational Mobile Robot; Line Following Robot; Real-time Operating System; ChibiOS/RT*

# NEURAL NETWORK FITTING USING LAVENBERQ- MARQUARDT TRAINING ALGORITHM FOR PM10 CONCENTRATION FORECASTING IN KUALA TERENGGANU

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## Abstract

The forecasting of Particulate Matter (PM10) is crucial as the information can be used by local authority in informing community regarding the level air quality at specific location. The non-linearity of PM10 in atmosphere after it was subjected by several meteorological parameters should be treated with powerful statistical models which can provide high accuracy in forecasting the PM10 concentration for instance Neural Network (NN) model. Thus, the aim of this study is establishment of NN model using Lavenberg-Marquardt training algorithm with meteorological parameters as predictors. Daily observations of PM10, wind speed, relative humidity, ambient temperature, rainfall, and atmospheric pressure in Kuala Terengganu, Malaysia from January 2009 to December 2014 were selected for predicting PM10 concentration level. Principal Component Analysis (PCA) was applied prior the establishment of NN model with the aim of reducing multi-collinearity among predictors. The three principal components (PC-1, PC-2, PC-3) as the result of PCA was used as the input for the NN model. The NN model with 14 hidden neurons was found as the best model having MSE of 0.00164 and R values of 0.80435 (Training stage), 0.85735 (Validation stage), and 0.8135 (Testing stage). Overall the model performance was achieved as high as 81.1% for PM10 forecasting in Kuala Terengganu.

# PRE-LIGHTNING STRIKES AND AIRCRAFT ELECTROSTATICS

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## Abstract

An electric storm is a source of electrostatic charge that can induce high current and electric potential on a surface of an aircraft through direct effects. It can also be a source of radiated electromagnetic pulses on an aircraft in flight through indirect effects. Both direct and indirect effects can have adverse effects on flight safety. Thus, it is vital to gain good understanding of the pre-lightning strike and the electrical characteristics of a thunderstorm in order to quantify lightning threats to aircraft. Since lightning parameters are not easily measurable, predictive modeling can be applied to model the pre-lightning strike and aircraft electrostatics. In this paper, we applied the 3D dipole model in predicting the electrostatics build up along an aircraft extremities as it approaches an ambient electric field of a charged cloud. The results give a quantitative evaluation of the threats during pre-lightning strikes and electrostatics buildup on the aircraft. This is vital in designing and coordinating shielding measures to mitigate the threats and to harden the protection systems for aircraft.

## CLUSTERED COORDINATOR SABTS (CC-SABTS) FOR BEACON TRANSMISSION IN IEEE802.15.4 LR-WPAN

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## Abstract

IEEE802.15.4 standard for Wireless Sensor Network (WSN) provides low-power transmission in the low-rate wireless personal area network (WPAN). It has three types of topology: star, peer-to-peer and cluster tree. Star topology has limit to expand network. Peer-to-peer topology has a complex multihop routing during network expansion due to the large number of full-function devices. A full-function device can act as coordinator and personal area network coordinator (PAN-C). Cluster tree topology is preferable because it can expand networks using less number of full-function devices and thus reduces complexity in routing messages. A cluster tree topologies consists of a wireless PAN-C, several cluster coordinators and a number of end devices. The coordinators periodically transmit beacon frames to one another to allow synchronization and communication. However, collision will happen if the coordinators transmit beacon frames at the same time and will degrade the network performance. Different mechanisms have been introduced to solve the collision problem and one of the mechanisms is superframe adjustment and beacon transmission scheme (SABTS). SABTS calculates the precise time for beacon transmission by assigning an accurate value of beacon order and superframe order for PAN-C, cluster coordinators and end devices. As the number of cluster coordinator increases, SABTS method reiterates the calculation for beacon transmission time numerously. Hence, in order to decrease the iteration, this paper introduces clustered coordinator SABTS (CC-SABTS) by clustering coordinator nodes that are separated by two length radius. The performance of CC-SABTS is simulated and evaluated using NS2 simulation software. Result shows that CC-SABTS provides better average throughput, packet delivery ratio and end-to-end delay compared to the conventional SABTS.

## A DESIGN OF A 345-KV ELECTRIC POWER TRANSMISSION LINE INTERLINKING RAMU AND ROUNA GRIDS IN PAPUA NEW GUINEA

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## Abstract

According to PNG Power Limited (PPL), Papua New Guinea's peak power demand is expected to increase from 210 MW in 2012 to 347 MW in 2026. Under the current state of the power sector in Papua New Guinea (PNG), it is critical to implement measures to cope with the increasing power demand to promote investment, economic growth, and ultimately to achieve poverty reduction through economic growth. One of the solutions identified to improve the reliability of PNG power systems and thus to meet the demand is to interconnect the

major grids in the country so that the loads could be shared among them. This project embarks in designing a 345-kV electric power transmission line to interlink the Ramu and Rouna power grids of Papua New Guinea. The design is done by analyzing all the necessary aspects of the transmission lines with in-depth calculations performed using MATHCAD software. This design is the basis for extra-high voltage (EHV) transmission network in anticipation for the power generation and demand growth in PNG.

Keywords: *EHV transmission line; interconnection; power grids*

# PNG'S ENERGY SECTOR AND ESTIMATION OF RENEWABLE ENERGY RESOURCES IN MOROBE PROVINCE, PAPUA NEW GUINEA: SOLAR AND WIND POWER FOR NEW UMI TOWNSHIP

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## Abstract

Papua New Guinea (PNG) is blessed with numerous energy resources, including oil, gas, wind, solar, tidal and biomass. Renewable energy resources have taken center stage as PNG along with other countries seek to push for 32% of its national power demand to be met by renewable energy sources by the year 2030. In addition, PNG has an ambitious programme to provide electricity to 70% of its scattered population by the year 2030. In this paper we discuss PNG's energy sector and we present an initial Geospatial Information System (GIS) based study to consider the development of renewable energy power generation at the new Umi Township in the Markham valley of Morobe Province. The Markham valley has sunshine for about 8 hours per day and an average insolation of about 500 W/m$^2$ each day. At a height of about 50m from the ground, the velocity averages to 4m/s. The paper will present the preliminary evaluation carried out using the GIS based data. It will also draw some general conclusions from the analysis carried out for the new Umi Township for the Markham district in the Markham Valley of the Morobe Province that could be adopted for all the entirety of PNG.

# IMPLEMENTATION OF SEGMENTATION SCHEME BASED ON WAVELET TRANSFORM IN MULTI-SPECTRAL FLUCTUATION PATTERNS

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## Abstract

Segmentation is one of signal processing methods that is fruitful to recognize some details of parts contained in a detail pattern before will be further processed. This study proposed a segmentation scheme, which is the input is based on the output of approximation of level two from wavelet transformation of 2D-DWT (Two Dimension Discrete Wavelet Transform). The segmentation scheme and algorithm process are implemented on the fluctuations patterns of HHF (High High-fluctuation) in multi spectral that previously are extracted. The fluctuation patterns of HHF are 2D (Dimensional) graphic that consist of matrix of the average value and standard deviation inside. The method that will be used is to apply the approach of segmentation scheme, which is suitable for treating HHF fluctuation pattern. Moreover, it also employs the approach to acquire the highest amplitude value and also to present the signals in the segments that have the top peak these fluctuations. In addition, there are some parameters that are very prominent in segmentation results to be analyzed, such as: the number of segments, the input frequency, spectral noise, the peak of amplitude value and VMR (Variance to Mean Ratio). Furthermore, the analysis results of these parameters will be compared between the highest top three segments in the pattern fluctuation of HHF. Based on the results, it is noticeable to say that the segmentation scheme can be implemented for HHF pattern. Moreover, there are some segments that have the highest peak of amplitude values and also some parameters show quite striking phenomenon compare to other segments with the same parameters. In addition, the result of VMR is suitable with the statistical approach at VMR <1. It can be said that the proposed segmentation approach can provide the illustration of the segment each of pattern fluctuations HHF clearly.

## REMOTE AC POWER CONTROL BY USING MICROCONTROLLER

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## Abstract

AC power control is already existed in our daily lifestyle but there are some limitations for presence control technology, such as some AC power control devices could not control remotely and provide limited power controlling range. To improve presence power control technology, this paper presented a phase control method implemented on Arduino microcontroller to control power delivered to AC loads by using TRIAC. In this paper, a lamp load is used as the AC load. Moreover, wireless remote technology based on Bluetooth is used to control the AC loads. Thus, users are able to control the AC loads with a Bluetooth enabled smartphone as graphical user interface (GUI). This system has provided a convenient solution to control AC load wirelessly which required only a smartphone as GUI. Furthermore, the response of the developed remote AC power control system is compared with a conventional dimmer switch available in market.

# HEART DISEASE PREDICTION SYSTEM USING WEIGHTED K-NEAREST NEIGHBOR ALGORITHM WITH SIMPLIFIED PATIENT'S HEALTH PARAMETERS

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## Abstract

Heart disease is the primary cause of death nowadays. Treatments of heart disease patients have been advanced, for example with machine-to-machine (M2M) technology to enable remote patient monitoring. To use M2M to take care of remote heart disease patient, his/her medical condition should be measured periodically at home. Thus, it is difficult to perform complex tests which need physicians to help. Meanwhile, heart disease can be predicted by analysing some of patient's health parameters. With help of data mining techniques, heart disease prediction can be improved. There are some algorithms that have been used for this purpose like Naive Bayes, Decision Tree, and k-Nearest Neighbor (KNN). This study aims to use data mining techniques in heart disease prediction, with simplifying parameters to be used, so they can be used in M2M remote patient monitoring purpose. KNN is used with parameter weighting method to improve accuracy. Only 8 parameters are used (out of 13 parameters recommended), since they are simple and instant parameters that can be measured at home. The result shows that the accuracy of these 8 parameters using KNN algorithm are good enough, comparing to 13 parameters with KNN, or even other algorithms like Naive Bayes and Decision Tree.

# PHOTOPLETHYSMOGRAM BASED BIOMETRIC IDENTIFICATION FOR TWINS INCORPORATING GENDER VARIABILITY

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## Abstract

This study focuses on a Photoplethysmogram (PPG) based biometric identification for twins incorporating gender variability. To the best of our knowledge, little has been said pertaining to this research which identifies twins using PPG signals. PPG device has been widely used due to its advantages such as non-invasive, low cost and small in size which makes it a convenient analytical tool. PPG signals has the capability to ensure the person to be present during the acquisition process which suggest that PPG can provide liveness detection suitable for a biometric system which is not available in other biometric modalities such as fingerprint. A total of four couple of twins which consists of four female and four male subjects in age range between twenty two to thirty years old were used to assess the feasibility of the proposed system. The acquired PPG signals were then processed to remove unwanted noise using low pass filter. After that, multiple cycles of PPG waveforms were extracted and later classified using Radial Basis Function (RBF) and Bayes Network (BN) to categorize the subjects using the discriminant features to calculate and analyze the performance of this system. The outcome also provides a complimentary mechanism to detect twins besides using the current existing methods.

# HEART ABNORMALITY DETECTION TECHNIQUE USING PHOTOPLETHYSMOGRAM SIGNALS

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## Abstract

In this study, photoplethysmogram (PPG) based heart abnormality detection method is discussed. PPG signals utilized were obtained from MIMIC II Waveform Database, Version 3 Part 1 with sampling frequency of 200 Hz with the duration of 10 seconds each. The feature of the PPG signals were then extracted using MATLAB and the peak-to-peak intervals (PPI) of PPG signals were calculated and evaluated to differentiate between the normal and abnormal PPG signals. Based on the experimentation results, PPI values between the systolic peaks of abnormal PPG signals are larger than the normal PPG signals. The significant difference between the PPI values of normal and abnormal signals indicates the reliability of the proposed method as a technique to detect heart abnormalities.

Keywords: *Photoplethysmogram, heart abnormality, peak-to-peak interval*

# CFD MODELING OF A PUMP AS TURBINE (PAT) WITH ROUNDED LEADING EDGE IMPELLERS FOR MICRO HYDRO SYSTEMS

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## Abstract

A Pump as Turbine (PAT) is one of micro hydro system components that is used to substitute a commercially available turbines due to its wide availability and low acquisition cost. However PAT have high hydraulic losses due to differences in pump-turbine operation and hydraulic design. The fluid flowing inside the PAT is subjected to hydraulic losses due to the longer flow passage and unmatched fluid flow within the wall boundaries. This paper presents the effect of rounding the impeller leading edges of the pump on turbine performance. A CFD model of a PAT was designed to simulate virtual performance for the analysis. The aim of this study is to observe the internal hydraulic performance resulting from the changes in the performance characteristics. Highest efficiency was recorded at 17.0 l/s, an increase of 0.18%. The simulation results reveal that there is an improvement in hydraulic performance at overflow operation. The velocity vector visualization shows that there is a reduction in wake and consequently less flow separation along impeller flow passages. However, adjusting the sensitive impeller inlet geometry will also alter the velocity inlet vector and consequently change the velocity triangles for the turbo machinery system.

Keywords: *micro hydro, Pump as Turbine (PAT), computational fluid dynamics, impeller, renewable energy, rural electrification*

# STABILITY OF CHLORINE TERMINATION ON GE(100) AND (111) SURFACES

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## Abstract

The different cleaning solution; HCl and HF solution are used to remove the suboxide and oxide component on Ge surface. The HCl cleaning results chlorine (Cl) termination on Ge surface whereas no Fluorine (F) termination was observed just after HF cleaning. The growth of Ge oxide is studied after treated with HCl cleaning on two surface orientations; (100) and (111), respectively in dry oxygen ambient and cleanroom air by spectroscopic ellipsometry (SE) and x-ray photoelectron spectroscopy (XPS). A clear step and terrace trend was observed for the oxidation growth of Ge (100) and Ge (111) in dry oxygen ambient compared to in clean room air. This trend shows the difference in surface reaction of Ge oxidation as humidity varies. The stability of chlorine termination of Ge (111) than Ge (100) explains the slower growth of oxidation in dry oxygen ambient.

Keywords: *Ge, Ge oxide, HCl, XPS.*

# A ROBUST, 3-ELEMENT TRAINGULAR. REFLECTORLESS, SINGLE BEAM ADAPTIVE ARRAY ANTENNA FOR COGNITIVE RADIO NETWORK: INTERELMENT DISTANCE DEPENDENT BEAM

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## Abstract

Cognitive Radio is a promising technique that allows the use of underused television spectrum to reach to remote, rural communication network users. In order to develop non-interfering, broad band communication link scattered users, there is a need for robust, narrow beam antennas with minimum of side lobes. In this paper we report the flexibility of a three element array antenna that produces single main beam with minimum negligibly small side lobes, without the use of any additional structures such as reflectors. The paper explores the geometrical arrangement and inter-element distances of such an antenna where single, rotatable beams are electronically produced towards pre-determined user clusters. The paper demonstrates the single beam, as opposed to multiple beams, that the antenna generates in different directions in the $360^o$ of the horizontal plane, as well as the flexibility in changing the antenna size (that is the inter element distance), to successfully achieve the single beam antenna without resorting to the conventional reflectors that are used to flip the mirror beam that appears in linear array antennas. The analytical solution, as opposed to iteratively calculated solution using such techniques as least mean square (LMS) method, makes the digital beam steered reported herein light on memory and fast in solution to give the desired beam.

Keywords: *Smart Antenna; Adaptive Array; Cognitive Radio; Single-beam Array*

# OPTIMISATION OF NEURAL NETWORK WITH SIMULTANEOUS FEATURES SELECTION AND NETWORK PRUNING USING EVOLUTIONARY ALGORITHM

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## Abstract

Most advances on the evolutionary algorithm optimisation of Neural Network are on recurrent neural network using the NEAT optimisation method. For feed forward network, most of the optimisation are merely on the Weights and the bias selection which is generally known as conventional Neuroevolution. In this research work, a simultaneous feature reduction, network pruning and weight/biases selection is presented. The fitness score also considers feature and the neuron reduction in the hidden layer. The results were demonstrated using four sets of data sets which are the cancer datasets Thyroid datasets, Crab dataset and glass dataset. Results showed backpropagation gradient descent error weights/biased optimisations performed slightly better at classification for all the datasets with lower misclassification rate and error. However, features and hidden neurons were reduced with the simultaneous feature /neurons switching using Genetic Algorithm. The number of features were reduced from 21 to 4 (Thyroid dataset) and 9 to 3 (cancer dataset) with only 1 hidden neuron in the processing layer for both network structures for the respective datasets. This research work shows that this feature reduction/network pruning can be simultaneous performed and suitable for noisy feature sets. The weightage to reduce the feature sets can be increased higher if the datasets is known to contain noisy and non-discriminant features to improve generalization.

Keywords: *Neuroevolution, feature selection, network pruning, Evolutionary algorithm*

# OPTICAL, ELECTRICAL AND STRUCTURAL INVESTIGATION ON DIFFERENT MOLARITIES OF TITANIUM DIOXIDE (TIO2) VIA SOL-GEL METHOD

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## Abstract

Titanium dioxide ($TiO_2$) solution having different molarities were synthesized and deposited on glass substrates by using sol-gel spin-coating method. The variation in thickness, optical, electrical and structural properties of $TiO_2$ thin films were investigated by surface profiler (SP), UV-Vis spectroscopy, two-point probes and atomic force microscopy (AFM) respectively. The result show that the thickness of $TiO_2$ thin film increases as the molarity increases. The optical band gap energy decreased from 3.78eV to 3.07eV as the $TiO_2$ molarity increases from 0.01M to 0.20M. The maximum value of the absorption coefficient was 16.27 x 104 cm−1 at 0.20M with surface roughness of 21.45nm. Thin films deposited with 0.01M show lower absorption coefficient ($3.87 \times 10^4$ cm−1) within visible region with surface roughness of 5.21nm. The improvement in optical and structural properties of $TiO_2$ thin films affects the electrical properties as the highest conductivity $9.62 \times 10^2$ S/m is obtained by 0.20M.

Keywords: *Sol-gel; $TiO_2$; structural properties; optical properties; electrical properties*

# AN INTERACTIVE LOCATION BASED APP FOR PART TIME JOB

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## Abstract

This paper presents the iOS mobile app for the use of both employers and part time job seekers, aiming to provide a user-friendly location based service (LBS) experiences. The proposed prototype captures user's current location, and returns the information to the nearest neighbourhood that offers a part time job instantly. Unlike the conventional job listing board, this app is able to sort the order of the listed job based on either the distance or the wages offered. These features are able to ease the process of part time job searching, and also simplify the hiring process for the employers. The development approach employed the evolutionary prototyping with a minimal functional working prototype is built initially, and additional requirements are implemented iteratively. Several screenshots of the graphical user interface are included to demonstrate the prototype.

# HIGH GAIN OF 3.1 – 5.1 GHZ CMOS POWER AMPLIFIER FOR DIRECT SEQUENCE ULTRA-WIDEBAND APPLICATION

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## Abstract

This paper presents the design a power amplifier (PA) for direct sequence ultra-wideband applications using 0.13 μm CMOS technology operating in a low band frequency of 3.1 GHz to 5.1 GHz. Current-reused technique is employed at the first stage to increase the gain at the upper end of the desired band. Cascaded common source configuration with shunt peaking inductor at the second stage helps to enhance the wideband frequency while increasing the gain approximately twice the performance. The simulation results specify that high gain of 20.3 dB with ± 0.8 dB flatness, group delay variation of ±121.3 ps, and good input return loss and output return loss is obtained over desired working band. The proposed PA achieves power consumption of 27.3 mW.

# A NON-ELECTROLYTIC-CAPACITOR LOW-POWER AC-DC SINGLE-STAGE SEPIC-FLYBACK LED CONVERTER

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## Abstract

This paper presents an isolated single-stage SEPIC-flyback ac-dc converter for supplying light emitting diode (LED) that can eliminate electrolytic capacitor adoption. The Single Ended Primary Inductor Converter (SEPIC) converter performs the power factor correction (PFC) function, while the flyback converter regulates the DC stage and provides circuit isolation for LED protection. This paper analyses the operation of the proposed LED topology and verifies the performance of the circuit using PSCAD simulation. The converter achieved a high power factor, low total harmonic distortion and low output voltage ripple. The proposed circuit also obtained voltage below 450 V across the storage storage capacitor, allowing low voltage rating components employment.

# ARIMA WITH REGRESSION MODEL IN MODELLING ELECTRICITY LOAD DEMAND

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## Abstract

Electricity is among the most crucial needs for every people in this world. It is defined by the set of physical phenomena related with the flow of electrical charge. The importance of electricity itself leads to the increasing electricity load demand in the world including Malaysia. The purpose of the current study is to evaluate the performance of combined ARIMA with Regression model in forecasting electricity load demand in Johor Bahru. Box-Jenkins Autoregressive Integrated Moving Average (ARIMA) and Regression models will be used as benchmark models since the model has been proven in many forecasting context. Using Root Mean Square Error (RMSE) and Mean Absolute Error (MAE) as a forecasting accuracy criteria, the study concludes that the combined method is more appropriate model.

# SEU RATE IN 90NM AND 180NM OF 6T SRAM AT NEQO ORBIT.

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## Abstract

RazakSat® was a remote sensing satellite which functioned as to acquire the information from the earth surface. RazakSat® was launched to low altitudes, around 600km above the earth surface in 2009. Although RazakSat® was a low altitude satellite but the malfunction of the RazakSat® was suspected experienced high rates of anomalies. The main factor of getting high rates of anomalies is due to the RazakSat® was exposed to space radiation environment when the satellite passed through the South Atlantic region at its NEqO trajectory. An investigation was carried out to predict the Single Event Upset (SEU) rate for 6T SRAM, which is located at On-Board Computer (OBC) of the satellite. The results show that the Q node in 6T SRAM is the most sensitive node and this node becomes the main focus in this paper in order to estimate direct ionisation induced SEU rates in the worst case scenario. Apart from that, the comparison by using 90nm and 180nm of 6T SRAM are shown whereby with 90nm, around 1083.5 error/bit day is occurred and there is around 4.538 errors/bit day is found by using 180nm of the 6T SRAM.

# ASYMMETRICAL SILICON-ON-INSULATOR RIB WAVEGUIDE FOR OPTICAL DIRECTIONAL COUPLER

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## Abstract

Beam Propagation Method (BPM) is used to simulate and analyse asymmetrical silicon-on-insulator (SOI) large cross section rib waveguide (LCRW) with 1.55 µm and 1.48 µm downstream wavelengths to design optical directional coupler. The rib height (H) is fixed to 6 µm. The slab height to rib height (r) ratios are 0.6, 0.7 and 0.8 which give different values of slab height (h), rib width (W) and etch depth (d). Generally, when the waveguide spacing (S) increased, the coupling length (Lc) of asymmetrical rib waveguides also increased for both wavelength. However, the wavelength of 1.48 µm gives more Lc compared to 1.55 µm within the similar geometry but the pattern of the increment is still the same. The LCRW based coupler with r = 0.7 are chosen due to shorten Lc with the increment of S and the normalized optical power remain stable above 99% for the S exceed 6 µm on both of communication wavelength. Maximum normalized output power for single mode S-bend is achieved at the transition length of 3500 µm which is 95.8%. For the same LCRW dimension, the 3dB coupler is successfully designed with the ratio of 42.6:41.4 and losses of 16%.

Keywords: *optical directional couplers, asymmetrical waveguide, S-bend waveguide, coupling lengths, silicon-on-insulator, OptiBPM 9*

## THE EFFECT OF CHAMFERING STRUCTURE TOWARDS THE DESIGN OF OPEN LOOP RESONATOR BANDPASS FILTER FOR MICROWAVE APPLICATIONS

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### Abstract

Filter is the most essential components in the transceiver system. It is used to accept and reject any unwanted frequencies that falls out of the bands. Recently, the design of bandpass filter (BPF) has been a great challenges for RF designer. Although many researches have designed filter in the unlicensed frequency but most of the filter suffered from high insertion loss, inadequate selectivity and wider bandwidth. Therefore, this project design an Open-Loop Resonator Bandpass Filter (OLRBPF) to produce a low loss filter to operate at 2.4 GHz frequency. In order to overcome the high insertion loss, chamfered bend is introduced and implemented at the OLRBPF's structure. This will reduce the radiation loss produced and enhanced the coupling between both resonators of the filter. The results show that the proposed OLRBPF produce better insertion loss compare to conventional filter.

## PHOTOVOLTAIC VERSUS MICRO-HYDROPOWER FOR RURAL NON-GRID CONNECTED AREAS OF EQUATORIAL SARAWAK

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### Abstract

There is currently a large expansion in photovoltaic installation worldwide especially in the temperate regions of the world which have tended to influence electrical power decisions in developing countries at the equator. This research clearly justifies hydropower over photovoltaic electricity generation in non-grid connected regions of equatorial Sarawak, Malaysia. A case study is made of photovoltaic installations versus micro-hydropower installation in these regions. There are problems of micro-hydroelectricity especially during dry seasons but this work justifies allocating more resources in improving micro-hydroelectricity research such that eventually it will produce enough electricity even with the low water flow rate of the dry seasons. This research can be done locally compared to photovoltaics whose research tends to be mostly imported into Malaysia. Some comparisons are made to grid connected hydroelectric dams to depict capabilities of this technology given sufficient research allocations.

# EXPERIMENTAL INVESTIGATION ON PALM-BASED OIL AS ALTERNATIVE FOR BIODEGRADABLE POWER TRANSFORMER OIL APPLICATION IN MALAYSIA

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## Abstract

Most power transformers used petroleum-based oil or so-called mineral oil as insulation. Power transformer oil functions not only as electrical insulation and cooling medium but also to suppress corona and arcing. Over the years, power transformer oil has been widely used because of its high dielectric field strength, low dielectric losses, and long-term performance. However, petroleum-based power transformer oil is non-biodegradable and non-renewable. A serious spill could contaminate soil and water. As a non-renewable source, depletion of the source will further increase the price. These have encouraged researchers to look for alternative power transformer oil for better sustainability. Palm-based oil has been seen as a potential substitute, because, it is environmentally friendly, biodegradable and renewable. However, a lot of studies need to be carried out before it can be used as alternative power transformer oil commercially. Thus, this work has been carried out to investigate several electrical and physical properties of palm-based transformer oil, such as breakdown voltage, partial discharge characteristics, kinetic viscosity, and flash point. The effect of ageing on electrical properties of the palm-based oil has also been investigated. Two types of palm-based oil, namely Palm Fatty Acid Ester (PFAE) and Refined, Bleached, Deodorized Palm Oil (RBDPO) have been selected in this work. As a comparison, the commercially available soy-based biodegradable oil is also investigated for assessment and further analysis purpose. The results revealed that PFAE and RBDPO have great potential as power transformer insulation because of their good insulating characteristics as commercially available biodegradable oil.

## NUMERICAL STUDY OF FREQUENCY-DEPENDENT SEISMOELECTRIC COUPLING IN PARTIALLY-SATURATED POROUS MEDIA

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### Abstract

The seismoelectric phenomenon associated with propagation of seismic waves in fluid-saturated porous media has been studied for many decades. The method has a great potential to monitor subsurface fluid saturation changes associated with production of hydrocarbons. Frequency of the seismic source has a significant impact on measurement of the seismoelectric effects. In this paper, the effects of seismic wave frequency and water saturation on the seismoelectric response of a partially-saturated porous media is studied numerically. The conversion of seismic wave to electromagnetic wave was modelled by extending the theoretically developed seismoelectric coupling coefficient equation. We assumed constant values of pore radius and zeta-potential of 80 micrometers and 48 microvolts, respectively. Our calculations of the coupling coefficient were conducted at various water saturation values in the frequency range of 10 kHz to 150 kHz. The results show that the seismoelectric coupling is frequency-dependent and decreases exponentially when frequency increases. Similar trend is seen when water saturation is varied at different frequencies. However, when water saturation is less than about 0.6, the effect of frequency is significant. On the other hand, when the water saturation is greater than 0.6, the coupling coefficient shows monotonous trend when water saturation is increased at constant frequency.

## EFFECTS OF CIGARETTES SMOKING ON PULMONARY FUNCTION AMONG UNIVERSITY STUDENTS

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### Abstract

Pulmonary function testing is a physiological test that measures how an individual inhales or exhales volumes of air as a function of time. Smoking is greatly associated with reduction of pulmonary function. This research is aimed to estimate the values of peak expiratory flow (PEF), forced expiratory volume in first second (FEV1), forced vital capacity (FVC) and ratio between FEV1/FVC among smoking and non-smoking students in Universiti Tun Hussein Onn Malaysia. Smoking is often related to obstructive disorder with low value of FVC, FEV1 and FEV1/FVC. These pulmonary functions were analyzed based on several variables such as; the number of cigarette smoked per day, duration of smoking, age, and body mass index (BMI) values. 70 healthy volunteers consist of smoking and non-smoking students was selected through several sessions. Students were interviewed to answer questionnaire on demographic, lifestyles and their smoking habit. The pulmonary

function tests were conducted according to American Thoracic Society (ATS) standards. The results of the pulmonary functions were analyzed by using SPSS software to compare the pulmonary functions between the smoker and the non-smoker students. The results of the studies showed that the number of cigarettes smoked by respondent and the BMI values were the significant predictors of the decrease in FEV1/FVC values among university students.

## ENERGY CONSUMPTION ANALYSIS BASED ON ENERGY EFFICIENCY APPROACH: A CASE OF SUBURBAN AREA

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### Abstract

Sufficient data about electricity consumption over large periods of time was accumulated and analysed in order to develop appropriate electricity-saving measures. An important first step was to analyse and identify electrical appliances that had energy saving potential. Different behavioural consumption profiles were analysed using information from two sources: 1) technical data about electricity consumption (electricity bill) and 2) data about household electrical appliance usage and consumer awareness obtained from a questionnaire survey. The questionnaire consisted of four sections of questions which concerned residents' backgrounds, residential information, consumers' awareness about energy efficiency (EE) and the energy usage of each house. The results showed that the electricity consumption profile of an individual household could be most related to the EE approach.

It indicated that consumers' behaviour (awareness and practice) resulted in one of the important factors related to high electricity consumption. Another important conclusion of our questionnaire-based analysis was that the implementation of the EE approach could help the consumer to reduce their monthly energy consumption.

## APPLIED TRIZ IN IMPROVING PRODUCTIVITY IN TEXTILE INDUSTRY

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### Abstract

TRIZ is a methodology and a collection of problem solving tools and strategies that has been used in many othe fields. Therefore, this paper proposes TRIZ method for improving the productivity in a textile industry. It focuses at the packing department in a textile company situated in Malaysia. The process was monitored and the problem was observed. TRIZ method is applied in this problem using Functional Analysis and trimming method. A comparison between before and after implementation is done in order to evaluate the productivity effectiveness.

# VIRTUAL MASS OF ANY SHAPE OF BODY BY USING GENERAL MAPPING FUNCTION

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## Abstract

When an object is moving in acceleration with fluid interaction from surrounding, it possesses virtual mass (added mass) in which the total mass of object is higher than the original mass. The exact conformal mapping method was proposed to determine the virtual mass. However, it is difficult to determine the virtual mass for the body of random shape by using conformal mapping. Therefore the new concept of mapping function is proposed. It is based on Laurent series that has been proposed to map the body of random shape to a circle. The function of a body shape is expressed in Fourier series which is essential to determine the complex coefficients of mapping function (Laurent series). Proposed method is compared with exact conformal method (equilateral polygon) and the validity is confirmed.

# LEVEL OF BUS PERFORMANCE BASED ON THE RELATIONSHIP BETWEEN DISTANCE AND TRAVEL TIME OF UNIVERSITI TUN HUSSEIN ONN MALAYSIA (UTHM) BUS SERVICE

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## Abstract

The bus service is an important vehicle for students at University Tun Hussein Onn because it is used as the primary vehicle to the destination they want to go in the campus. This service is often associated with the quality of service in terms of time when needed. Geometric progression and infrastructure development has resulted in increased service should do well from time to time. Therefore, this study is focused on several routes in the study to assess the distance and travel time to determine the level of service provided at present time. Primary data collected in the study area to obtain information related to the speed, position, movement of bus time and headway. These data were obtained using a GPS device which is Slute Gear i-trail. In addition, secondary data from journals, reports and previous studies to obtain information used for evaluating the information bus service based on Highway Capacity Manual (HCM 2010). The formula was use based on assessment of progress used to determine the level of quest service. As such problem frequently occurs as a result of delays by bus or volume of unequal can be overcome according to the assessments that have been provided.

Keywords: *Speed, travel time, GPS, HCM 2010*

# MAPPING OF TIDAL ENERGY POTENTIAL BASED ON HIGH AND LOW TIDES FOR SABAH AND SARAWAK

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## Abstract

Tidal energy is one of the best predictable and reliable source of renewable energy. Therefore, this paper aims to map extractable tidal energy, and to determine potential locations to generate electricity from tidal power along the coastline of Sabah and Sarawak states of Malaysia. The data was obtained from Sarawak Marine Department, and analyzed by using ArcGIS version 10.3. There are two potential locations, namely Tawau in Sabah, and Pending in Sarawak, where 67.0kW and 115.4kW of optimum power generated were obtained respectively.

## EFFECTS OF INTERMEDIARY RESERVOIR IN A TWO-STAGE IMPEDANCE PUMP

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## Abstract

Impedance pump is a simple valve-less pumping mechanism, which transport fluid through the mismatch of impedance in the system. A typical open-loop impedance pump consists of an elastic tube, connected to rigid tubing, where the rigid section is connected to a reservoir. Mismatch in impedance occurs when an asymmetrical periodic excitation is exerted on the elastic tube. Studies showed that sequential excitations on the elastic tube infers higher volumetric efficiency than a single excitation. This work studies the effects of an intermediary reservoir between two excitation points on an elastic tube. This study aims to shed some light on the steady state response and fluid motion within the intermediary reservoir; in which increased volumetric efficiency is demonstrated.

Keywords: *Steady state response; fluid motion; intermediary; impedance pump*

## ACTIVE HETEROGENEOUS CAO CATALYST SYNTHESIS FROM ANADARA GRANOSA (KERANG) SEASHELLS FOR JATROPHA BIODIESEL PRODUCTION

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### Abstract

Heterogeneous catalysts are often used at large to produce biodiesel from non-edible vegetable crude oils such as *Jatropha curcas* oil (JCO). In this study, an active heterogeneous CaO catalyst was synthesized from a tropical biodiversity seashells *Anadara granosa (A.granosa)*. The catalytic efficiency of *A.granosa* CaO was investigated in transesterification of JCO as biodiesel. The *A.granosa* CaO catalyst was synthesized using 'Calcination – hydration – dehydration' protocol. The spectral characterization of the catalyst were investigated by employing FT-IR, SEM, BET and BJH spectrographic techniques. The experimental design was executed with four reaction parameters that include catalyst concentration (CC), methanol ratio (MR), transesterification time (TT) and reaction temperature (RT). The JCO transesterification reactions as well as impact of reaction parameters on the Jatropha biodiesel yield (JBY) were analyzed. The sufficiency of the experimental results conformed through sequential validation tests, as a result, an average of 96.2% JMY was noted at optimal parametric conditions, CC of 3wt. %, TT of 120 min, MR of 5 mol. and RT of 60°C at a constant agitation speed of 300rpm. An average JMY of 87.6% was resulted from the *A.granosa* CaO catalyst during their recycling and reuse studies up to third reuse cycle.

## DEVELOPMENT OF WIND TUNNEL FOR ULTRAFINE PALM OIL FUEL ASH SEPARATOR

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### Abstract

Palm Oil Fuel Ash (POFA) is a pozzolanic material that offers great potential in concrete production. POFA size range between 1 to 10 µm is preferable. Thus, there is a need for efficient method to separate the POFA according to the size needed. This paper explores the idea of using simple wind tunnel as a separator for ultrafine POFA. The existing operation of the wind tunnel was simulated using ANSYS-CFX, a numerical modelling software. The identified main weakness of the wind tunnel design is located at the hopper. The wind tunnel are simulated with different air inlet velocity in order to visualize the air flow profile as well as air flow energy at the hopper. Different air inlet velocity have similar air flow profile but the air flow intensity is different. Further simulation the modification of the air flow profile are conducted. Altering the hopper angle shows the air flow profile is changing. Based on the simulation results, the angle of hopper, 60° yield best flow

characteristic. At 60° of hopper angle, the air flow is mostly directed downward into the tunnel and the air flow energy is low. Therefore, it allows the POFA to be directed into the tunnel and reduced ultrafine POFA losses at the tip of the hopper. This conventional yet simple concept utilises a simple open wind tunnel that enable the process to be practical and economical whereby the production of ultrafine POFA can be increased.

Keywords: *ultrafine palm oil fuel ash (POFA), separator, wind tunnel, ANSYS-CFX*

# SLIDING WEAR BEHAVIOUR OF CARBURIZED STEEL

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## Abstract

Experiments have been carried out to investigate the effect of carburization process on the sliding wear resistance of mild steel. The carburization process was conducted in carbonate salts mixtures of $Na_2CO_3$-$NaCl$. Carburization followed by water quenching resulted in the formation of martensite with a hardness of 900 HV in the subsurface, up to the depth of 400 μm. This hardness value was substantially higher than the non-carburized steel which had a hardness of 520 HV. In the initial stage of sliding in air, abrasive wear and cluster of fine cavities due to adhesion were formed. This was followed by the formation of large-scale fracture at the cavities. The high hardness of the carburized steel reduced the severity of adhesive wear and thus the tendency of the worn surface to fracture.

# DEVELOPMENT OF IN-PIPE ROBOT D300: CORNERING MECHANISM

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## Abstract

Utilization of robots for in-pipe maintenance considered as one of the most effective ways to improve the pipeline operation. The specific condition and structure of a pipeline system is a challenge for the robots to perform its task. This research aims to assess the characteristic and performance of the in-pipe robot in a 90° pipe elbow. Hence, a prototype of in-pipe robot for 300 mm UPVC pipe diameter (IPR-D300) has been built. The conception of the robot is based on wall-pressed caterpillar type which is suitable for not only horizontal pipeline position, but also vertical and elbows pipeline. This robot is equipped with ultrasonic sensors, high performance microcontroller board and powerful geared motor for travelling in the corner of pipeline. The developed IPR- D300 consist of three independent driving modules that are able to alter the speed according to the pipeline characteristic. The hardware and software of the IPR-D300 performance have been tested and successfully perform the cornering task smoothly. The developed IPR-D300 potentially can be applied for in-pipe cleaning operation especially on centralised sewerage system. As standard pipeline size for sewerage system housing in Malaysia is 200 mm, smaller and robust in-pipe robot will be the future target.

Keywords: *In-pipe robot, 90˚, elbow, UPVC pipe, Caterpillar, wall pressed*

# PHYSICAL AND MECHANICAL PROPERTIES OF NI-CR BASED COMPOSITES WITH ADDITION OF SOLID LUBRICANTS PRODUCED THROUGH POWDER METALLURGY PROCESS.

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## Abstract

Ni-Cr based composites with and without the addition of solid lubricants ($MoS_2$, silver and $CaF_2$) were prepared by powder metallurgy method. The samples were sintered at two different temperatures, 1000°C and 1200°C. The physical properties such as shrinkage, sintered density and porosity were studied. The microstructures of the Ni-Cr based composites were observed by using SEM analysis while the mechanical properties of the composites were measured by Rockwell Hardness Tester. The results revealed that the increased in sintering temperature improved the shrinkage, sintered density and hardness of the composites while less porosity produced. Ni-Cr based composites with the addition of silver and $MoS_2$ exhibited better shrinkage, density and porosity. Besides, 5% of $MoS_2$ addition in the composites improves the hardness of the composites at sintering temperature 1200°C.

Keywords: *solid lubricants, Ni-Cr composites, powder metallurgy, $MoS_2$, silver, $CaF_2$*

# OPTIMISATION OF ELECTROSPINNING PARAMETER FOR POLY(L-LACTIC) ACID (PLLA) ELECTROSPUN NANOFIBRE

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## Abstract

Poly (L-lactic) Acid (PLLA) ia one of the biodegradable polymer that normally used in the biomedical application. In this work it is shown that electrospinning of PLLA electrospun fibre was affected by electrospinning processing parameters such as the solvent systems selection, polymer solution concentration, flow rate and accelerating voltage. Optimisation of these parameters is necessary to obtain a beadless and submicron diameter fibre as desired in this research.

# A STUDY ON RELATIONSHIP BETWEEN CARRYING SCHOOLBAGS AND THE PREVALENCE OF NECK AND BACK PAIN AMONG 7 – 9 YEAR OLD STUDENTS

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## Abstract

There is a growing concern these days that children are carrying way too much weight on their backs. School students are at risk of developing Musculoskeletal Disorder or possibly long term back pain due to the frequent exposure of carrying heavy schoolbags. In Malaysia, this problem is currently an overlooked issue as not many are aware of the importance of maximum allowable load that should be carried by school students together with proper posture and how all these will affect the children in the future. An interview was conducted based on 90 school students of age 7 to 9 year old regarding the body part discomfort that they experience while carrying the schoolbag. Furthermore, the weight of the schoolbag and the student's height and weight was taken for this study. The responses were classified based on age and gender as the anthropometry differs on ages and gender. A statistical analysis is carried out with the results obtained. The finding of the statistical analysis showed that the prevalence of neck and back pain does exist among 7-9 year old school students and almost 90 of them are affected. Among the main problems are that the schoolbag design, the incorrect ways of carrying the schoolbag, the excessive weight of the schoolbag and the prolonged duration of constantly carrying the schoolbag. Necessary action should be taken to overcome these problems.

# PREPARATION OF NANO-SCALE BIOPOLYMER EXTRACTED FROM COCONUT RESIDUE AND ITS PERFORMANCE AS DRAG REDUCING AGENT (DRA)

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## Abstract

Drag or frictional force is defined as force that acts opposite to the object's relative motion through a fluid which then will cause frictional pressure loss in the pipeline. Drag Reducing Agent (DRA) is used to solve this issue and most of the DRAs are synthetic polymers but has some environmental issues. Therefore for this study, biopolymer known as Coconut Residue (CR) is selected as the candidate to replace synthetic polymers DRA. The objective of this study is to evaluate the effectiveness of Nano-scale biopolymer DRA on the application of water injection system. Carboxymethyl cellulose (CMC) is extracted by synthesizing the cellulose extracted from CR under the alkali-catalyzed reaction using monochloroacetic acid. The synthesize process is held in controlled condition whereby the concentration of NaOH is kept at 60%wt, $60^\circ$C temperature and the reaction time is 4 hours. For every 25g of dried CR used, the mass of synthesized CMC yield is at an average of 23.8 g. The synthesized CMC is then grinded in controlled parameters using the ball milling machine to get the Nano-scale size. The particle size obtained from this is 43.32 Nm which is in range of Nano size. This study proved that Nano-size CMC has higher percentage of drag reduction (%DR) and flow increase (%FI) if compared to normal-size CMC when tested in high and low flow rate; 44% to 48% increase in %DR and %FI when tested in low flow rate, and 16% to 18% increase in %DR and %FI when tested in high flow rate. The success of this research shows that Nano-scale DRA can be considered to be used to have better performance in reducing drag.

# STUDY OF CUTTING EDGE TEMPERATURE AND CUTTING FORCE OF END MILL TOOL IN HIGH SPEED MACHINING

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## Abstract

A wear of cutting tools during machining process is unavoidable due to the presence of frictional forces during removing process of unwanted material of workpiece. It is unavoidable but can be controlled at slower rate if the cutting speed is fixed at certain point in order to achieve optimum cutting conditions. The wear of cutting tools is closely related with the thermal deformations that occurred between the frictional contact point of cutting edge of cutting tool and workpiece. This research paper is focused on determinations of relationship among cutting temperature, cutting speed, cutting forces and radial depth of cutting parameters. The cutting temperature is determined by using the Indium Arsenide (InAs) and Indium Antimonide (InSb) photocells to measure infrared radiation that are emitted from cutting tools and cutting forces is determined by using dynamometer. The high speed machining process is done by end milling the outer surface of carbon steel. The signal from the photocell is digitally visualized in the digital oscilloscope. Based on the results, the cutting temperature increased as the radial depth and cutting speed increased. The cutting forces increased when radial depth increased but decreased when cutting speed is increased. The setup for calibration and discussion of the experiment will be explained in this paper.

Keywords: *High speed machining; pyrometer; thermal deformation; cutting temperature*

## SIMPLE ARM MUSCLE MODEL FOR OIL PALM HARVESTING PROCESS

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## Abstract

Arm are essential in order to perform manual material handling work that normally involves lifting, handling, placing, push and pull, carrying and moving heavy loads. When these work elements are performed over prolonged periods repeatedly, it will expose workers arm to awkward posture and possible ergonomic risk factor. For example, work element that requires repetitions frequently may lead the arm to face physical stress and mental fatigue. The situation can be extremely risky if the worker task requires higher focus or time consumable. These issues are unavoidable in palm oil harvesting process since the workers are still using manual handling when harvesting the fresh fruit bunch (FFB). The worker using a chisel to harvest the young palms and a sickle mounted on a bamboo or aluminum pole to harvest taller palms. When perform this work element combining with heavy physical workload, it may lead to work-related muscle disorders (WSMDs). This study was conducted to identify the force reaction and inverse dynamic analysis during oil palm harvesting process using ergonomics software called Anybody Technology. Inverse dynamic analysis is a technique for figuring strengths and/or moments of power (torques) taking into account the kinematics (movement) of a body and the body's inertial properties.

# DEVELOPMENT OF ANKLE FOOT ORTHOSIS (AFO) USING PNEUMATIC ARTIFICIAL MUSCLE FOR DISABLED CHILDREN

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## Abstract

Ankle foot orthosis (AFO) are commonly used to correct the instabilities and joint weaknesses of lower limb. AFO was developed by using pneumatic artificial muscles (PAM) to prevent plantarflexion to occur and also correct the foot from the inversion syndrome. The purpose of this study was to design the AFO by using SolidWorks software based on anthropometry measurement data (n= 5, age=12 years old). Then, the mechanical simulation is done in order to obtain safety design before fabrication is made with Autodesk Invertor software and it shows that this design is safety enough for user to wear. The fabrication of AFO is made from thermoplastic elastomer (TPE) rubber material by using 3D printer. PAM is tested by using test bed machine to test the generated force and contraction by muscle and results shows that it is suitable for slow speed as the displacement result is greater. This orthosis could be valuable for gait rehabilitation.

Keywords: *Ankle foot orthosis; pneumatic artificial muscle*

# DEVELOPMENT OF HAND GRIP ASSIST DEVICE CONTROL SYSTEM FOR OLD PEOPLE THROUGH ELECTROMYOGRAPHY (EMG) SIGNAL ACQUISITIONS

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## Abstract

Due to ageing, old people suffered from the decrease of physical capabilities including hand. They face difficulty to do task that require hand such as gripping, pinching, eating, and many more. Thus, the hand grip assist device was developed to amplify the hand strength of old people. However, improvement was needed on the device control system. Therefore, we developed new control system that utilize two sensors namely the electromyography (EMG) and flex sensor. The new control allowed the user to use the device in two modes, whether it semi-active or active mode. This new control system not only allows the hand grip assist to work seamlessly also to encourage old people to use their hand more with different kind of modes.

Keywords: *Weak hand, grip assist, control system, EMG*

## THE CONTROL SYSTEM DESIGN FOR KEROPOK KEPING DRYING MACHINE

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### Abstract

In *keropok keping* industries, most of the production processes are implemented by semi-automated machines. However, the drying process is still conducted using a traditional method where the *keropok* is arranged under the sunlight. In order to improve the drying process, a new rotary type of *keropok keping* drying machine was invented. Nevertheless, the machine does not have any special system to control the dryer's operation. This research is focused on the design of control system for the *keropok keping* drying machine by using programmable logic controller (PLC) as the main controller. The control panel and human machine interface (HMI) were developed for the machine. An experimental study was conducted to validate the HMI speed data by the control panel speed display. The evaluation of the duty cycle (%) and current flow (amp) effect to the motor and fan speed was also conducted. The results shows that around 1 - 30 % and 1 - 3 % differences speed reading were recorded by the HMI for the motor and fan respectively. The linearity of the current flow curve to all duty cycle can be observed. The speed (rpm) and current flows (amp) tend to be constant when the percentage of duty cycle close is to 100%. The development of the control system is expected to improve the operation of the *keropok keping* drying machine.

Keywords: *Keropok Keping, Drying Machine , PLC, Human Machine Interface (HMI)*

## DEVELOPMENT OF KEK LAPIS SARAWAK'S MACHINE: A REVIEW

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### Abstract

Kek Lapis Sarawak is a beautifully decorated and flavorful cake that can be considered as the artwork of the Malays in Sarawak. There is an overwhelming demand of the Kek Lapis Sarawak in the market that consequently need for automation. This paper summarizes comprehensive reviewed patents of the current machine and journals which have similar functions and related to the current function of manual process of producing Kek Lapis Sarawak. Conceptual idea of the Kek Lapis Sarawak machine consists of three modules namely Depositor Module, Cooling and Pressing Module and Baking Module. Therefore, patents and journals that have similar functions with these modules are reviewed that look into its advantages. The disadvantages of the design also considered for future design. Hence, the crucial advantages of each module considered are namely improved production rates, increased of hygienic rating, easy to maintenance and portability of a design. The reviewed patents and journals can be considered for the development of Kek lapis Sarawak's machine with some improvisations are needed to meet up the specific requirements of the machine.

Keywords: *Kek Lapis Sarawak, depositor, cooling, pressing, baking*

# EFFECT OF BOTTOM ASH AND FLY ASH AS A SUSCEPTOR MATERIAL ON THE PROPERTIES OF ALUMINIUM BASED COMPOSITES PREPARED BY MICROWAVE SINTERING

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## Abstract

The use of aluminium as a single material in automotive applications is not suitable without a mixture with reinforcement materials that can support the properties at high temperature. In this study, aluminium based composite were prepared with weight percentage of SiC reinforcement, varying from 5 to 20 wt%. Aluminium powder and reinforcement materials were mixed using ball milling machine with speed of 100 rpm for 2 hours. The powder mixture were then compressed at pressure 4 tonnes with 5 minutes holding time. The compact samples were sintered using microwave sintering technique. Microwave sintering techniques in this study using two different types of susceptor materials that are bottom ash and fly ash. Sintered aluminium based composites using bottom ash susceptor material involving the sintering temperature of $526^0C$ for 30 minutes whereas for the samples sintered using fly ash susceptor material, involving a temperature of $523^0C$ for 15 minutes. From the result, the sintered samples using fly ash susceptor material, showed higher density with a value of 2.1933 $g/cm^3$. compared to bottom ash 2.0002 $g/cm^3$ and having the higher hardness value 72.1315 HV compared to bottom ash 50.0511 HV. The using of fly ash could affect the heating rate during the sintering process which could influence the properties of aluminium based composites. In conclusion, the type of susceptor could affect the physical and mechanical properties of aluminum-based composite reinforced with silicon carbide.

# ENVIRONMENTALLY BENIGN SYNTHESES AND CHARACTERIZATION OF 4-ARYLDIHYDROPYRIMIDIN 2(1H)-ONES

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## Abstract

A general, simple, efficient, cost-effective and environmental benign procedure for the syntheses of 4-aryl-3, 4-dihydropyrimidin-2(1H)-ones (DHPMs) has been developed. The reaction is efficiently catalyzed by using various amino acids viz., glycine, L-proline, L-cysteine, leucine and tryptophan. Reactions give excellent yields under reflux conditions. The chemical structures of these compounds were identified by Fourier Transform-Infra Red Spectroscopy (FT-IR), Gas Chromatography-Mass Spectroscopy (GC-MS) and Nuclear Magnetic Resonance Spectroscopy (1H NMR).

Keywords: Green Approach, Amino Acids, 4-Aryldihydropyrimidinone.

# MICROSTUCTURAL CHARACTERISATION OF TITANIUM ALLOY COATED BY YZP-30% TIO2 FOR DENTAL APPLICATION

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## Abstract

The present work aimed to investigate the microstructural characteristics of yttria stabilized zirconia (YZP) - 30 wt% titania ($TiO_2$) coating on titanium alloy for dental implant. Plasma spray were used to prepare yttria stabilized zirconia (YZP) and titania ($TiO_2$) coatings. Microstructure, phase composition, and surface topography of the coatings were examined using a variety of techniques including SEM, roughness and contact angle measurement. Examination of coating microstructure reveals a typical plasma sprayed structure inclusive of pore, cracks and rough surface. Roughness results showed YZP coating is finer (7.06±0.9 m) than YZP/$TiO_2$ coating (7.97±0.4 m). The roughness increased with addition of $TiO_2$, as well as contact angle value.

Keywords: *Coatings; zirconia; contact angle; dental materials*

# MICROSTRUCTURE AND MECHANICAL PROPERTIES OF PLASMA SPRAYED AL₂O₃ – 13%TIO₂ CERAMIC COATING

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## Abstract

This paper focused on the effect of deposition conditions on the microstructural and mechanical properties of the ceramic coating. In this study, $Al_2O_3$ – 13%$TiO_2$ coated mild steel were prepared by using atmospheric plasma spray technology with different plasma power ranging from 25 kW to 40 kW. The as-sprayed coatings consist of γ-Al2O3 phase as the major phase and small amount of the titania phase existed in the coating structure. High degree of fully melted region was observed in the surface for the coating sprayed with high plasma power, which lead to the high hardness and low percentage of porosity. In this study, nanoindentation test was carried out to investigate mechanical properties of the coating and the results showed that the coatings possess high elastic behaviour, which beneficial in engineering practice.

# EFFECTS OF SWIRL BUBBLE INJECTION ON MASS TRANSFER AND HYDRODYNAMICS FOR BUBBLY FLOW REACTORS : A CONCEPT PAPER

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## Abstract

Bubble flow reactors (BFR) are commonly used for various industrial processes in the field of oil and gas production, pharmaceutical industries, biochemical and environmental engineering etc. The operation and performance of these reactors rely heavily on a range of hydrodynamic parameters; prominent among them are geometric configurations including gas injection geometry, operating conditions, mass transfer etc. A huge body of literature is available to describe the optimum design and performance of bubbly flow reactors with conventional bubble injection. Attempts were made to modify gas injection for improved efficiency of BFR's. However, here instead of modifying the geometry of the gas injection, an attempt has been made to generate swirl bubbles for gaining larger mass transfer between gas and liquid. Here an exceptionally well thought strategies have been used in our numerical simulations towards the design of swirl injection mechanism, whose paramount aspect is to inhibit the rotary liquid motion but facilitates the swirl movement for bubbles in nearly stationary liquid. Our comprehension here is that the swirl motion can strongly affect the performance of bubbly reactor by identifying the changes in hydrodynamic parameters as compared to the conventional bubbly flows. In order to achieve this bubbly flow, an experimental setup has been designed as well as computational fluid dynamic (CFD) code was used with to highlight a provision of swirl bubble injection by rotating the sparger plate.

Keywords: *Keywords: Swirl flow, mass transfer, hydrodynamic, bubbly flow reactor.*

# SEASONAL VARIATION OF CRITERIA POLLUTANT IN AN URBAN COASTAL ENVIRONMENT

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## Abstract

The aim of this study are (i) to determine the yearly and monsoonal variations of the criteria pollutants in Kuala Terengganu, (ii) identify the influences of the meteorological factors and other minor criteria pollutants that impose on the concentration of the most significant criteria pollutant using Principal Component Analysis (PCA). The hourly data for the criteria pollutants (PM10, CO, O3, NO2, and SO2) and meteorological factors (temperature, relative humidity, windspeed) for the duration of 10 years procured from the Department of Environment, Malaysia were analyzed. PM10 is the only pollutant that frequently recorded concentrations exceeding the MAAQG in the length of the year 2001 to 2010 and the criteria pollutants reported differ significantly between the monsoon seasons. PCA showed that sources contributing to the most significant criteria pollutant (PM10) are meteorological factor influences and industrial emissions.

Keywords: *PM10, criteria pollutants, meteorological factors, PCA*

**Paper No: EC024**

## AERATED STEEL SLAG FILTER SYSTEM PERFORMANCE STUDY FOR POLLUTANTS REMOVAL FROM DOMESTIC WASTEWATER

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## Abstract

Nitrogen removal from wastewater often requires a highly cost of chemical treatment to prevent over loading of nutrient in effluent discharge to the surface water body. However, to remove nitrogen it requires a complex process. Therefore, the aim of this study is to develop an aerated rock filter (ARF) system design under Malaysia condition. A pilot-scale VFARF with 2.0m height and 0.3m diameter and a HFARF with 1.0m long and 0.3m wide and 0.5m height has been developed at Taman Bukit Perdana Wastewater Treatment Plant (WWTP) Batu Pahat, Johor to monitor the performance of the ARFs for nitrogen removal from domestic wastewater. The optimum value of HLR and aeration rate was 2.72 m3/m3.day and 10 L/min, respectively. For monitoring the effectiveness of the VFARF and HFARF, influent and effluent twice a week grab samples have been collected and analysed for TKN, Ammonia Nitrogen, BOD5, COD, TSS, Alkalinity, E-coli, pH, Dissolved Oxygen and Temperature. From the study, it was found that the VFARF system has outperformed as the removal efficiency of TKN, AN, TSS, and E-coli was 89%±7%, 97%±2%, 86%±17%, and 97%±2%. The removal efficiency was slightly lower in the HFARF as their removal was 78%±11%, 71%± 12%, 88%±15%, and 91%±16% for TKN, AN, TSS, and E-coli. However, their performance insignificant in removing organic matter, BOD5, COD as the removal efficiencies in the VFARF and HFARF were 84%±13%, 65%±23% and 85%±12%, 75%±21%, respectively. Alkalinity, pH and DO profiles for VFARF and HFARF systems effluent values were average at 107.08±28.35 mg/L, 7.14±0.27, 5.20±0.84 mg/L, 147.24±16.20 mg/L, 6.99±0.15 and 3.75±0.37 mg/L, respectively. Temperature value for this VFARF and HFARF system was 31.1±1.1$^0$C. From monitoring study between VFARF and HFARF, it found that VFARF system was outperformed than the HFARF in removing nitrogen from domestic wastewater.

Keywords: *Domestic Wastewater, Horizontal flow aerated rock filter, Hydraulic loading rate, Vertical flow aerated rock filter.*

# MEASUREMENT OF STREAMING POTENTIAL IN DOWNHOLE APPLICATION: AN INSIGHT FOR ENHANCED OIL RECOVERY MONITORING

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## Abstract

Downhole monitoring using streaming potential measurement has been developing in order to respond to actual reservoir condition. Most studies have emphasized on monitoring water flooding at various reservoir condition and improving the approaches of measurement. Enhanced Oil Recovery (EOR) could significantly improve oil recovery and the efficiency of the process should be well-monitored. Alkaline-surfactant-polymer (ASP) flooding is the most promising chemical EOR method due to its synergy of alkaline, surfactant and polymer, which could enhance the extraction of residual oil. However, limited studies have been focused on the application of streaming potential in EOR processes, particularly ASP. Thus, this paper aims to review the streaming potential measurement in downhole monitoring with an insight for EOR application and propose the potential measurement in monitoring ASP flooding. It is important for a preliminary study to investigate the synergy in ASP and the effects on oil recovery. The behaviour of streaming potential should be investigated when the environment of porous media changes with respect to ASP flooding. Numerical model can be generated from the experimental data to forecast the measured streaming potential signal during production associated with ASP flooding. Based on the streaming potential behaviour on foam assisted water alternate gas (FAWAG) and water alternate gas (WAG) processes, it is expected that the streaming potential could change significantly when ASP flooding alters the environment and surface properties of porous media. The findings could provide new prospect and knowledge in the relationship between streaming potential and ASP mechanisms, which could be a potential approach in monitoring the efficiency of the process.

## ROAD TRAFFIC EMISSION ANALYSIS FOR SUSTAINABLE TRAFFIC IN INDUSTRIAL AREA: CASE STUDY AT SHAH ALAM INDUSTRIAL PARK

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## Abstract

The human population growth is causing urban expansion, industrialization and growth of traffic network throughout the world abreast to global development. However, urbanization, industrialization and growth of traffic network have led to environmental degradation which is providing an unhealthy environment for the human population. In pursuit of a better living environment and sustainable development, this paper discusses the aspect of urban traffic management system as road traffic is among the major contributor of pollutant in an industrial area within cities. This study determines the concentration of SO2, NO2, CO, O3 and PM10 in Shah Alam industrial area. The results shows that the level of pollutants detected at the sampling area is higher on a working day compared to a non-working day. The number of vehicle on a working day is significantly correlated to the concentration of PM10($r = 0.54$, $p < 0.05$) and O3 ($r = 0.66$, $p < 0.05$) and the number of vehicle on a non-working day is significantly correlated to the concentration of SO2 ($r = 0.71$, $p < 0.05$) and O3 ($r = 0.77$, $p < 0.05$). The results demonstrates that vehicular emission is closely related to the concentration of air pollutants. A better road traffic management system should be able to control air pollution problems in pursuit of a low carbon city to provide a better living environment and enhance liveability for urban sustainability and at the same time protecting the urban environment and urban health.

# CHARACTERIZING LOCAL GARDEN CROTON ('POKOK PUDING') LEAF POWDER AS LOW COST BIOMATERIAL FOR CHROMIUM(VI) UPTAKE

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## Abstract

This paper reports the first ever characterization of the use of raw Garden Croton (locally known as 'pokok puding') leaf powder as low cost biomaterial for Cr(VI) removal. Biosorption experiments were carried out at ambient temperature to study the effects of initial pH (1-7), contact time (15, 30, 45, 60 min), leaf powder's particle size ($\leq$ 150, 151-300, 301-500 µm), and initial Cr(VI) concentrations (10, 20, 40, 60, 80 and 100 mg/L) towards Cr(VI) uptake. Optimum Cr(VI) uptake was observed at pH 1 (2.41 mg/g) and 2 (2.19 mg/g) ($p > 0.05$). The leaf powder in the 151-300 µm size displayed better Cr(VI) uptake up to 2.77 mg/g (77.78%; $C_o = 100$ mg/L) at pH 2, after 30 min ($p < 0.05$). Equilibrium metal uptake fitted best ($R2 = 0.927$) to the Freundlich isotherm model ($Kf = 0.21$ mg/g, $n = 1.23$) indicating biosorption onto a heterogeneous surface of active sites. Morphological and elemental analyses by SEM/EDX and FTIR confirmed Cr retention, and presence of active chemical moieties. Interestingly, XRD revealed that Cr was immobilized within the biomass leaf powder in both forms, i.e. hexavalent, Cr(VI) as chromatite ($CaCrO4$) and trivalent Cr(III), as chromium(III) oxide ($Cr2O3$). Overall findings support the feasibility of the leaf powder as potential biomaterial for water pollution abatement.

# HC-SCR: NO$_X$ REDUCTION USING MN AND CU CATALYSTS IMPREGNATED IN COCONUT AND PALM KERNEL SHELL ACTIVATED CARBON

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## Abstract

The characteristics of catalysts impregnated in coconut shell (CS) and palm kernel shell (PKS) activated carbon were determined as potential precursors of catalysts used in a flue gas denitrification system at low temperature. In this study, Manganese (Mn) and Copper (Cu) with metal loading of 8% were impregnated in the activated carbon (AC) before undergoing low temperature calcination process. The morphological properties of samples was analysed using Scanning Electron Microscopy (SEM) and Brunauer, Emmett and Teller (BET) was used to determine the surface area and pore size of samples. The exhaust gas from a diesel engine at a constant flow rate of 4L/min was passed through in a fixed-bed catalytic reactor containing the catalyst, and the concentration of NOx was measured for temperatures ranging from 150°C to 250°C. It was found that the CS catalysts (CS-Mn and CS-Cu) and PKS catalysts (PKS-Mn and PKS-Cu) have the potential to reduce NOx concentration, and results showed that the metal loading of 8% resulted NOx reduction ranging from ~48% to 64%.

# DIFFERENTIAL SCANNING CALORIMETRY (DSC) AND THERMOGRAVIMETRIC ANALYSIS (TGA) OF WOOD POLYMER NANOCOMPOSITES

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## Abstract

This study evaluates the thermal property of clay dispersed Styrene-co-Glycidal Methacrylate impregnated wood polymer nanocomposite (WPNC). The WPNC was characterized by FTIR, TGA and DSC methods. FT-IR result showed that the absorbance of wave number at 1730 cm−1, increased for clay dispersed Styrene-co-Glycidyl Methacrylate wood polymer nanocomposite (ST-co-GMA-clay-WPNC). From TGA, ST-co-GMA-clay-WPNC showed better thermal stability at the temperature below 450$^o$C. The final weights of ST-co-GMA-clay-WPNC and ST-Clay-WPNC, between 420 and 700$^o$C, were significantly less than the raw wood. When the temperature was below 450$^o$C, nanoclay-incorporated surface modified wood composites showed enhanced higher thermal properties compared with those without nanoclay. From DSC, the degradation enthalpy at around 360$^o$C of ST-co-GMA-Clay-WPNC was the highest.

Keywords: *ST-co-GMA , Nanoclay , TGA , DSC*

# PHYSICAL, MECHANICAL, THERMAL AND MORPHOLOGY PROPERTIES OF BIODEGRADABLE POLYMER NANOCOMPOSITES AND ITS COMPARISON

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## Abstract

Polyvinyl alcohol (PVA) and Polylactic acid (PLA) were fabricated with the addition of nanofiller such as nanoclay and fumed silica through suitable technique namely solution intercalation film casting. These nanocomposites undergo Fourier transform infrared spectroscopy, scanning electron microscopy, tensile test and thermogravimetric analysis. FT-IR results showed that both nanocomposites were well intercalated with fumed silica and clay with the reduction of hydroxyl groups. From SEM results, it proved that clay 1.28E is more suitable to be intercalated with PLA matrix while clay 1.30E is more suitable to be introduced into PVA matrix. The addition of both nanofillers improved the tensile properties of the nanocomposites. TGA results showed that polyvinyl alcohol/fumed silica/clay (PVA/fsi/clay) had better thermal stability compared to polylactic acid/fumed silica/clay (PLA/fsi/clay) nanocomposites. Both nanocomposites are applicable in the biomedical field.

## Paper No: EC125

## INVESTIGATION OF NANOPARTICLES DISPERSION IN SODIUM HYDROXIDE (NAOH) SOLVENT

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### Abstract

Recently, the study on nanoparticles application in enhanced oil recovery (EOR) starts to growth. Nanoparticles have given better indication for EOR development such as in foam stability as its nano size particles can be feasibly dispersed in aqueous solution and easily flow through porous media. Aggregation of nanoparticles are said to be a major contributor for paralyzing nanoparticles dispersion deep into the formation. Hence, in this research sodium hydroxide (NaOH) is used as stabilizing solvents or carrier fluids in enhancing nanoparticles properties to prevent coagulation of nanoparticles when mixed to create a nanofluid. The dispersion of various concentration of silica oxide ($SiO_2$) and aluminium oxide ($Al_2O_3$) are examined by using turbidity test. Results from this research show that the silicon dioxide nanoparticles are at best to be mixed in NaOH solvent to retain longer retention time.

## Paper No: EC169

## COMPARISONS OF THE PHYSICOCHEMICAL AND FUNCTIONAL PROPERTIES OF COMMERCIALLY AND TRADITIONALLY PROCESSED SAGO STARCH

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### Abstract

Commercial sago starch was obtained from nearby supermarket while traditional sago starch (lemantak) was obtained from local wet-market. In this study, the physicochemical (moisture content, colour, particle size and microstructure) and functional properties (FT-IR spectrometer) of both types of starch were compared. Traditional sago starch (lemantak) exhibits moisture content two times higher than the commercial sago starch. Providing that commercial sago flour has been bleached in the factory, its LAB value also shows higher value than lemantak. Moreover, the particle size of sago flour is also smaller than lemantak, as the effect of multiple-refining in the factory. Meanwhile, the microstructural analysis shows significant difference that is cluster-form-granule in lemantak and disassociated-form-granule in commercial sago flour, which proof that commercial sago flour has been in an extensive process. Finally, the FT-IR results indicated that both sago flour and lemantak has similar spectrometer patterns but differ in the peak intensities, which also indicates the changes in functional properties of sago flour. Results obtained here show that the modern processing equipment as well as the chemical and drying treatment in factory, had led to the loss in some of the purity and functional characteristic in sago starch.

# PALM OIL MILL EFFLUENT TREATMENT USING COCONUT SHELL – BASED ACTIVATED CARBON: ADSORPTION EQUILIBRIUM AND ISOTHERM

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## Abstract

The current ponding system applied for palm oil mill effluent (POME) treatment often struggle to comply with the POME discharge limit, thus it has become a major environmental concern. Batch adsorption study was conducted for reducing the Chemical Oxygen Demand (COD), Total Suspended Solids (TSS) and Color of pre-treated POME using coconut shell-based activated carbon (CS-AC). The CS-AC showed BET surface area of 744.118 $m^2$/g, with pore volume of 04359$cm^3$/g. The adsorption uptake was studied at various contact time and POME initial concentration. The CS-AC exhibited good ability with average percentage removal of 70% for COD, TSS and Color. The adsorption uptake increased over time and attained equilibrium in 30 hours. The equilibrium data were analyzed using the Langmuir, Freundlich, Temkin and Dubinin–Radushkevich isotherm models. Based on the coefficient regression and sum of squared errors, the Langmuir isotherm described the adsorption of COD satisfactorily, while best described the TSS and Color adsorption; giving the highest adsorption capacity of 10.215 mg/g, 1.435 mg/g, and 63.291 PtCo/g respectively. The CS-AC was shown to be a promising adsorbent for treating POME and was able to comply with the Environmental Quality Act (EQA) discharge limit. The outcome of treated effluent using CS-AC was shown to be cleaner than the industrial biologically treated effluent, achieved within shorter treatment time.

# ADSORPTION OF COLOUR, TSS AND COD FROM PALM OIL MILL EFFLUENT (POME) USING ACID-WASHED COCONUT SHELL ACTIVATED CARBON: KINETIC AND MECHANISM STUDIES

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## Abstract

The disposal of palm oil mill effluent (POME) without proper treatment before being discharged into natural water sources has become undesirable because of high concentration of suspended solid (SS), oil and grease (O&G), chemical oxygen demand (COD) and biological oxygen demand (BOD). This study investigated the feasibility of removing colour, total suspended solid (TSS) and COD using acid-washed coconut shell based activated carbon (CSAC) through the evaluation of the adsorption uptake as well as the adsorption kinetics and mechanism. The percentage removal of colour, TSS and COD from POME onto CSAC were 61%, 39%, 66%, respectively achieved within 48 hours of contact time. The kinetic models studied were pseudo-first-order (PFO), pseudo-second-order (PSO), and Elovich models. The intra-particle diffusion (IPD) model was studied to interpret the adsorption diffusion mechanism. The adsorption of colour, TSS and COD onto CSAC were best interpreted by the PSO model, and well fitted by the Elovich model. The IPD and Boyd plots indicated that IPD and film diffusion controlled the adsorption of colour, TSS and COD onto the CSAC.

# EFFECT OF ACTIVATED CARBON IN PSF-PEI-AG SYMMETRIC MEMBRANE

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## Abstract

Polysulfone (Psf) composite membrane consist of activated carbon, polyethyleneimine and silver nitrate was prepared by phase inversion. The activated carbon (AC) act as adsorbent to adsorb heavy metal present in synthetic waste water while polysulfone membrane act as support. Phase inversion was carried out on different composition of activated carbon from 0 to 0.9% while other component are remain constant. The surface morphology of composite membrane was characterized by scanning electron microscopy (SEM) while heavy metal absorption was quantified by atomic absorption spectrometer (AAS). The SEM image show symmetric membrane matrix with sponge structure. The composite membrane with 0.9wt% AC has the highest water flux as well as removal of heavy metal (chromium, lead, silver and cadmium) compare to composite membrane with 0.3wt% AC and 0.5wt% AC. The percentage of heavy metal reduction by composite membrane 0.9wt% AC was 35% cadmium, 19% chromium, 16% silver and 2% lead. The result indicated that the introduction of 0.9wt% AC indeed plays an important role towards enhancing the adsorption of heavy metal in water.

**Paper No: EC042**

# A COMPARISON STUDY OF STUDENTS' PERFORMANCE IN PRE AND POST RESULT OF A MATHEMATICS COMPETENCY TEST

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## Abstract

The objective of this study was to compare the performance of Engineering Technology (ET) students' in a Pre and Post Mathematics Competency Test during their first year of study at the Faculty of Engineering Technology (FTK), Universiti Teknikal Malaysia Melaka (UTeM). This article also aims to examine the student's understanding in the area of Mathematics, particularly in Algebra, Trigonometry and Functions. A total of 176 first year students from the Department of Mechanical Engineering Technology (JTKM) were chosen to answer the Mathematics Competency Test. The pre-test was held in the first week of the semester, while the post-test was held during the second semester. The results showed that the students' performance in post-test was better compared to that pre-test. However, statistical analysis on students' performance by each question showed that most of the students did not understand the basic concepts in Algebra, Trigonometry and Functions.

**Paper No: EC057**

## COMMUNICATING SCIENCE TO THE PUBLIC

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## Abstract

It is not adequate to rely on our education system alone to provide our citizens the knowledge they will need to navigate effectively in today's highly technical society and make well-informed policy choices. There has been an outright explosion of new knowledge and no one person can know it all. To bring accurate, relevant information from the front lines of research to the pages of newspapers, the general public and academics must be willing and able to communicate with each other. But as the author found, this does not always come easily. Academics complained that the publics didn't understand many of the basics of their methods, including peer review, the incremental nature of research, and a proper interpretation of statistics. Conversely, the general population complained that academics get wrapped up too much in the jargon about such matters and fail to explain their work simply and cogently. The result of this apparent impasse is that good, important knowledge may go begging for lack of communication. While many major newspapers do a superb job of covering research, majority of it often do not have the wherewithal to devote precious resources to science stories that are often difficult to write and may not attract a wide audience. The writing and hence the communication of these stories requires mutual trust between the academics who is the object of the story and the reader who reads it.

# FTK STUDENTS' PERFORMANCE IN MATHEMATICS: COMPARISON BETWEEN SPM AND FIRST YEAR EXAM

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## Abstract

In the last 20 years, mathematics teaching and learning encounters quite a big problem, especially at the tertiary level. The main concern always surrounds the students' achievement in the subject matter. Students' performance in mathematics at first year is reflected by the students' mathematical background prior to the admittance into the university. The study examined 165 first year students in the Faculty of Engineering Technology (FTK) who took the Mathematics Competency test upon entering the university at the beginning of their first semester. A test consisted of 40 fundamental mathematical questions which students have learned them before. From the result, 84% of these students failed this test. However, looking at their Sijil Pelajaran Malaysia (SPM) mathematics result during Form Five (12th grade) in school, the majority did quite well in that exam. These students also took a first year mathematics course which is Technical Mathematics at the same semester. At the end of the semester, the result of their Technical Mathematics course seemed to be quite good. The performance of these three mathematics results was being compared and studied.

# THE DEPENDENCY OF ENGINEERING TECHNOLOGY STUDENTS' TOWARDS THE USAGE OF CALCULATOR IN MATHEMATICS

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## Abstract

Calculators are one of the important technology used to solve mathematical computations. It also can be the tool for learning mathematics if it is used appropriately. However, too much depends on calculator can be harmful to students ability to solve simple mathematical problem. The purpose of this study is to examine the dependency of students in Faculty of Engineering Technology (FTK), Universiti Teknikal Malaysia Melaka, on the usage of calculator to solve the mathematical problems. A sample of 383 first year Engineering Technology (ET) students' taking mathematics subject are selected from five different course. Students were examined based on the results of Mathematic Competency Test and the survey from a questionnaire that covers questions regarding the students' enjoyment on the usage of calculator and the usefulness of calculator in mathematic activities. The investigation yield a result showing that the students has a high dependency on using calculator to solve mathematical problem.

## ASSESSING URBAN AND RURAL TEACHERS' COMPETENCIES IN STEM INTEGRATED EDUCATION IN MALAYSIA

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### Abstract

In order to fulfil the need of sizeable skill workers, Malaysia will introduce STEM integration education in mainstream schools throughout the country. However, like any educational reform, one important issue that needs to be taken into account is the teachers' readiness especially in terms of their skills and competency in implementing the reform.

As such, the purpose of this study is to assess differences between teachers' competency for STEM integration education between urban and rural teachers. A total of 244 teachers (urban = 129, rural = 115) are employed as sample in this cross-sectional quantitative study. Responses from an 18-item questionnaire were analysed using Rasch Model analysis to determine characteristics of item that measure competency between urban and rural teachers. The DIF analysis shows that items related to competency in (1) ICT integration, and (2) organizing co-curricular activities showed a significant difference in their measures between both sets of teachers. The result from this study would certainly provide useful information to relevant stakeholders, especially with regards to providing training for the teachers in the designated areas.

## ACADEMICS AND LEARNERS' PERCEPTIONS ON BLENDED LEARNING AS A STRATEGIC INITIATIVE TO IMPROVE STUDENT LEARNING EXPERIENCE

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## Abstract

The increasingly tighter shift of socio-economic constraints on higher education sectors in the recent year has called for greater flexibilities in student learning experience both locally and abroad. To this end, we have recently implemented a Blended Learning Initiative in an attempt to provide better learning support and greater flexibility to our students. This initiative is also in line with the University's aim of having 50% of our learning and teaching delivered on-line by 2020. In this report, we present our findings on academics and learners' perceptions on the approach which were obtained through surveys. Results showed that blended learning approach was new to the academics and the factors for successful blended learning implementation were identified. Results also showed that learners appreciated the approach as it made learning more accessible and flexible. Furthermore, they also enjoyed the interesting online activities incorporated into their units. In addition, learners were also able to review and pace their own learning. They also perceived that they have the access to the resources and technical ability to cope with online learning materials and activities. Nonetheless, the survey also revealed that learners still prefer to have academics delivering information to them directly rather than a flipped classroom model. In conclusion, findings from this study provide insights that blended learning could be effective to supplement courses offered by the faculty.