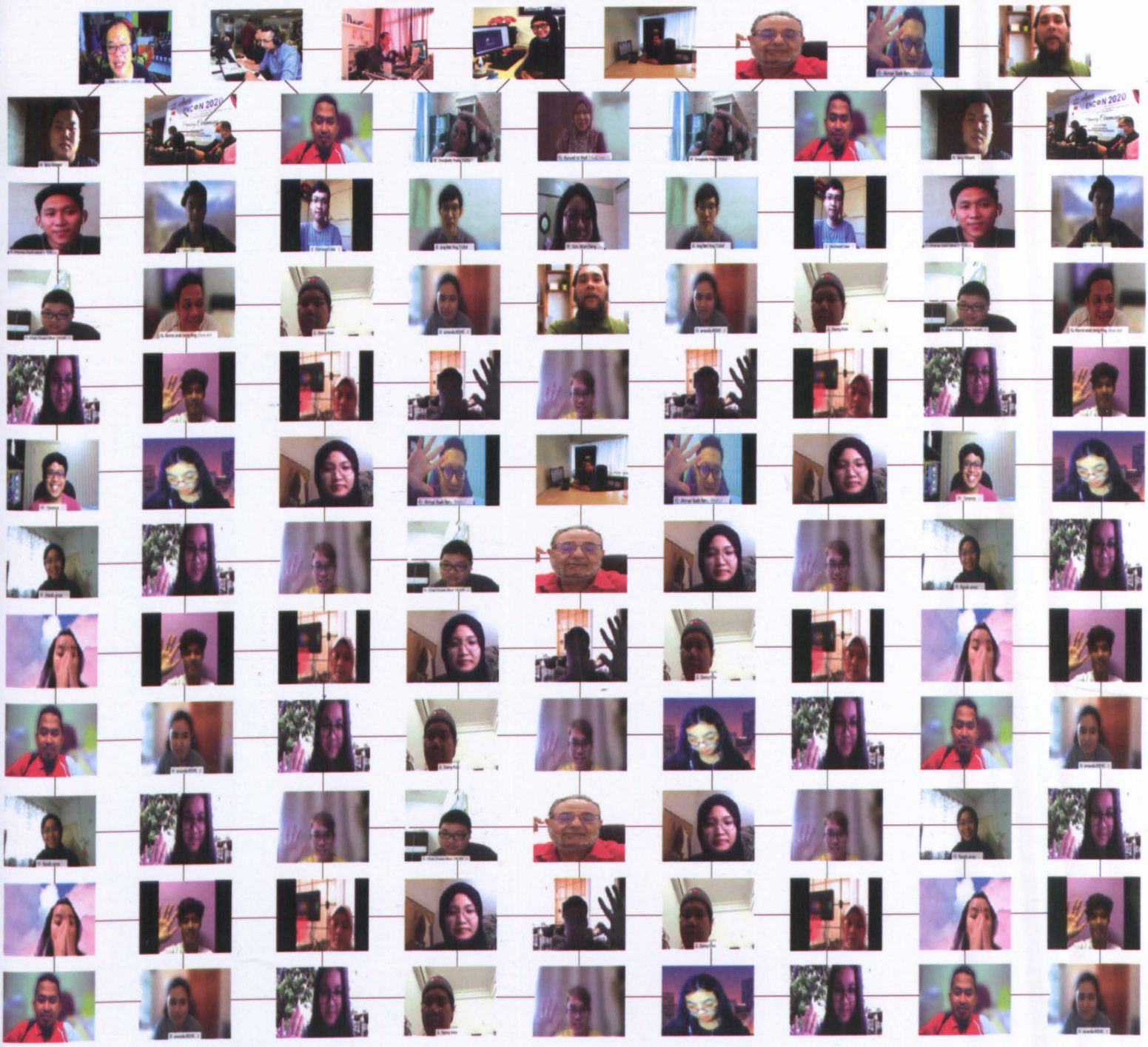
Research Bulletin
Faculty of Engineering
Universiti Malaysia Sarawak

FENG BULLETIN

www.feng.unimas.my ISSN1985-2894 Volume 12 , January 2021



Challenges & Opportunities in The New Norm

EDITORIAL NOTE

FENG RESEARCH BULLETIN

PUBLISHER
Faculty of Engineering
Universiti Malaysia Sarawak
94300 Kota Samarahan
Sarawak, MALAYSIA

Vol. 12, January 2021
ISSN 1985 -2894

Printer
Lee Ming Press Sdn Bhd
Lot 2050, Jalan Swasta,
Pending Industrial Estate
93450 Kuching
Sarawak, MALAYSIA

Editorial Policy
The FENG Research Bulletin is a publication of the Faculty of Engineering, Universiti Malaysia Sarawak (UNIMAS). It publishes current information on Research Activities, Research Publications, Research Findings, Recent Research Equipments, Conferences, Seminars and Resarch Students of Faculty of Engineering, UNIMAS.

EDITORIAL NOTE

This is the FENG Research Bulletin for the year 2020. As it is widely known, research endeovours with persistent and sustained efforts may well lead to impactful results. When research is done in the field of Engineering, it could have multifold implications not only on the industry but also on the academia.

The theme of the bulletin, which is Challenges and Opportunities in the New Norm, is covered through four feature articles. The main article from Civil Engineering looks at the contactless fabrication of a pre-cast lean concrete green pavement system, using renewable materials, that requires minimal number of workers in line with the new norm. The mini article from Electrical and Electronic Engineering examines the impact of COVID-19, under the Movement Control Order (MCO), on the electric load demand profile in peninsular Malaysia as compared with similar periods in 2019. The article from Chemical Engineering describes a solar-based sustainable energy provision alternative that not only fulfils the energy needs of rural dwellers in Sarawak, but also provides them with an air-conditioning system to enhance their quality of living. The article from Mechanical Engineering provides a perspective on using Internet of things (IoT) dashboards to remotely monitor the energy efficiency of boiler feedwater systems to maintain contactless supervision of plants, in line with the new norm.

FENG Research Bulletin Team

CONTENTS

MESSAGES

Assoc. Prof. Ir. Dr Siti Noor Linda bt Hj Taib
Dean,
Faculty of Engineering, UNIMAS

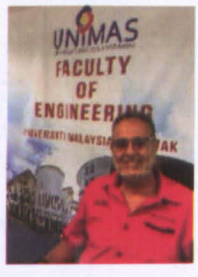
Dear Readers,

It is indeed my great pleasure to share with you our latest edition of FEng Research Bulletin. This bulletin serves as a medium for us to highlight significant research works, activities and achievements of our academics. The year 2019 witnessed the wide spectrum of achievements in the faculty from attaining the most coveted grants in the country like the Sarawak Research and Development Council Grants, Ministry of Higher Education Grants to attaining grants from TERAJU to help improve the socioeconomic status of communities through technological innovation. You will be particularly intrigued by how our researchers incorporate technologies into solving local issues. Take for example, a group of Mechanical Engineering researchers working on a clean and efficient tool to collect palm sugar from our local Pokok Apong or maybe you shall be further amazed to know that our international researchers solving local issues which are not familiar to them! Looking at the research works performed, I am proud to declare of our strong conviction in ensuring full benefit to our communities and nations in all of our research efforts. We will go strong in years ahead with this in mind.

Sincere appreciation to the editorial team for your great teamwork in the production of this research bulletin.

Enjoy reading and do contact us for further information.

Assoc. Prof. Dr Mohamed Abdel Moneim Shaaban
Chief Editor



The biggest story of this year 2020 has been the COVID-19 pandemic and its worldwide impacts. As the virus was rippling across the globe, so much has changed. This includes the way we interact with one another, the way we travel, and the way we conduct business. With the movement control order (MCO) and ist variants imposed in Malaysia, many personal, social and working habits are changing to adapt to the new norm. The pandemic has also raised challenging issues of isolating crews to prevent the spread of the disease, distance education, remote working and contactless modus operandi. Inasmuch as COVID-19 has posed significant challenges to the engineering and technology practices, it opened new opportunities that may have a lasting impact on the profession.

The theme of this issue of the bulletin is '*Challenges and Opportunities in the New Norm*'. The authors from different Faculty Departments are presenting some of these emerging engineering challenges and the associated opportunities of research solutions. A brief outline of these articles was articulated in the editorial note in the front page.

I would like to express my appreciation to all authors of articles and contributors to this issue of the FEng research bulletin. I also want to thank all members of the editorial board for their respective efforts and dedicated time to bring the bulletin to its final shape. As a novice chief editor to the FEng research bulletin, I thank Dr Jethro Anak Henry Adam who went above and beyond the call of duty to assist me closely with the preparation of this issue.

FEATURE ARTICLE

Machine Made StormPav Green Pavement for Contactless Lean Construction

By: Prof. Dr M. A. Mannan (mannan@unimas.my), Norazlina Bateni and Dr Darrien Yau Seng Mah



Abstract

The rapid urbanisation creates increased impervious landscape which triggers increased runoff resulting flash flood among others. The socio-economic activities are disrupted by this flash flood. An investigation using on-site micro-detention pond with machine-made concrete blocks to be known as StormPav green pavement was formulated to minimise this flash flood issue especially on flat land. This green pavement is able to hold stormwater detention of 0.19m^3/m^2 pavement surface area which is capable of providing stormwater detention for 3 hours' continuous rainfall with magnitude of 10-year Average Recurrence Interval (ARI) as worst case scenario. Precast concrete product, StormPav offers better structural efficiency with high safety factor due to superior product geometry and engineering performance. In line with Industrialised building system (IBS) and Lean construction concept, StormPav green pavement is able to enhance early access in trade. Overall, StormPav green pavement contributes to economic gain, social and environmental benefits as sustainable and resilient infrastructure in new normal with contactless fabrication for total gain.

Keywords: Sustainable and resilient infrastructure, Flash floods and stormwater runoff, StormPav green pavement, Lean construction product, Contactless fabrication

Introduction

The rapid urbanization due to exponential growth of population and demand has shifted natural landscape to increased impervious surfaces. The impact of impervious surface is directly related to an increase in runoff volumes and substantially increased frequency of flash flood. Flash flood is a body of water overflows on land that is not normally submerged and subsides after only a few hours. Flash flood is caused by various factors such as high rainfall intensities, impermeable pavement, blocked and silted drainage, and improper garbage disposal.

The developing countries especially South-East Asia, China, India, Indonesia and Vietnam show the highest growth rates in the construction sector. The global Civil Engineering Market size is expected to reach USD 11.72 trillion by 2025. IBS is identified as construction technique in which components are produced in a controlled environment (on or off site), transported, positioned and assembled into a structure with minimal additional site works. Use of IBS in construction has several advantages such as (i) Reduction of unskilled workers, (ii) Less wastage, (iii) Less volume of building materials, (iv) Increased environmental and construction site cleanliness, (v) Better quality control, etc. These advantages also promote a safer and more organized construction site, and shorten construction time. Lean construction in another aspect is being practiced globally with aim of decreasing time, effort, and waste of materials. It ensures that lower costs are incurred during the building process.

Rapid urbanization also has triggered for sustainable and efficient infrastructure solutions. The annual worldwide concrete usage standing at 2.7 billion m^3 has caused serious depletion of non-renewable natural stones used in concrete production. It is noted that nearly 80% of the resources used today in construction industry are non-renewable. Due to the scarcity of conventional raw materials, there is a great opportunity to use lean construction product through contactless fabrication to reduce production cost under new-normal construction practice.

Therefore, it is an aim to formulate green pavement with on-site micro-detention pond using machine-made lightweight-structure as user-and environmental-friendly, and cost effective.

Methodology and Findings

The shape and size of precast StormPav (given name) green pavement system were determined early, based on several factors including lean construction concept. Figure 1 shows shape of StormPav blocks. The moist mix design of concrete to meet machine-made is formulated as shown in Table 1, with targeted 28-day compressive strength of 50MPa. The appearance of moist mix concrete sample is shown in Figure 2. The crushing strength of hexagonal block (Figure 3) has attained of more than 100kN which is more than 20kN as wheel load mentioned in Hong Kong Pavement design guideline (Figure 4). The shear capacity of interlocked key has been performed (Figure 5) to meet monolithic property of this pavement system.

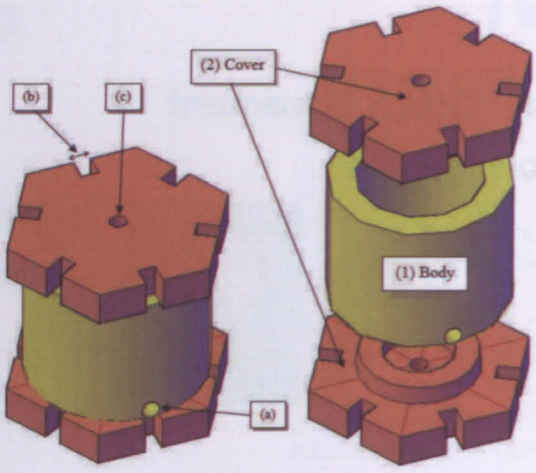


Figure 1: Shape of precast StormPav green pavement blocks

Table 1: Concrete mix proportion and mechanical properties

Moist mix (kg/m³)						Compressive strength (N/mm²)			Cover block, crushing load (kN)
Binder		Fine aggregate		Water	Non-met. fiber	7-day	14-day	28-day	28-day
OPC	SCM	River sand	M. sand						
315	315	616	924	252	3	39	48	60	>100 [minimum requirement = 20kN/wheel]

Note: OPC- ordinary Portland cement; SCM- Supplementary cementitious material; M.- Manufactured; Non-met. - Non metallic

Figure 2: Appearance of moist mix condition

Figure 3: Crushing load capacity determination of cover block using circular load and circular support (Ref. Figure no. 4)

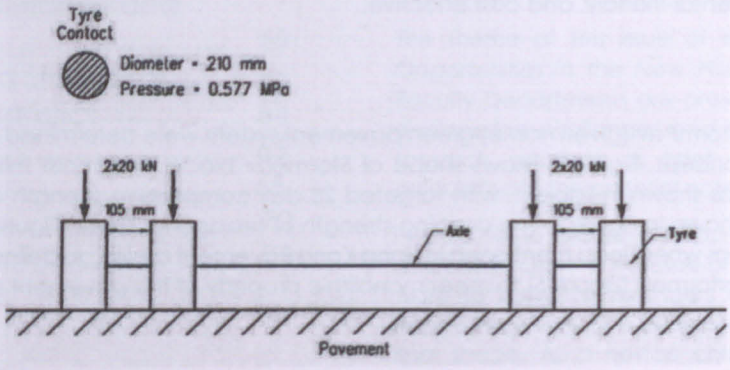


Figure 4: Load configuration of standard axle with 80kN single axle dual-wheel (Hong Kong ref. no. RD/GN/042)

Figure 5: Shear strength determination of Interlocking keys for StormPav blocks

The details of StromPav blocks are shown in Table 2. The health safety of construction workers is of utmost importance. In new normal situation, the expenditure due to site-sanitization during construction is additional burden. This sanitization cost is able to minimise with employing full-automated manufacturing facility where minimum workers are involved. As such, minimum workers are required to fabricate StormPav blocks using full-automated manufacturing machines as shown in Figures 6 and 7. Figure 8 shows machine-made StormPav blocks.

The general comparisons among Flexible, Rigid and StormPav green pavement are shown in Table 3. The typical arrangement of both conventional flexible and StormPav green pavement is shown in Figure 9. Figure 10 shows the location of tensile strain occurrence in StormPav and conventional flexible pavement. Table 4 shows the post construction performance and cost comparisons among Flexible, Rigid and StormPav green pavement. Table 5 brings comparable studies on Greenhouse gas, embodied energy, LEEDS and GBI among Flexible, Rigid and StormPav green pavement. The lorry mounted crane can be employed easily for loading and un-loading of StormPav blocks (Figure 11). The StormPav green pavement system is shown in Figure 11 with pleasant appearance and strength capacity check. The potential remarks of StormPav green pavement on hydrological, heat island effect, trapping of pollutant, water cycle benefit and internal air circulation on accelerating snow melting etc. are shown in Table 6.

Table 2 Materials for machine-made StormPav green pavement

Description	Properties
Fibre reinforced concrete using 50% SCM	Grade 50 (50MPa) at 28-day
Number of units made using 1m^3 concrete	24 units (1 unit = 2 Hexagonal blocks and 1 Hollow cylinder block)
Area coverage with 24 units	4 m^2 pavement area
Units required for 1m^2 pavement area	6 units
Weight of StormPav pavement	576 kg/m^2 pavement area
Pavement thickness	450mm
Weight of one Hexagonal block	28 kg
Weight of one Hollow cylinder block	40 kg
Production capacity of Hexagonal blocks using Machine-1	720 nos./ 8 hrs operation daily (pavement covering area = 60m^2)
Production capacity of Hollow Cylinder blocks using Machine-2	480 nos./ 8 hrs operation daily (pavement covering area = 80m^2)

Figure 6: Full-Automated Manufacturing of Hexagonal block machine-1

Figure 7: Full-Automated Manufacturing of Hollow cylinder block machine-2

Figure 8: Shape of StormPav blocks made using machines (ref. Figures 6 and 7)

Table 3 General comparisons among Flexible, Rigid and StormPav green pavement

Description	Conventional Pavement		StromPav Pavement
Pavement type	Flexible Pavement	Rigid Pavement	
Type of fabrication	Hot Mix Asphalt made in-situ in solid form	Cast in-situ or precast concrete in solid form	Precast solid & hollow blocks
Machine made product	No	No	Yes
Factory produced as IBS	No	No, if cast in-situ Yes, if Precast	Yes
Design principle	Empirical method	Elastic theory	Elastic theory
Material type	Granular materials	Prestressed concrete/ Reinforced concrete/ Plain concrete	Fibre reinforced concrete with SCM
Material consumption, kg/m² pavement area	Very large (i) Heavy loaded: [800mm thick] = 1,800 (ii) Carpark: [450mm thick] = 960	Large Heavy loaded: [265mm thick concrete+300mm thick subbase] = 1,300	Low [450mm thick]=576
Flexural strength	Low or Negligible	High flexural strength	High flexural strength
Wheel load transfer	Grain to Grain contact	Beam action	Beam action
Excessive loading [20kN/wheel for 80kN single axle dual-wheel, Hong Kong RD/GN/042]	Local depression resulting rutting etc.	Crack formation	Crack formation in hexagon block for load of more than 100kN
Load induced Stress	Transmit vertical and compressive stresses to lower layers	Tensile stress	Tensile stress only
Thermal stress development and expansion joint	No	Yes, Required Expansion Joint	No
Strength of Road	Highly dependent on Subgrade strength	Less dependent on strength of subgrade	Less dependent on strength of subgrade
Load induced Subgrade deformation	Yes, transferred to upper layer	No	No
Speed of construction/installation	Slow [several layers]	Slow	Rapid [precast system]
Machinery involvement in installation/road construction	Several Heavy machinery	Several Heavy machinery	Light machinery for production, lifting and installation
Skilled workers involvement in pavement construction	Yes	Yes	Machinery driven pavement installation [to be developed]

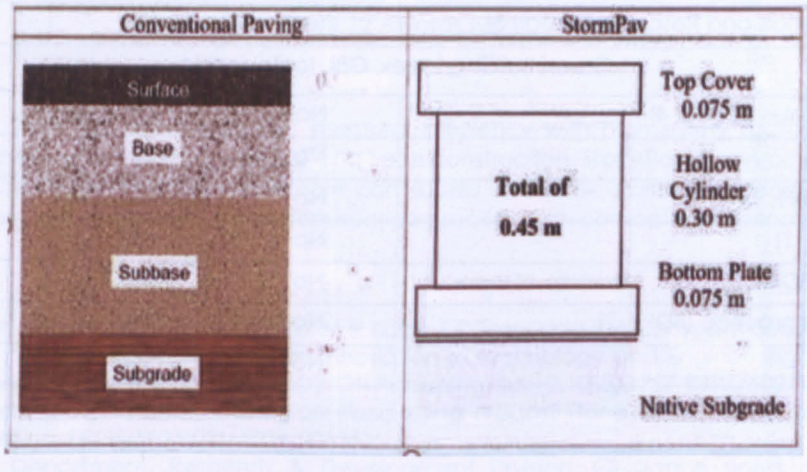


Figure 9: Typical arrangement of both conventional flexible and StormPav green pavement

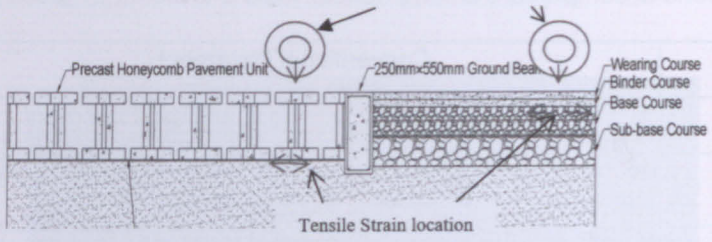


Figure 10: Location of tensile strain in StormPav and conventional flexible pavement

Table 4 Post construction performance and cost comparisons among Flexible, Rigid and StormPav green pavement

Description	Conventional Pavement		StromPav Pavement
Pavement Type	Flexible Pavement	Rigid Pavement	
Pavement Settlement	Differential	Uniform	Uniform having interlocked and monolithic characters
Repair cost	High [required frequent repairing over a period]	Low	Expected to be minimum [required field data]
Opening to Traffic	Within a day	14 (!) days until achieving design strength [cast in situ]	Immediate
Pavement Repair	Slow	Slow	Very rapid [precast system]
Initial investment	Medium	High	Low
Cost and Time Effective	No	No	Yes

Table 5 Comparison among Flexible, Rigid and StormPav green pavement on Greenhouse gas, embodied energy, LEEDS and GBI

Greenhouse gas (GHG) and Embodied energy (EE)			
Description	Conventional pavement		StormPav green pavement
Pavement type	Flexible	Rigid	
Greenhouse gas emission for concrete usage in 1 m^2 road area, KgG/m^2 area (0.16KgG/Kg of concrete)	-	101.76	92.16
Embodied energy required for concrete usage in 1m^2 road area , MJ/m^2 area (1.6MJ/kg EE of concrete)	-	1,017.6	921.6
U.S. Green Building Council's Leadership in Energy & Environmental Design (LEED)			
Sustainable Sites (Credit 6.1)	No	No	Yes
IBS concrete products for other environmental benefits, such as reducing heat island effects (Sustainable Site Credit 7.1)	No	No	Yes
Regional materials (Materials and Resources Credit 5).	Yes	Yes	Yes
Green Building Index, GBI, for Township			
Heat Island design principles (CEW1, 4)	No	No	Yes
Health design (CPD6, 2)	No	No	Yes
Low impact material (BDR1, 1)	No	No	Yes
Regional material (BDR3, 1)	No	No	Yes
Quality in construction (BDR4, 2)	No	No	Yes
Sustainable construction practice (BDR7, 2)	No	No	Yes
Innovation (BSI2, 6)	No	No	Yes

(a) Loading and unloading of StormPav blocks using lorry mounted crane

(b) Pleasant view of exposed surface of StormPav green pavement

(c) Functionality verification of StormPav green pavement using light vehicles

(d) Functionality verification of StormPav green pavement using loaded truck

Figure 11 Functionality verification of StormPav green pavement

Table 6. Hydrological, Thermal and related performances of StormPav green pavement

Description	Remark
Stormwater detention of 0.19m^3/m^2 pavement surface area	Yes
Capable of providing stormwater detention for 3 hours continuous rainfall with magnitude of 10-year ARI as worst case scenario	Yes
Able to provide surface permeation at 180mm/hr of rain water to detention storage	Yes
Lowering heat island effect having empty space of 0.19m^3/m^2 pavement surface area	Yes
Trapping of pollutant and low risk in subsoil pollution	Yes
Providing high buffering capacity on acidic rainfall	Yes
Potential water cycle benefit through filtration	Yes
Accelerating melting of snow due to internal air circulation	Yes

Figure 12 Awards won

Conclusion:

Precast concrete product, StormPav offers excellent structural efficiency with high safety factor due to superior product geometry and engineering performance. In line with IBS and Lean construction, StormPav green pavement is able to enhance early access in trade. Overall, StormPav green pavement contributes economic gain, social and environmental benefits as sustainable and resilient infrastructure at new-normal construction practice with contactless fabrication for total gain.

References:

1. E E Putri, F J H Rewani, M A Mannan, W H W Ibrahim, M R Kabit, L S Tirau, and R A Chan @ R Buking, 2019, Sensitivity analysis of StormPav composite pavement, Conference on Innovation in Technology and Engineering Science, IOP Conf. Series: Materials Science and Engineering 602 (2019) 012100 IOP Publishing doi:10.1088/1757-899X/602/1/012100
2. Final Report, 2017, Performance of Micro-detention Pond using Precast Honeycomb Structure for Green Pavement in Housing Area, ERGS grant no. ERGS/TK03(02)/1009/2013(06)
3. Hong Kong, Highways Department, Research & Development Division, Guidance notes on pavement design for carriageway construction, RD/GN/042, September 2013

An Overview of Covid-19 Impact on Power Grid Operation in Malaysia

By: Assoc. Prof. Dr Ahmed M. A. Haidar (ahahmed@unimas.my)

The first notable impact of COVID-19 on the states and regions connected to the National power grid in peninsular Malaysia was a decreased ramping of load demand, particularly during usual peak demand hours. Due to the uncertainty in the transmission rates of this pandemic, the electricity demand will continue to fluctuate because of the change in human behavior and lifestyle globally.

The daily electricity demand in Malaysia has been reduced significantly during the dark days of COVID-19 pandemic, as Malaysia was compelled to reduce the business and commercial activities to combat the threat of the virus. The COVID-19 pandemic lockdown which has been extended several times was the main factor behind the increase in residential load [1]. On the contrary, the commercial and industrial electricity loads have been dropped at levels not seen for a long time, since many employees were prompted to work from home.

This mini-article aims to highlight the scenarios of the national power grid with the economic impact faced by power utilities during the movement control order (MCO, 25 March to 12 May 2020), conditional MCO (CMCO, 13 May to 9 June 2020) and recovery MCO (RMCO, 7 June to 31 August 2020)[2].

COVID-19 induced reductions in energy demand which has undermined revenues for most power generation. The high surplus baseload generation condition observed during MCO was problematic for coal and hydro power stations. Figures 1- 6 show the difference between the generated power before COVID-19 (2019) and during COVID-19 (2020). As seen in Figure 2, a reduction of the energy generation from gas power stations is observed compared to Figure 1.

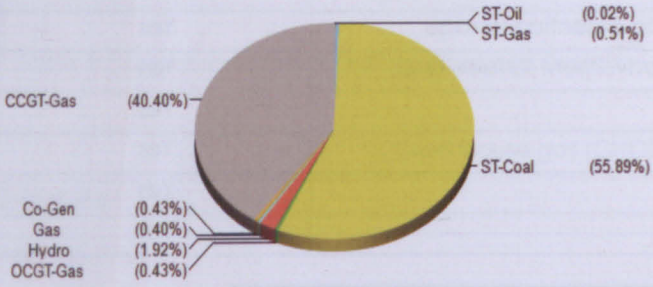


Figure 1: Power generation from 20/03/2019 to 17/05/2019

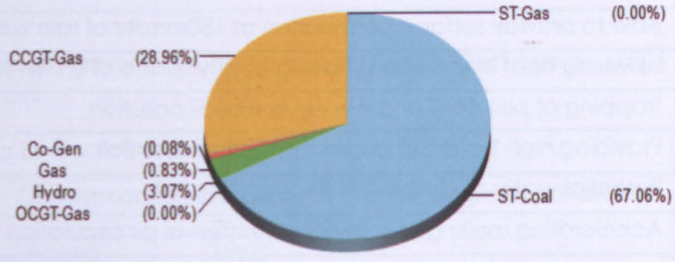


Figure 2: Power generation from 20/03/2020 to 17/05/2020 during MCO

The preventive measures taken by the federal government of Malaysia from MCO to CMCO and then, to RMCO have boosted the power generation gradually (see Figures 4 and 6) close to the normal level as in Figures 3 and 5. It is worth mentioning that the total generated energy from hydro power stations over the period of movement restriction was higher compared to the last year.

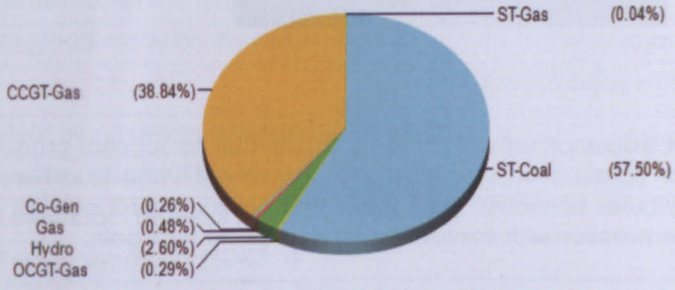


Figure 3: Power generation from 10/05/2019 to 12/06/2019

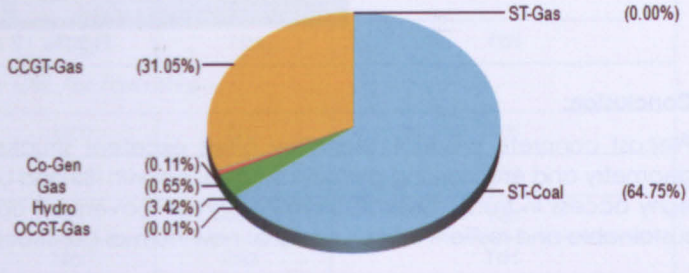


Figure 4: Power generation from 10/05/2020 to 12/06/2020 during CMCO

[1] The data has been obtained from the grid system operator (https://www.gso.org.my/), Energy Commission of Malaysia.

[2] New Straits Times Malaysia June 7, 2020 @ 3:08 pm

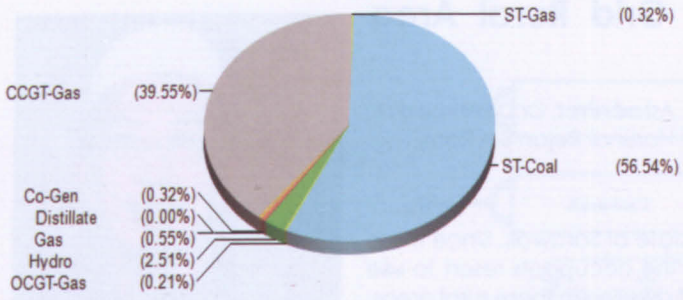


Figure 5: Power generation from 05/06/2019 to 03/09/2019

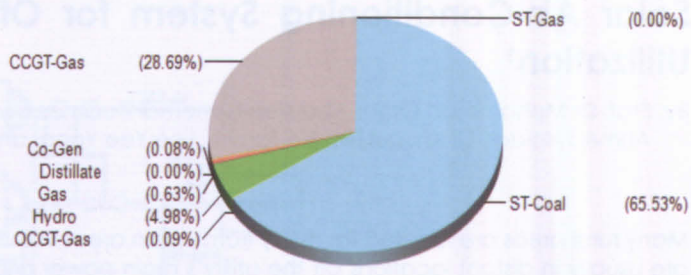


Figure 6: Power generation from 05/06/2020 to 03/09/2020 during RMCO

The impact on demand due to COVID-19 restrictions, differ according to the preventive measure imposed at each period. For instance, mitigation efforts to eliminate the risk of the pandemic during MCO have caused a significant reduction in the daily electricity demand as seen in Figure 7. Unlike, the energy consumption in 2019, the confinement measures (25 March to 12 May 2020) have resulted in a high reduction of energy consumption throughout the lockdown period. The decline of energy consumption during CMCO as seen in Figure 8 indicates the uncertainty in load demand. Gradual recovery of activities after easing the restrictions has stabilized the load profile during the RMCO as depicted in Figure 9. It can be concluded from the data that the application of full lockdown has painfully affected the energy production due to the accelerated demand reduction in (March–April) to approximately 22%, as compared to the same period in 2019.

Generally speaking, the global movement restrictions have impacted world economies in an unprecedented scale. Malaysia is no exception with more reductions in the household income and loss of jobs. As such, it is still early to fully evaluate the impacts of COVID-19 on the national power grid and its operation cost as the coronavirus still continues to spread around the world. The unforeseen circumstances of COVID-19 and its unpredictable nature will indeed open new horizons in the research related to power grid planning and operation.

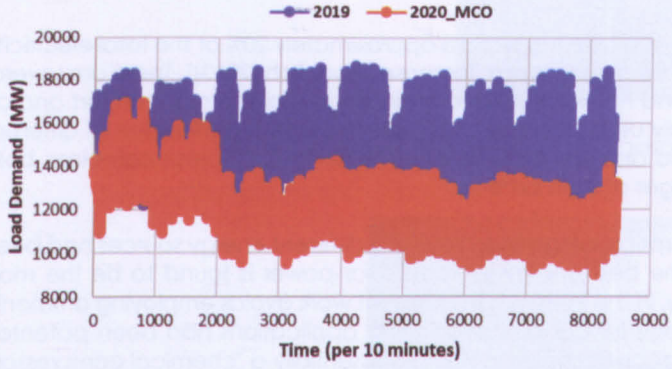


Figure 7: Daily electricity demand from 20 March to 17 May (2019 and 2020), data recorded every 10 minutes

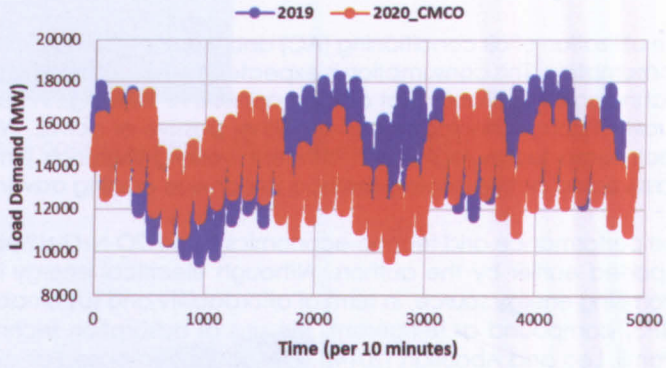


Figure 8: Daily electricity demand from 10 May to 12 June (2019 and 2020), data recorded every 10 minutes

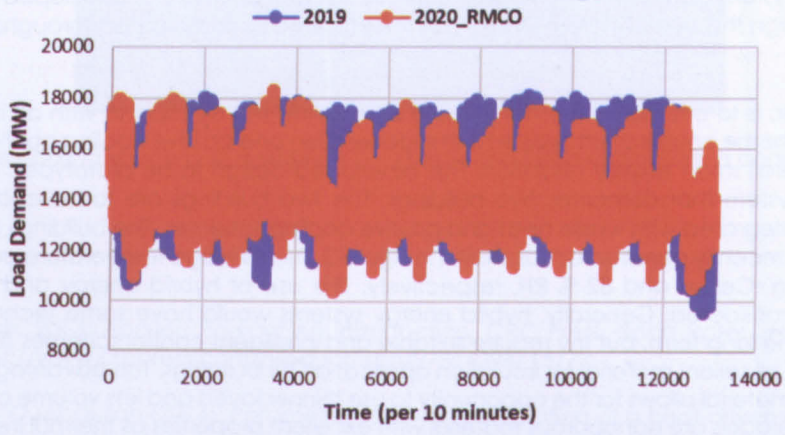


Figure 9: Daily electricity demand from 05 June to 03 September (2019 and 2020), data recorded every 10 minutes

Solar Air-Conditioning System for Off Grid Rural Area Utilization[1]

By: Prof. Dr Mohammad Omar Abdullah (amomar@unimas.my), Assoc. Prof. Dr Dr Ahmed M. Ahmed Haidar, Dr Khairul Fikri Bin Tamrin, Lee Yee Yong, and Harunal Rejan Bin Ramji

Many rural areas are located far away from urban areas in the state of Sarawak. Since these are usually in distant locations off the utility's main power grid, the occupants resort to use diesel generators to satisfy their energy demands. The majority of dwellers in these rural areas, however, are of the low-income category who tend to live in low-cost houses. Many of such rustic houses are deprived of air-conditioning, although the houses are hot and humid. When there is no outdoor wind together with hot sun periods, in particular from 11:30 am till 5:00 pm, occupants are usually complaining about the hot and humid climate. They are even sweating at times. This, in turn, creates an uneasy feeling of discomfort.

Many rural areas are located far away from urban areas in the state of Sarawak. Since these are usually in distant locations off the utility's main power grid, the occupants resort to use diesel generators to satisfy their energy demands. The majority of dwellers in these rural areas, however, are of the low-income category who tend to live in low-cost houses. Many of such rustic houses are deprived of air-conditioning, although the houses are hot and humid. When there is no outdoor wind together with hot sun periods, in particular from 11:30 am till 5:00 pm, occupants are usually complaining about the hot and humid climate. They are even sweating at times. This, in turn, creates an uneasy feeling of discomfort.

While the initial cost of the diesel generator is relatively reasonable, merely RM4500, its operation cost is high. During the movement control order (MCO) and its subsequent variants, that were imposed nationwide to limit the spread of the coronavirus COVID-19, the economic conditions have deteriorated. Low-income households in the rural areas suffered the most due to this pandemic. They were even compelled to stay at home for longer periods of time, which has aggravated their uneasy feeling of discomfort. There is a need to develop a modular, cheaper, and sustainable alternative for diesel generation that not only fulfils the energy needs of rural dwellers in Sarawak, but also provides them with an efficient energy system that has an air-conditioning mechanism to enhance their quality of living.

The utilization of air conditioning (AC) and electrical fans in facilities all over the world is approximately 20% of the total electricity consumption. This consumption is expected to rise depending on the demographic increase [Abdullah (2013)]. There are several technologies available that can be applied to buildings in hot and humid regions to maintain indoor thermal comfort and air quality. Such technologies can be either passive or active. Widely used active technologies include the utilization of different heat pump technologies with different working materials [Enteria and Sawachi (2020)]. This research project combines both passive and active cooling method to achieve cooling advantages of both systems.

The performance and techno-economics for a H2O-NH3-H2 absorption refrigerator driven by different energy sources had been reported earlier by the authors. Although electrical energy is the best energy sources; solar power is found to be the most promising energy source, in term of affordability and sustainability, in the long run. The present work avoids employing ammonia (NH3) compound as refrigerant. The use of adsorption technology for car air conditioning applications had been patented [Ramji, Leo and Abdullah (2014)]. The adsorption-based air conditioner, shown in Fig. 1, is essentially a "chemical compressor", used to replace electric driven compressor. Our study shows that such method of cooling can eliminate vibration and noise greatly for automobile application; however, adsorption system is having low efficiency as compared to absorption method.

An adsorption refrigeration system based on hybrid power sources has been designed, developed and tested successfully, see Figure 2. In that previous design the overall system shows that the efficiency can be varied throughout the day- without battery storage.

The objective here, however, is to overcome the hot climate by assisting the occupants with an innovative, affordable solar-powered air conditioning scheme coupled with waste heat regeneration and passive cooling abilities. The intended system can ultimately maximize the overall smart energy utilization. The developed design to be prototyped consist of a comprehensive affordable energy saving system that comprises two buildings. The two buildings are to be cooled with the solar-powered absorption cooling system integrated with waste heat and passive cooling schemes. The buildings are a surau and living space with chimney that has been recently constructed, as shown in Figure 3. The average temperature and humidity in this area were found to be around 37 deg. Celsius and 82 % RH, respectively. The use of hybrid energy and the idea of evolving smart technology potential was considered. Generally, hybrid energy systems would have some techno-economical advantages over standalone system in the long term; but thy require suitable and intelligent control schemes [Enteria and Sawachi (2020)]. Aerogel was found to be an excellent material for insulation application for buildings. The advantage of this relatively new lower thermal conductivity of the material allows for the opportunity to use thinner layers and less volume of insulation material. Aerogel product made from silica aerogels are nanoporous material with excellent properties as thermal insulation, such as light weight, high specifies surface area, high porosity, low density and high thermal insulation value. The overall prototype system is expected to form an intelligent remote-control air conditioning system. Such design, if successfully realized, can be an affordable and economical tool to be utilized in rural farms across Malaysia and elsewhere.

---

[1] An article based on recent approved PRGS grant, Ministry of Higher Education Malaysia.

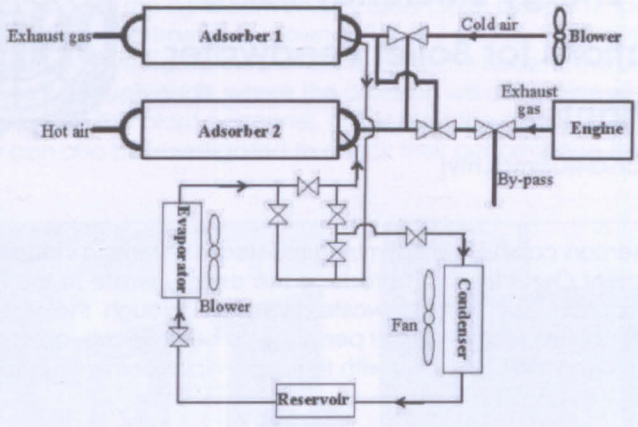


Figure 1. Schematic of the adsorption cooling system

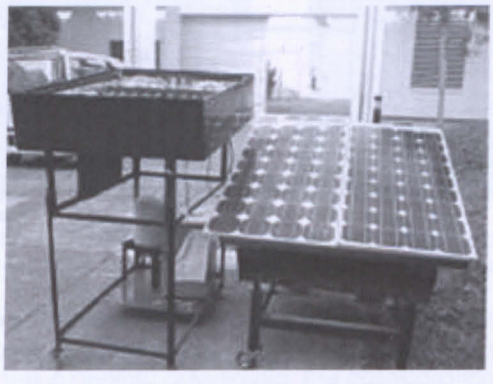


Figure 2. Hybrid solar thermoelectric adsorption cooling system [(Abdullah et. al. 2009)]

Figure 3. The cooling space built comprises of a surau and living space with a cooling chimney

References:

Mohammad Omar Abdullah, 2013, Applied Energy: An Introduction, CRC Press, Boca Raton, New York (Book), 432p. ISBN: 9781439871577, [Online] http://www.crcpress.com/product/isbn/9781439871577.

H. R. Ramji, S. L. Leo, and M. O. Abdullah (2014). Parametric study and simulation of a heat-driven adsorber for air conditioning system employing biomass-based activated carbon-methanol working pair, *Applied Energy*, Volume 113, pp. 324–333.

N. Enteria, and T. Sawachi, 2020. Air Conditioning and Ventilation Systems in Hot and Humid Regions. In Building in Hot and Humid Regions (pp. 205-219). Springer, Singapore.

e

M. O. Abdullah, J. I. Ngui, K. Abd.Hamid, S. L. Leo and S. H. Tie, 2009, Cooling Performance of a combined solar thermoelectric-adsorption cooling system: an experimental study, Energy & Fuels, 23, 11, pp. 5677-5683.

Remote Monitoring of Energy Efficiency Using Solar Thermal Applications for Boiler Feedwater Systems in Industrial Plants

By: Ir. Dr Mohd Danial Ibrahim (imdanial@unimas.my)

Remote monitoring with intelligent sensors can help in optimizing the steam systems in industries. The projects initiated by UNIDO (United Nations Industrial Development Organization) to reduce the energy waste in the manufacturing sector enables the manufacturing plants involved to control their energy waste, remotely through their IoT Monitoring dashboards. Remote monitoring supports the condition of not requiring the plant personnel to be physically on-site i.e., contactless, thus ensuring the physical distancing is kept at its outmost condition, in line with the current pandemic situation and the new norm's SOPs.

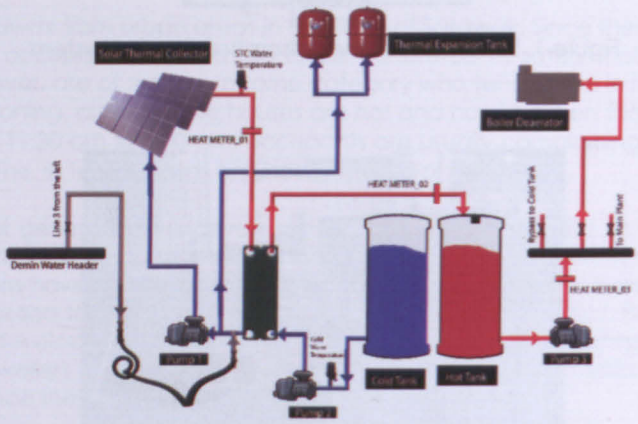


Figure 1: Solar thermal for boiler feedwater system

The relation between industry and UNIMAS was enforced through this collaboration. The industry was always trying to meet its demand with neither monitoring of its energy efficiency nor system optimization. Ir Dr Danial has obtained his system optimization expert certification from UNIDO through the energy efficiency project initiated by the Ministry of International Trade and Industry Malaysia (MITI) and Ministry of Science, Technology and Innovation (MOSTI).

In January 2019, Ir. Dr Danial and his postgraduate students, Ms Sitti Aishah Najamudin has conducted a preliminary audit of the system optimization for a Palm Oil Mill in Tawau, Sabah. The preliminary audit objective was to find any possible improvement for the mill to gain savings. The findings were then shared to the plant top management to propose improvements to be implemented by the mill. UNIMAS being a relatively young university, but with a strong desire to aggressively collaborate with the industry, would certainly gain by collaborating with these manufacturing plants. This collaboration is based on a 50-50 collaboration where the data for these audits are used for Ms Sitti Aishah's Bachelor of Engineering and Master of Engineering projects. The preliminary findings showed that the mill could obtain an energy savings amounting to RM 400,000.00, if the projects are implemented, with an ROI of one to two years.

The collaboration is an attempt to find any inefficiency in the mechanical systems in the manufacturing plants. In normal practice, the initial savings without any capital investment would allow the organization to save around 10-15% of its operational cost. These savings are considered as the low hanging fruits and can be simply conducted with no difficulties.

Figure 2: Ir Dr Danial (second from right), Sitti Aishah (center) with the palm oil mill engineers

Figure 3: Sitti Aishah with Ir Dr Danial on top of the stack doing one of the measurements

In the preliminary audits, the performance of the significant energy users (SEUs) plays an important role to obtain massive energy reduction without the need of any capital investment. As shown in Figure 3 above, the preliminary audits would normally involve the checking on the stack temperature to investigate the performance of the boiler of the plant. Other than that, the preliminary audits will be conducted with the walk-through audit, where the assessors will determine what other improvements that can be implemented together with the help from the plant personnel. Other than the steam systems, similar mechanical systems such as fan, pump and compressed air can also be investigated to check their performance through similar walkthrough audits.

Figure 4: Presentation of the findings to the top managements including the mill manager

Figure 5: Some activities during the preliminary audits at one of the project sites

After the successful completion of the project with the palm oil mill in Sabah, the student was then placed as a residential engineer at one of the petrochemical plants in peninsular Malaysia. The collaboration similarly aims at reducing the inefficiency of systems in the manufacturing plant, in particularly its steam system, because steam system is the SEU in the plant. The collaboration targeted improving the MP boiler feedwater system with a solar thermal application. The problem with the boiler was identified to be the low temperature of feedwater system. By applying the solar thermal heating, the system helped to increase the temperature using the abundant renewable solar energy while supporting the sustainability policy of the company.

The system will be remotely monitored from the dashboard, eliminating the requirement of resources to physically measure the performance of the systems. Figure 6 shows some of the sensors being used in this project which are: ultrasonic water level sensor (shown upper left), infrared temperature measurement sensor (shown lower left), the pyranometer and wind speed and direction sensor (shown center), temperature sensor to measure the feedwater temperature (shown upper right) and the expansion tank (shown lower right). The pyranometer was installed to measure the solar irradiance from the roof, near the installed solar thermal collectors.

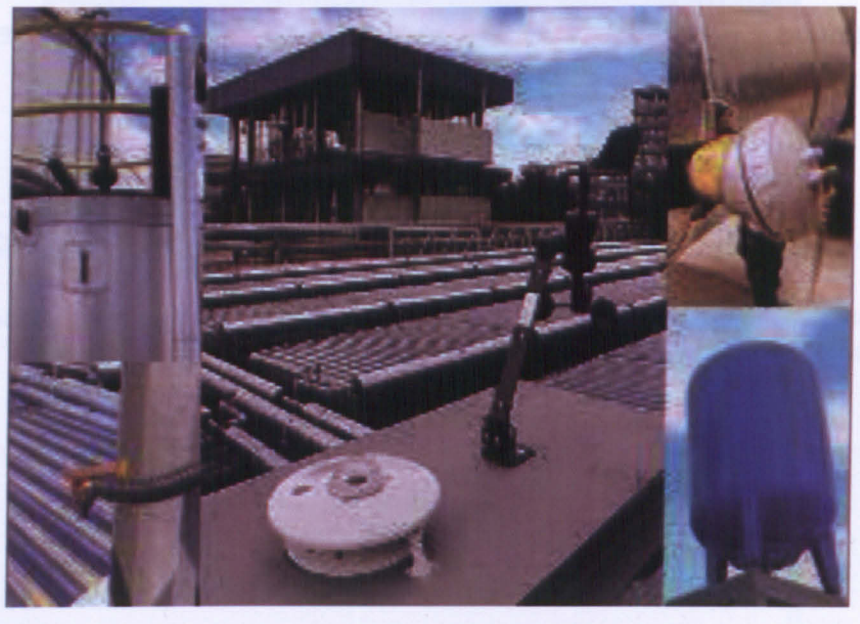


Figure 6: Some of the remote sensors and equipment installed at the project sites

The online monitoring dashboard allows the users to be informed in-situ of how the system is performing, based on the demand required by the manufacturing plant. The boiler system used for the plant will be preheated using the solar thermal collectors and heated up using the irradiance available on top of the roof of the plant. Solar thermal collector has a much higher efficiency compared to the conventional solar PV available in the market. Figure 8 shows some of the parameters that are being monitored in this solar thermal system. The monitored parameters can maintain the performance at its most efficient state most of the time, reaping the most benefits from the system.

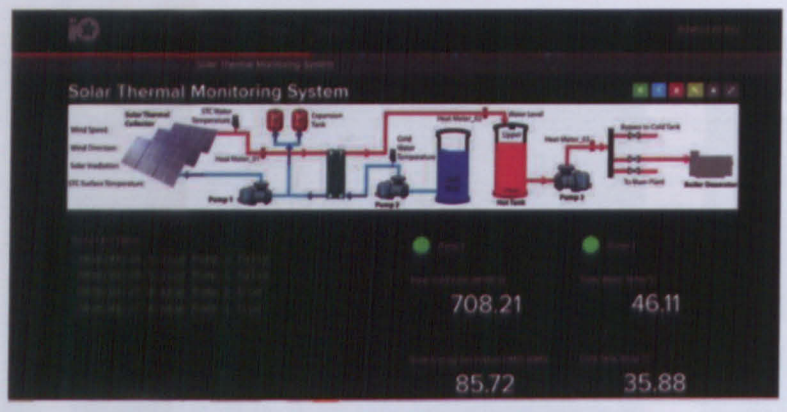


Figure 7: Online monitoring dashboard of solar thermal project

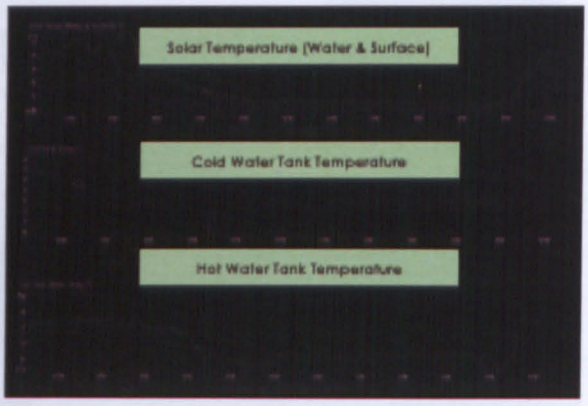


Figure 8: Parameters being monitored through the dashboard

The collaboration work has helped the plant in savings tremendous amount of money by eliminating its waste and optimizing its system. Ir Dr Danial Ibrahim and the plant assistant general manager have had previous relation together in system optimization projects in particular optimizing the pump systems under UNIDO projects, back in 2015. These systems optimization and energy efficiency projects are also contributing towards Malaysia achieving its target to reduce the carbon emission as declared in Paris Agreement, 2015. Malaysia has committed to achieve its National Determined Contribution under the Paris agreement by cutting CO_2 intensity by 45% relative to 2005's level, by 2030.

Figure 9: UNIMAS student standing next to Assistant General Manager, Technical and Engineering of the petrochemical plant with other UNIDO staff.

References

[1] Malaysia Energy Efficiency & Solar Thermal Application (MAEESTA) – IOI Pan Century Oleochemical Case Studies Audit Report.

[2] Agreement, Paris. "Paris agreement." Report of the Conference of the Parties to the United Nations Framework Convention on Climate Change (21st Session, 2015: Paris). Retrieved December. Vol. 4. 2015.

EXTENDED ABSTRACTS OF SELECTED PROJECTS

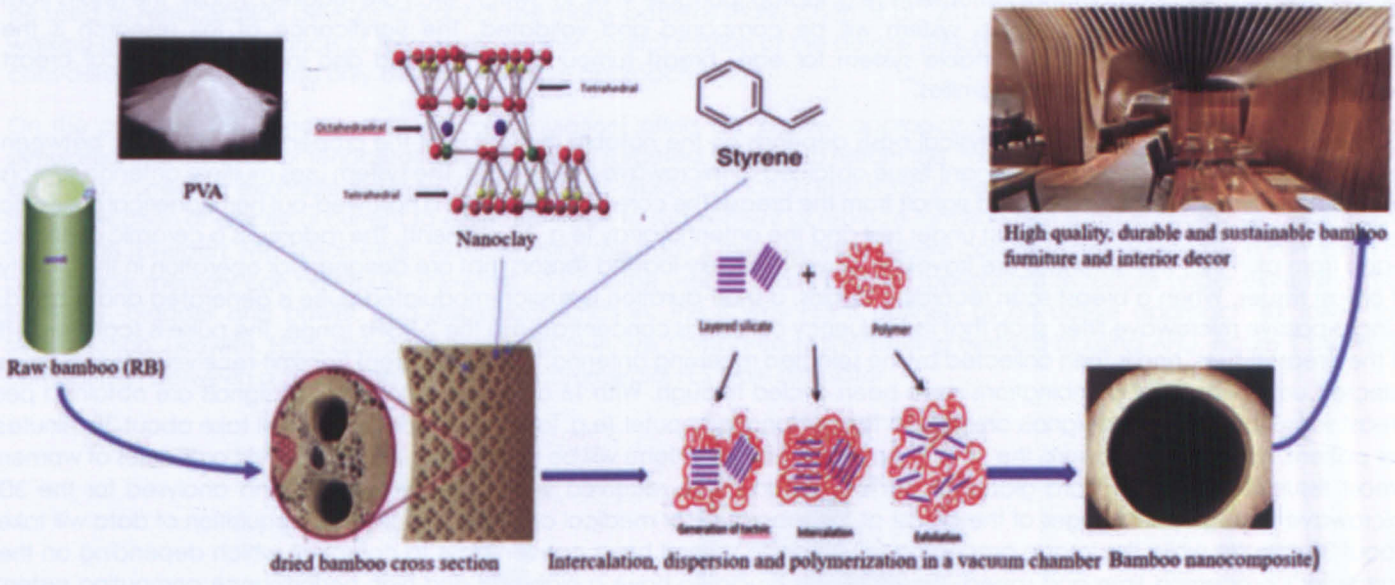
Formulation Optimization and Characterization of Bamboo/Polyvinyl Alcohol/Clay Nanocomposite by Response Surface Methodology

Md Rezaur Rahman

Faculty of Engineering, Universiti Malaysia Sarawak, 94300, Kota Samarahan, Sarawak, Malaysia.
E-mail: rmrezaur@unimas.my

Abstract

An investigation of the effects of montmorillonite nanoclay and polyvinyl alcohol (PVA) treatments on the physical, mechanical, and thermal properties of bamboo reinforced nanocomposites was carried out. Response surface methodology (RSM) was used to develop models for predicting mechanical properties of the nanocomposite and optimized the modification phase change materials. The FTIR spectra of the nanocomposites indicated incorporation of the polymer and nanoclay in the structure and diffractograms from XRD also higher crystallinity of the prepared nanocomposite compared to raw bamboo. The SEM image revealed that of the lumens of the raw bamboo were filled by the polymer and nanoclay after formation of the nanocomposite. Improved mechanical properties were observed in the prepared nanocomposites compared to the raw bamboo with the modulus of elasticity (MOE) increased from 7.82 GPa to 17.32 GPa and modulus of rupture (MOR) increased from 68.67 MPa to 118.74 MPa. Optimal values were found to be 15.082 GPa for MOE and 96.879 MPa for MOR with R2 of 0.9999. Better thermal properties were observed in the developed nanocomposites compared to the raw bamboo as revealed by both the DSC and TGA results.



The Development of Microwave Breast Screening System using Multiple Sensors

Kismet Anak Hong Ping, Dyg Norkhairunnisa Binti Abang Zaidel, Dayang Azra Binti Awang Mat, Shafrida Binti Sahrani

Faculty of Engineering, Universiti Malaysia Sarawak, 94300, Kota Samarahan, Sarawak, Malaysia.
E-mail: hpkismet@unimas.my

ABSTRACT

Breast cancer is the leading cause of death among females, early diagnostic methods with suitable treatments improve the survival rates significantly. Microwave imaging and detection methods have been intensely researched in recent years as the most potential to become the alternative tool for detecting breast cancer as compared to the X-ray mammography. Microwave imaging promises a non-invasive screening with low-cost system fabrication and operation. Scanning does not require breast compression and can be repeated frequently since no ionizing radiation is used. The aim is not to replace mammography, ultrasound, or MRI, but to develop an alternative approach that can act as an early warning system to flag the need for more comprehensive testing. The breast image quality is affected by the sensors (antennas) and the size of the sensor. Numerous microwave biosensors have been developed for biomedical applications, with particular focus on breast tumour detection. Compared to the conventional medical imaging techniques, microwave sensors not only enable better cancer detection and improve the image resolution, but also provide attractive features such as label-free detection. This research work aims to develop a single- and dual-polarization antenna array using an inhomogeneous multilayer model of the human breast. The proposed multiple sensors will be analysed on the substrate materials (e.g. FR4, RT Duroid, ceramic dielectric, etc.) by using 3D Electromagnetic Simulator (e.g. FEKO) with high-end workstation. Sensing dielectric property differences of tissues will be studied over a wide frequency band. The proposed system is to operate in a frequency range of 2–8 GHz (with reflection coefficient (S11) below –10 dB). To validate the performance of the proposed sensors, measurement and experimental works will also be conducted at the Universiti Kebangsaan Malaysia (UKM). In order for the proposed system to be used as portable health services, small and compact instruments (e.g. laptop, portable VNA, RF Switch, etc.) are required. Finally, the results from the experimental works and portable system will be compared and validated. The significance of this research is the development of a low cost and portable system for early breast tumour detection and also inexpensive clinical breast examination to serve for low income families.

For microwave breast imaging, the physical basis depends on the notable distinction of the properties of dielectric between the normal breast tissue and the malignant tissue obtained at microwave frequencies. The system uses multiple antenna sensors to collect the transmitted and reflected signals from the breast. The core of the system is a hollowed-out hemispherical dielectric radome, which houses both the breast under test and the antenna array (e.g. 16-element). The radome is a ceramic dielectric made from alumina. The antennas are travelling-wave, resistively-loaded sensors that are designed for operation in the vicinity of breast tissues. When a breast scan recording begins, a short-duration Gaussian-modulated pulse is generated and shaped, using a passive microwave filter, such that its frequency content is concentrated in the 2-8GHz range. The pulse is scattered off of the breast tissues, and is then collected by the selected receiving antenna. Then, a different transmit-receive antenna pair is selected until all possible combinations have been cycled through. With 16 antennas, a total of 240 signals are obtained per breast scan. These received signals are save in the personal computer (e.g. laptop). This procedure will take about 30 minutes per patient. However, in this work, the heterogeneous breast phantoms will be used to mimic the dielectric properties of women breast tissues such as skin, fibro glandular, fat and tumour. The received signals will be brought and analysed for the 3D microwave tomographic images of the breast at the laboratory or medical centre in the city. The acquisition of data will take about 30 minutes while the image processing will be done several hours or even days to complete which depending on the computer's processing time and speed. Therefore, it is crucial to have a high-end and high performance computing system (e.g. workstation or parallel computing system) in order to reduce the computational time and fasten to process of getting the results. If the suspicious object or area is detected, the case will be reported to clinical expert or specialist further check-up or diagnosis.

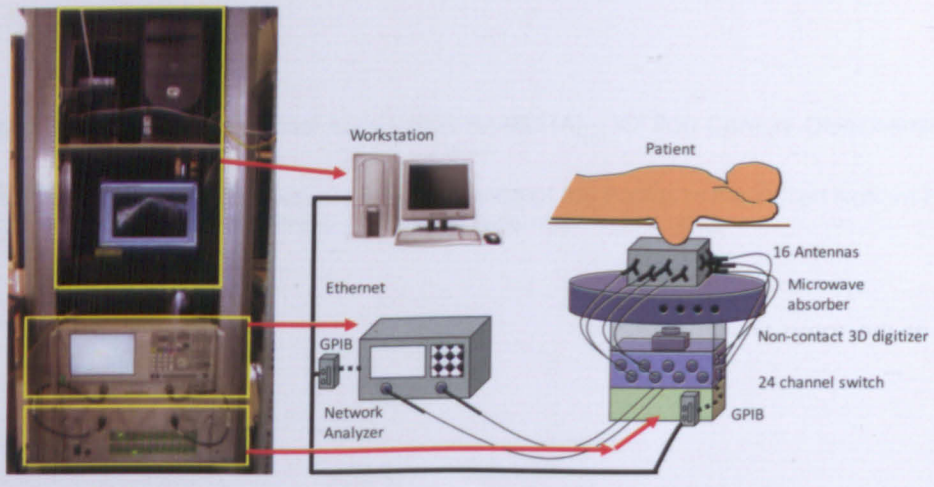


Figure 1: Typical measurement setup in the laboratory

Parametric Study of Human Muscle using Functional Electrical Stimulation (FES) for Lower Limb Rehabilitation

Lidyana Roslan[1], Shahrol Mohamaddan[1], Annisa Jamali[1], Saidatul Ardeenawati[2]

[1] Faculty of Engineering, Universiti Malaysia Sarawak, 94300, Kota Samarahan, Sarawak, Malaysia
[2] School of Biomedical Electronics Engineering, Universiti Malaysia Perlis
E-mail: rlidyana@unimas.my

ABSTRACT

The human foot plays an important role in human motion such as standing, walking, running, jumping, balancing, and also helps to withstand the force from body parts. Every person has a gait, or manner of progressive locomotion which is peculiar to that individual (Boehler, Hollander et al., 2008). However, one can have an abnormal gait due to certain disease like foot drop syndrome. The patient tends to walk with an exaggerated flexion of the hip and knee to prevent the toes from catching on the ground during the swing phase. As a result, the force of the heel strike exceeds body weight and the direction of the ground reaction vector passes behind the ankle and knee center throughout the gait. This is because foot drop occurs from a muscular condition caused by problems with the common peroneal nerve or paralysis of the muscles in the anterior region of the lower leg. Some of the most common diseases that can cause foot drop include direct hit to the back of the knee, muscular dystrophy, multiple sclerosis, and cerebral palsy. Complications in a replacement surgery or knee ligament reconstruction surgery may also cause this problem.

To fix the problem, AFO (ankle-foot orthosis) is introduced to patients diagnosed with weakness in the lower limb (Mohamaddan, Ishak et al., 2018). The AFO is a device or brace that covers the foot, ankle, and part of the leg (Chin, Hsiao-Weckler et al., 2009). The approach of AFO is to mechanically lift the foot without trying to replace the muscle action. The device is used to correct the instabilities and joint weaknesses of the lower limb muscle (Kao & Ferris, 2009). AFO was able to improve mobility and can be used as rehabilitation devices to correct the motor patterns (Park, Chen et al., 2011). Moreover, the AFO may improve the walking pattern performance of the user by proper control motion of the device (Peckham & Knutson, 2005). However, AFO is considered bulky in size and only offered a passive approach.

On the contrary, FES (functional electrical stimulation) offers an 'active' approach where human muscles and nerves are stimulated that imitates for rehabilitation exercises on targeted muscles to retrain the 'muscle memory'. FES is the application of electrical current to excitable tissue to supplement or replace function that is lost in neurologically impaired individuals. FES is the application of electrical current to excitable tissue to supplement or replace function that is lost in neurologically impaired individuals (Everaert, Thompson et al., 2010). By using the body's muscles nerves, there can be some rehabilitation from exercise, and muscle memory can be rebuilt. Therefore, FES can be used in many clinical applications to restore upper extremity, lower extremity, bladder and bowel, and respiratory function. This is why FES is defined as an active approach for lower limb rehabilitation. Likewise, FES is also considered lighter in size compared to the existing method of using AFO. Figure 1 shows the comparrison between a 3D printed APO and a commercial FES walk stimulator.

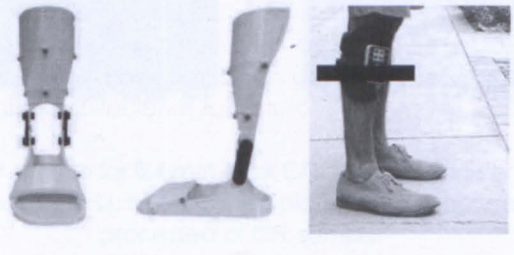


Figure 1: Left: 3D printed AFO. Right: Commercial FES walk stimulator (Retrieved from Amazon).

The objective of this research is to study the suitable and important human muscle parameters by using FES for lower limb rehabilitation in the effort to find suitable and important human muscle parameters that can improve the lower limb rehabilitation. The understanding of human muscles and their characteristics provides a platform to design the FES circuit and algorithm. By proper placement of the surface electrode on the lower limb, designing the mechanical switch for the overall system, and control the current or voltage for the stimulator, the goal is to reduce pain or discomfort. To achieve this, three important parameters; pulse frequency, amplitude, and duration will be manipulated for stimulation to acquire maximum muscle contraction. The locomotion experiment will be used to study the gait pattern (plantarflexion and dorsiflexion) to validate the finding. This includes manipulating those parameters to control the strength of muscle contraction.

The research outcome is expected to have efficient stimulation (lowest stimulation with the strongest contraction) with lower electrode leads and at the same time reduce pain or discomfort to the patient. The finding may contribute to further understanding of human muscle and propose new methods such as combining the passive and active approach in supporting lower limb rehabilitation.

This research is aligned with the Sarawak Digital Economy Strategy 2018-2022: To increase accessibility and improve the level of medical and health services in rural and remote Sarawak and promote world-class health tourism. The study is supported by Sarawak Research and Development Council.

Modelling and Adaptive Control of Home-based Lower Limb Rehabilitation Robot

***Shahrol Mohamaddan[1,2], Mohd Rizal Arshad[3], Annisa Jamali[1], Helmy Hazmi[4] and Muhammad Naim Leman[5]**

[1] Faculty of Engineering, Universiti Malaysia Sarawak, 94300, Kota Samarahan, Sarawak, Malaysia
[2] Department of Bioscience and Engineering, College of System Engineering and Science, Shibaura Institute of Technology, Japan
[3] School of Electrical and Electronic Engineering, Universiti Sains Malaysia, Malaysia
[4] Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak, Malaysia
[5] Industrial Training Institute Kota Samarahan, Malaysia
E-mail: mshahrol@unimas.my / mshahrol@shibaura-it.ac.jp

ABSTRACT

According to Word Health Organization (WHO) and United Nation (UN), there is an increasing number of elderly and people with disabilities (PWD) around the world. Among the PWDs, stroke has the highest number of patients. In order to regain the functionality of the body (upper and lower limb), the stroke patient needs a consistent rehabilitation program guided by the therapist. Unfortunately, the traditional rehabilitation program is laborious and intensive especially for the lower limb (e.g. gait rehabilitation). The impact of rehabilitation program is also depending on the therapist's experiences. The rehabilitation program is difficult to meet the requirement of high intensity and repetitive training due to the increasing number of patient and the lacking number of therapists. The development of lower limb rehabilitation robot (LLRR) is one of the solutions to support the rehabilitation program. LLRR has been used to regain the muscle strength and to support the patient's mobility. In this research, LLRR with the home-based concept will be developed. The 'compact and mobile' LLRR is expected to be used by the rural community in Sarawak. The research starts with kinematic and dynamic analysis of the LLRR. Based on the analysis, design and fabrication of the LLRR will be conducted. The novelty of this research will be on the adaptive control system that will be implemented on the developed LLRR. The control system will ensure that the LLRR is more flexible and adjustable based on patient's condition, progress and participation. In the era of Industrial Revolution 4.0, this research is hoping to support the community in Sarawak by providing the robotics solution for biomedical application.

Experimental and Numerical Investigation on Multi-Pass Laser Cutting of Natural Fiber Composite

K. F. Tamrin*,[1], K. Moghadasi[1], N. A. Sheikh[2]

[1] Faculty of Engineering, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia
[2] Department of Mechanical Engineering, Faculty of Engineering, International Islamic University, Islamabad, Pakistan.
E-mail: tkfikri@unimas.my

ABSTRACT

An experimental and numerical investigation of low power laser cutting of cotton fiber laminate (CFL) is presented. CFL is very useful for electrical insulation applications at low voltages, and usually used in gears, spacers and coil supports in turbine generator. Analysis of Variance (ANOVA) along with Taguchi experimental design is conducted to determine the optimum levels of all input parameters; it is observed that heat affected zone (HAZ) and kerf width are largely affected by the cutting speed and least affected by the stand-off distance (SOD). Detailed examination using SEM micrographs shows protruding fibres due to the polymeric matrix vaporization under laser processing. Additionally, it was noted that multiple beam passes produce a greater fiber pull-out than a single beam pass. In order to understand the underline physics, detailed numerical simulation of the problem is also performed in order to predict formation of heat affected zone (HAZ), kerf width and thermal residual stress. Owing to fatigue, higher values of residual stresses result in cracking, delamination and failure. Using Abaqus software, user defined routines for defining laser beam profile and material removal are carried out for determining temperature gradient and cut characteristics. The approach for material removal uses element deletion based on temperature-dependent Hashin failure criteria when the fibers lose their strength at ablation point. The numerical results match reasonably well with the experimental measurements of HAZ and kerf width using the temperature dependent material removal approach.

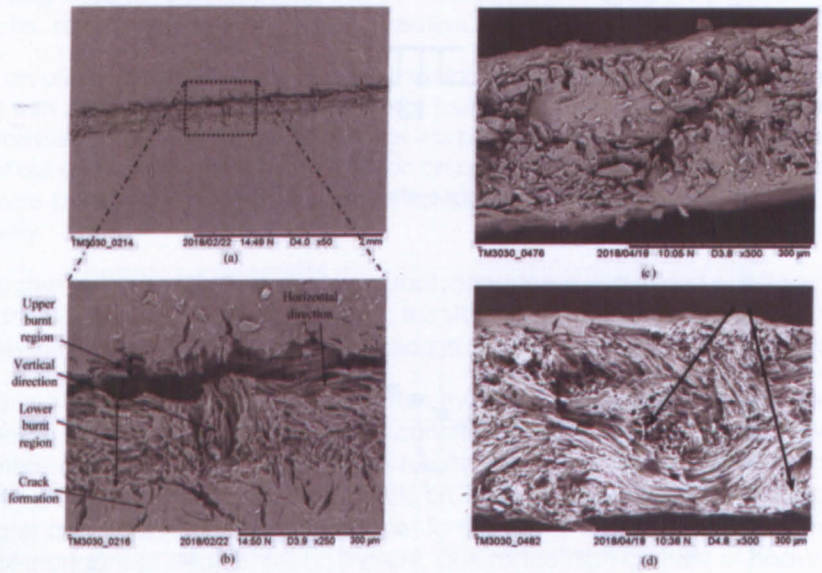


Figure 1: a) Microstructure images: cut section for 0.4 mm thick CFL (low laser power, high cutting speed, high stand-off distance and high number of beam passes CFL), b) Magnified picture of cutting area, c) raw (scissor cut) and (b) laser processed of CFL sample

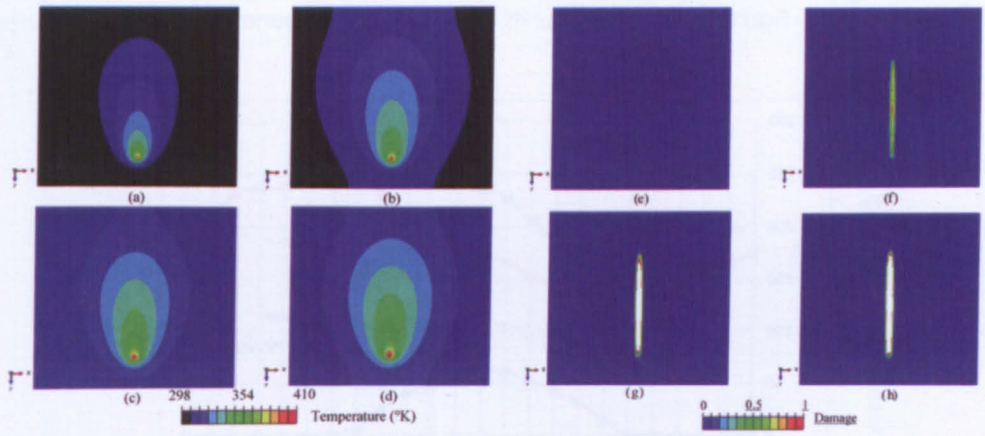


Figure 2: Temperature gradient for each laser pass at the same increment, a) 1st pass (max temperature= 372.7°K, t=4 s), b) 2nd pass (max temperature= 386.1°K, t=8.5 s), c) 3rd pass (max temperature= 403.2°K, t=13 s), d) 4th pass (max temperature= 409.1°K, t=17.5 s). Damage propagation in cotton fiber composite for each pass, e) 1st pass, f) 2nd pass, g) 3rd pass, h) 4th pass

Optimal Microgrid Energy Scheduling with Variable Solar PV Generation

Anan. A. Dweekat, Mohamed Shaaban*

Faculty of Engineering, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia
E-mail: *mshaaban@unimas.my

ABSTRACT

Minimizing operation costs of a microgrid, incorporating solar PV generation, while satisfying its load demand commitment is vital for enhancing the reliability of the main distribution grid. This paper presents an energy scheduling approach for a microgrid containing conventional generation along with variable renewable energy resources, namely, solar PV. The problem is cast as a stochastic nonlinear optimization problem, where the variability of the PV is described by the probability density function of the solar irradiance data. A mixed-integer linear programming (MILP) approach is then employed to solve the microgrid energy scheduling problem. Numerical simulations are performed on a six-bus microgrid configuration. Test results confirm the efficacy of the proposed approach.

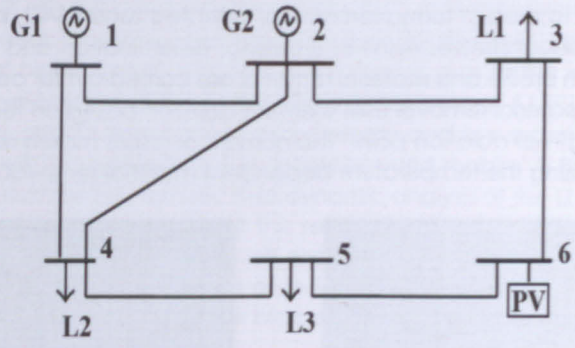


Figure 1: The 6-bus system representing a microgrid

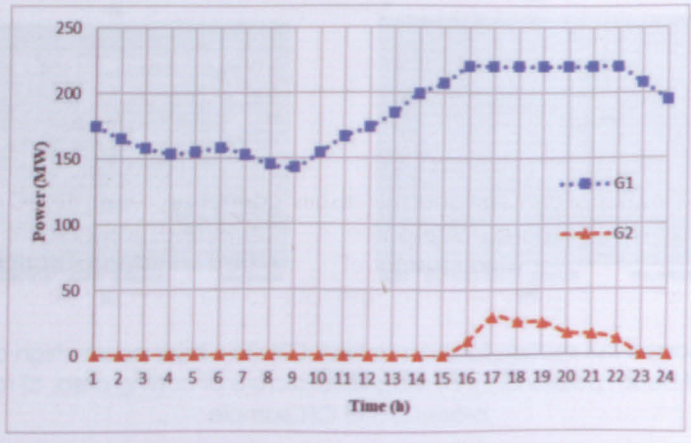


Figure 2: Generating units output at 35% PV penetration level

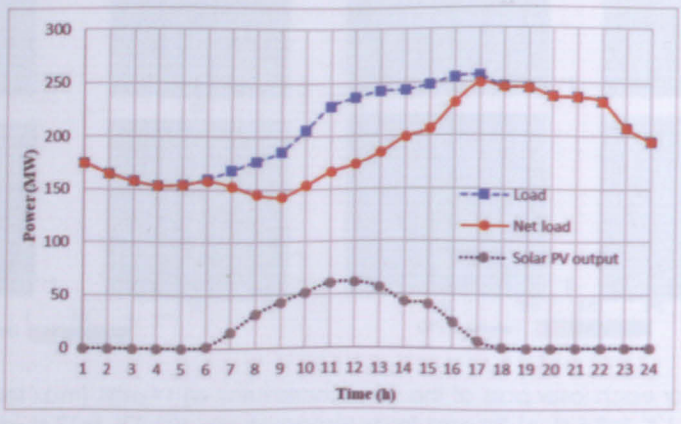


Figure 3: Load demand of a day, solar PV generation and net load demand at 35% PV penetration level

Performance of Manganese Slag-Cement Concrete: Mechanical Properties and Durability

Chee Khoon Ng, Hoo Tien Nicholas Kuan, Leonard Lik Pueh Lim, Sim Nee Ting, Idawati Ismail

Faculty of Engineering, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia
E-mail: ckng@unimas.my

ABSTRACT

The ferrosilicon and manganese alloys production in Samalaju Industrial Park generates abundant of by-products known as silica fume and manganese slag. These by-products are categorised as scheduled wastes by the Department of Environment (DOE). Manganese slag has been found to posses pozzolanic properties and therefore suitable for usage in concrete mix. This proposed research will focus on utilising these waste materials in the production of concrete and/or geopolymer concrete. The mechanical and durability properties will be determined for the optimum mix of maganese slag-cement concrete and geopolymer concrete. Leaching test will also be carried out to identify the environmental impact of using these types of concrete in building construction. A life-cycle cost analysis will also be carried out to compare the cost of using maganese slag-cement concrete and/or geopolymer concrete compare with conventional concrete in building construction.

The use of manganese slag as pozzolanic material in concrete mix is still very profound to the best knowledge of the authors. The percentage of ordinary Portland cement that can be replaced by manganese slag without compromising the material properties of concrete remain unknown. Furthermore, the research on manganese slag in geopolymer concrete is even more scarce. The ferrosilicon and manganese alloys production in Samalaju Industrial Park generates abundant of by-products known as silica fume and manganese slag. These by-products are categorised as scheduled wastes by the Department of Environment (DOE). If the manganese slag is found to be applicable in cement blend and concrete production through this research, then the benefits are two-fold, i.e., recycling waste and wealth creation.

Some preliminary studies on utilising silicomanganese slag as replacement material had been carried out by Frias et al. (2006) and Altun & Yılmaz (2002) with 5% to 45% of replacement. It was found that the 7th day compressive and flexural strengths of the mortars had been compromised by 10-25% but the effect was less profound at 28th and 90th day strengths. It is important to note that this study was carried out on mortars with limited variation on percentage of replacement. Therefore, there is still a need in research of actual concrete behaviour with more variation in replacement percentage in order to utilise this waste material (manganese slag) efficiently.

In a separate study conducted by Wang (2017), it was found that manganese slag mixing with fly ash has a potential application in geopolymer concrete through alkali activation. However, this study only provides preliminary results indicating the potential use. Therefore, further investigation into utilising manganese slag in geopolymer concrete is still a necessity.

On durability aspects, Ganesh et al. (2018) reported that when the coarse aggregate of concrete was replaced with 50% of manganese slag, the strength and durability aspects of the concrete were not compromised. However, this study did not use manganese as replacement of Portland cement and the results cannot represent research on using manganese slag as pozzolanic material. Liu et al. (2012) conducted a research on manganese slag-cement concrete and found that it has improved on both seawater and freezing-thawing resistance. To the best knowledge of the authors, there is no research on leaching characteristics of manganese slag-cement concrete. Due to the high content of heavy-metal oxide in manganese slag, it is envisaged that leaching of heavy metal from this type of concrete posts environmental impact. Therefore, it is an important aspect to investigate if this type of concrete is going to be used in building construction.

The optimum replacement percentage of Portland cement with manganese slag without compromising the mechanical and durability of concrete and/or geopolymer concrete can be identified. The effect of leaching will also be present to study on the effect of environmental issue.

Characterization of Recycled Polymer Materials in Construction Piles Application for Civil Works

Yee Yong Lee, Nicholas Hoo Tien Kuan, Chee Khoon Ng, Sim Nee Ting

Faculty of Engineering, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia
E-mail: yylee@unimas.my

ABSTRACT

With the many applications of polymers (more commonly known as plastic) in the domestic, business and industrial sectors, the world production of plastics including Sarawak, Malaysia has reached a unprecedented highs in terms of volumes and numbers in recent years. Due to its non-biodegrable nature and long lifespan, the world now need to deal with the resulting increased volumes of plastics waste and the disposal of such waste has proven to be energy and resources consuming. This study advocates polymer recycling for Sarawak in order to resolve plastic waste disposal and the related issues and their associated negative impacts. It is proposed that plastics waste has potential to be recycled and used for construction works application such as piles production for foundations with light loadings, especially those in civil works. The piles proposed herewith is short piles to replace bakau (mangrove) pile. Due to the rapid deforestation of mangrove, harvesting of mangrove bakau is no longer sustainable and feasible in terms of environment and economy. This study will include researching on the best recycled polymers combination/s that emulates (or even better improves) bakau piles' properties, designing the optimised size and shape of the piles and proposing a value engineered product that is beneficial in terms of costs and functionality. It is envisaged that recycled polymers piles not only resolve environmental problems from polymer wastes and mangrove deforestation, it paves a direction for two whole new industries in Sarawak, namely recycling and short piles manufacturing.

Sarawak in general has yet to capitalize on the many domestic and industrial uses of recycled polymers (plastic). The study suggests recycling polymers in order to resolve polymer waste disposal and management issues in the Sarawak State while creating a new economic sector for the State. The shift in our waste management approach to include polymer waste management is a wholesome approach that will provide many benefits to the State's economy, environment, taxpayers and communities as a whole. Recycling polymers blends in with the State's vision of a green and clean Sarawak.

The study closes the loop of recycling polymers by putting forward an application of the recycled polymer herewith in pile construction for civil works. Recycled polymer piles will seek to replace the traditional bakau piles used in road constructions, drainage construction, light water related structures and sewerage manhole works. Civil works represents big components of state construction activities, which has emphasized greatly on infrastructures construction (eg. The Pan-Borneo Highway). As population grow, land development will continue to enlarge and inevitably, Sarawak will need to resolve the engineering issues related to construction on very soft soil where the soft clay and very-soft clay have properties which tend to be highly compressible, low shear strength, low permeability, and have low bearing capacity. Traditionally, bakau piles have been used where there are constraints related to using shallow foundations to overcome land subsidence.

As a replacement to bakau piles, the proposed recycled polymer piles not only resolve engineering issues related to construction and environmental issues related to polymer waste disposal and mangrove deforestation, it will improve the current market for pile selection. There are basically no recycled polymer piles in the construction market. The application of recycled polymer piles has very high potential and success rate as the compressive strength of the polymer has been found to be higher than bakau pile (Curbell, 2019; Yunus, 2018). Recycled polymer piles may well prove to be the engineering solution to waste disposal, environment and construction challenges.

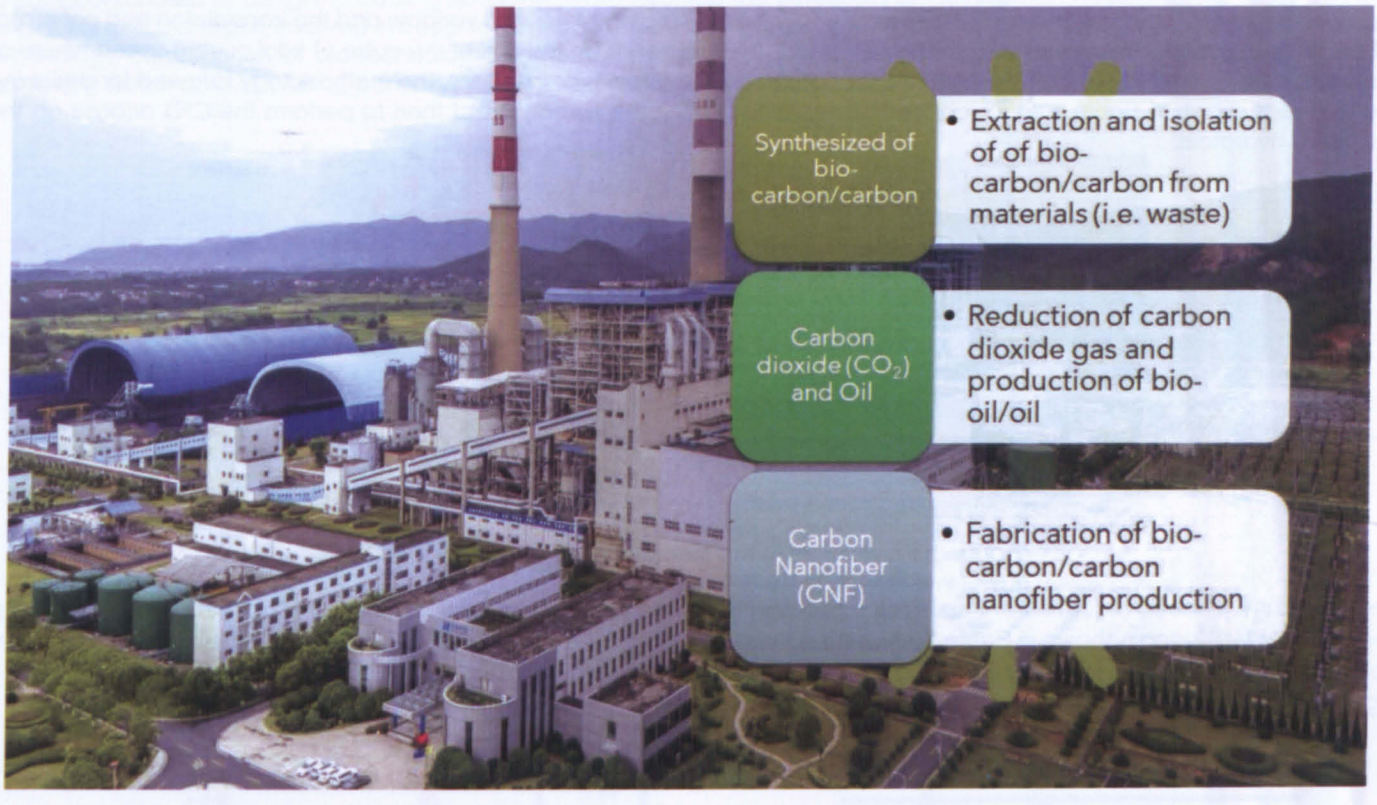
Potential of Carbon Nano Fiber (CNF) for Reduction of CO_2 Emission

Md Rezaur Rahman

Faculty of Engineering, Universiti Malaysia Sarawak, 94300, Kota Samarahan, Sarawak, Malaysia.
E-mail: rmrezaur@unimas.my

Abstract

The 18th century industrial revolution ignited the rapid growth of the global economy that intensely changed our direction and lifestyles. Unfortunately, the mass fossil fuel consumption, creating a greenhouse effect and global warming gives rise to a huge amount of carbon dioxide (CO_2) into the atmosphere. Therefore, currently many studies were done to investigate the development of a sustainable material by immobilized emitted CO_2 and the effective CO_2 utilized technology development. The proposed study covered from the fabrication of carbon nanofiber (CNF) using its char by pyrolysis process, and/or entrapped the CO_2 gas as a carbon source. It is reported that the CNF growth is affected by CO_2 and hydrocarbon gases, through catalytic chemical vapor deposition (CCVD) catalysts. Four factors identified that may influence the process, which is the effectiveness of the catalyst, the reaction temperature, the CO_2 concentration, and the specific hydrocarbons supplied in the feed gas. The process could also help industry to manage and utilized the exhaust gas emitted from thermal power stations and factories as a carbon source, which converting CO_2 to help the growth of CNF by utilizing the heat given off by emission as a heat source in CNF synthesis. Through process CNFs co-catalyst deoxidization, the synthesized reaction between $C_2H_5OC_2H_5$, Zn and Fe powder can be done for 10 hours at 650 °C. The diameters may range around ~80 nm and lengths ranging from several micrometers to tens of micrometers. X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), and scanning electron microscopy (SEM) showed CNFs may possess low graphitic crystallinity. However, as electrode, the CNFs resultant shows capacity around ~220 mAh/g and with little hysteresis in the insertion/deintercalation reactions of lithium-ion, which is high reversibility. In addition, the possible growth of CNFs shows big potential.



Tidal Stream Power Assessment and Design of Turbine for Pulau Triso

Andrew Ragai Henry Rigit*[1], David Bong Boon Liang[1], Yanuar Z. Arief[1], Almon Wei-Yen Chai[2], Imran Ali[1], Jane Labadin[3], , Omar Yaakob[4], , Chi Hung Chong[1],

[1] Faculty of Engineering, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia.

[2] School of Engineering, Swinburne University of Technology, Kuching, Sarawak, Malaysia.

[3] Faculty of Computational Science and Information, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia.

[4] Faculty of Engineering, Universiti Teknologi Malaysia, Skudai, Johor, Malaysia.

E-mail: arigit@unimas.my

ABSTRACT

An attempt is made for the first time to assess the potential of Trisao island, located at the river mouth of Batang Lupar, for power generation. The study area is subjected to have the tidal currents which are considered sufficient for power generation. There are several approaches to model tidal energy extraction potential in the macro tidal sites. In this study, the momentum sink approach is adopted to assess the power generation potential. The energy potential of the Triso island is assessed as the maximum kinetic energy of the tide. The areas of high energy density are considered as suitable for the installation of tidal in-stream energy converting devices. The seawater depth around the island ranges from 10 to 15 m. It is also aimed to design the low depth and low speed tidal current turbine suitable for this site.

In the first stage, the tidal current speed data is collected batter to understand the local hydrodynamics and assessing the power potential from these currents. The onsite measurements of tidal current speeds are usually carried out by using the current meter made by Valeport (BFM105 with a serial number of 21233). The current meter is deployed 5 m below the seawater surface. The current meter will be scheduled to log the readings of the stream velocity for every 5 minutes. The power generated by electromechanical energy converting device which extracts the kinetic energy in the horizontal flow of the tide and converts it to electricity. The electric power generation depends on the power of the rotor as a variable and the transmission and generator efficiency as the constant. The power generated by the rotor depends on the half of the cube of tidal current speed where as seawater density, rotor area, and the coefficient of performance remains as constant. The methodology followed for designing the turbine is shown in Figure 1. In which the first step is to shortlist the hydrofoil and then to perform the CFD analysis on the shortlisted hydrofoils.

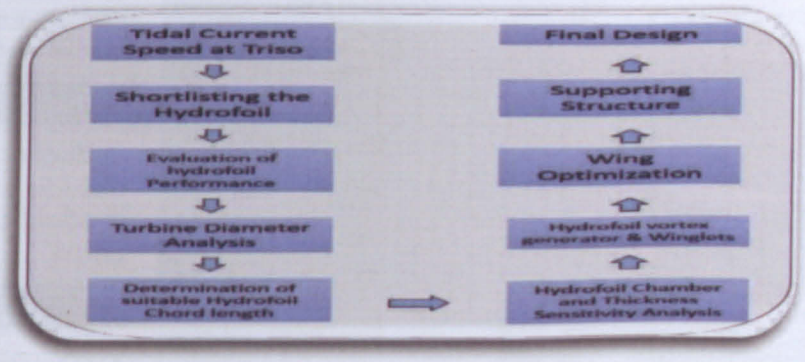


Figure 1: Flow chart of the steps for designing the turbine

The tidal current speed recorded at Triso island is meeting the minimum requirement for the installation of a turbine. The speed recorded at Triso island is shown in Figure 2, where the maximum speed was noted as 2.6 m/s. Based on the maximum recorded speed at Triso island, the energy density is also calculated. The kinetic energy flux density available at Triso island is shown in Figure 3.

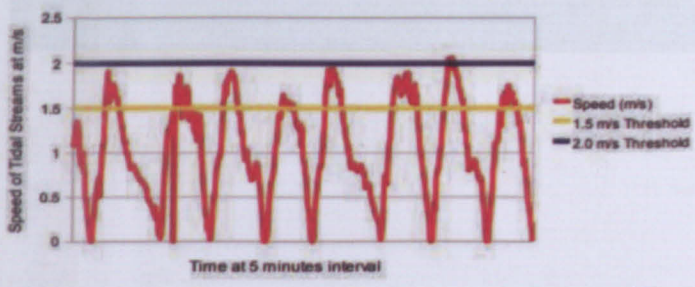


Figure 2: Tidal current speed measured at an interval of 5 minutes

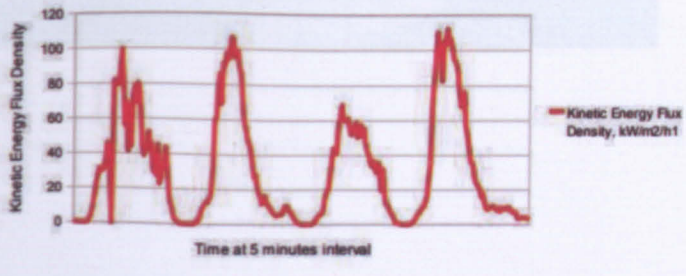


Figure 3: Tidal energy flux density curve at Triso island

Tidal energy is the future sustainable energy option for Malaysia. There are some of the sites available in Malaysia which can be utilized for green energy generation. Among these sites, Triso island at the river mouth of Batang Lupar is focused on this study. The step made for the first time understand the local hydrodynamics of the Triso island and its potential for power generation. It is concluded that the Triso island has the potential to provide the electricity to remote coastal villages of Sarawak that are not connected to the National grid.

Study On Mitigating Turbine Cooling System Inefficiency for Increasing Energy Production Performance: Pilot Study at Bakun 2400MW Hydro Power Plant

Shahidul Islam

Faculty of Engineering, Universiti Malaysia Sarawak (UNIMAS), 94300 Kota Samarahan, Sarawak, Malaysia
E-mail: mislam@unimas.my

Green energy for achieving Sustainable Development Goal (SDGs) is a key; and strategy of Goal-7 (SDG-7, green and affordable energy) is playing a vital role in using hydro-electricity system for reducing carbon emission.

This research is conducted by the Operations Research and Sustainability study group led by Professor Shahidul Islam of Universiti Malaysia Sarawak (UNIMAS) for improving turbine cooling performance of Bakun Hydroelectric Power Plant (HEP). In this project, Biotechnology and Nanotechnology were used to eliminate biomass and bacteria based pollutants from the turbine cooling water. Experiment of Design (DOE) software was used to optimize experimental run, as well as a range of independent inputs variables and performance of polluted cooling water treatment plant.

Research findings demonstrated that biomass based micro solids, and water born bacteria including sulphate reduction bacteria (SRB) have contributed in clogging tubes of shell and tube type heat exchanger (HE), which was potentially increased the HE maintenance cycle compared to the designing parameters. To address the cooling water problem, bio-technology has installed in cooling water inlet stream for decomposing biomass based micro solid particles and finally remove it as a sludge (>95%). Additionally, nano-membrane technology has installed for separating SRB and other water born bacteria (>99.9) from inlet cooling water. The purified cooling water has been used in turbine cooling system, which has significantly (p-value<0.05) contributed to reduce HE maintenance cycle and enhanced turbine cooling performance [6].Indeed, the findings would be greatly contributed to designing cooling system of hydro turbines. The outcomes of this research would be also a reference for engineers and managers involved in designing and managing hydro turbine power plants. The study concludes that advanced technology combination of bio-technology, nano-technology and optimization process is a power technological blend in achieving sustainable operating performance of hydro power plants.

Pilot study at 2400 MW Bakun Hydro power plant

Monetization of Environmental and Socio-Economic Externalities from Oil Palm Biomass through Green Solvents

Chung Loong Yiin[1], Suzana Yusup[2]

[1]Faculty of Engineering, Universiti Malaysia Sarawak (UNIMAS), 94300 Kota Samarahan, Sarawak, Malaysia
[2]Higher Institution of Center of Excellence: Centre for Biofuel and Biochemical Research, Institute of Self-Sustainable Building, Universiti Teknologi PETRONAS, 32610, Bandar Seri Iskandar, Perak, Malaysia
E-mail: clyiin@unimas.my

The Malaysia pulp and paper industries are heavily relied on imported fibre, particularly virgin pulp. As an importer of fibre and pulp and paper products there are concerns over origins of the fibre sources, some of which lack robust forest governance. Thus, other sources of supply such as non-wood materials, ie: oil palm residues are used as alternatives to wood fibre. In recent years, tree-free paper business using oil palm empty fruit bunch (EFB) has caught up in Malaysia with a few startups initiating the trend. With the increasing demands in relation to environmental protection, the application of green chemistry in solvents is desirable. Hence, mild pulping technologies based on low-transition-temperature mixtures (LTTMs) came up as a promising sustainable alternative which are resource-, cost- and energy- effective for conventional chemical pulping process in pulp and paper industry which produced wastewater and result in toxic effects for aquatic organisms. In this sense, our green solvents can be used to pretreat EFB in order to make pulping process easier prior to mechanical pulping and reduce waste water generation since LTTMs are biodegradable.

RESEARCH NEWS

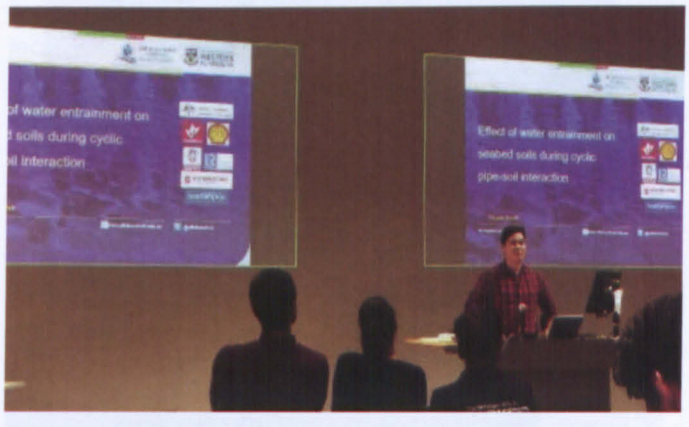
UNIMAS STEM Engineering Conference (ENCON) 2019

Faculty of Engineering has successfully organised the 12th UNIMAS STEM engineering conference (Encon 2019) themed '*Revolutionized Innovative Engineering and Technology Towards Sustainable Development*'. The conference was held from 28 to 29 August 2019 in Riverside Majestic Hotel, Kuching, Sarawak.

International Science, Technology and Engineering Expo (i-STEEx) 2019 was also held in conjunction with the 2-day conference.

Research and Development

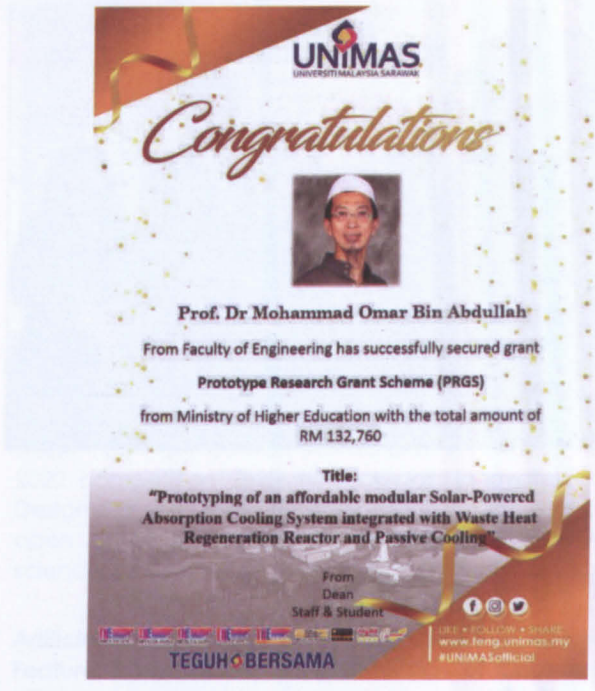
Talk in Oceans Graduate School, University of Western Australia (UWA)



Dr Fauzan Sahdi of Department of Civil Engineering gave a talk on the 'Effect of water entrainment on seabed soils during cyclic pipe-soil interaction' in the Oceans Graduate School (OGS) seminar at The University of Western Australia (UWA) on the 10th September 2020. This talk was originally meant for presentation at the ISFOG 2020 conference (https://www.isfog2020.org/) in Austin, Texas USA, which was postponed due to the Covid-19 pandemic. The talk was attended by researchers from OGS (UWA), The University of Melbourne as well as offshore geotechnical engineers from Fugro.

In his talk, he presented data that provides the first quantitative proof of water entrainment induced volume changes in seabed soils during cyclic pipe-soil interaction. He showed that some aspects of water entrainment in seabed soils can be explained using critical state theory. This research may pave the way towards understanding the physics governing the formation of seabed trenches, which affect the integrity of offshore infrastructure such as steel risers and anchoring systems. He intends to pursue this research topic further when he returns to UNIMAS, through collaboration with his FENG colleagues via a multidisciplinary research approach combining fluid dynamics, geotechnical engineering, structural mechanics as well as sediment transport physics.

PRGS Grant Recipient



Prof. Dr Mohamad Omar bin Abdullah has successfully secured grant Prototype Research Grant Scheme from Ministry of Higher Education amounted RM132,720 for project entitled "Prototyping of an Affordable Modular Solar-Powered Absorption Cooling System Integrated with Waste Heat Regeneration Reactor and Passive Cooling".

Department of Chemical Engineering and Energy Sustainability Receives Industry Grant Funding for Research Projects

Trienekens (Sarawak) Sdn Bhd awarded two industry grants to Universiti Malaysia Sarawak (UNIMAS) researchers for collaborative research work focusing on research and development programmes, namely studies on solid waste characterisation and leachate treatment process. Two memorandums of agreement (MoA) between Trienekens and UNIMAS have been signed and exchanged in a ceremony which was held at the 12th International UNIMAS STEM Engineering Conference (ENCON2019). The MoA exchange ceremony was presented on behalf of UNIMAS by UNIMAS Holdings Sdn Bhd's Chairman, Datu Dr Hatta bin Solhi and while Trienekens was represented by its Group Chief Executive Officer (CEO) Stephen Chin.

The first study, "Solid Waste Characterisation using Experimental and Analytical Methods," is led by AP Ir Dr Lim Soh Fong of the Department of Chemical Engineering and Energy Sustainability. The project aims to analyse waste samples and quantify the correlation of waste characterisation to waste reduction. Currently, inadequate recent data on waste composition and characterisation are known to improve further the waste management

solution that can be adopted by Sarawak. Hence, having the current waste trend information and differences between waste streams will prioritise recovery, recyclable opportunities and make new strategies for waste management necessary.

The second study, "Phycoremediation of Landfill Leachate," is led by Ms Noraziah Abdul Wahab of the Department of Chemical Engineering and Energy Sustainability, the Director of UNIMAS Sustainability Centre. Her research focusses on leachate treatment using phycoremediation approaches.

SRDC Grants Recipients

Seven lecturers from Faculty of Engineering has secured grants from Sarawak Research and Development Council (SRDC) with the total amount of RM1.13 million.

MESTR Project

Four lecturers from Faculty of Engineering has secured UNIMAS Community Project amounted RM38,290.

Members of FEng Bagged Awards in InTEX 2019

A research project entitled "Enhanced Bolted Timber Joint Design for Ductile Failure Mode" led by Ir. Dr Abdul Razak Abdul Karim won a gold award at the Innovation Technology Expo 2019 **(InTEX 2019)**. The 12th technology exposition held on 24 – 25 July 2019 at the Imperial Hotel Kuching was featured by 220 projects including participations from external institutions of higher learning and other research institutions.

At the same expo, two research projects entitled "Design and Implementation of Smart Parking Using Arduino Based on Internet of Thing (IOT)" and "Design and Implementation of Smart Home Control System Based on Internet of Things" led by Dr. Yonis.M. Yon won gold and bronze respectively.

Gold Award in MTE 2019

Ir. Dr Abdul Razak Abdul Karim won a gold award for his research project entitled "An Improved Procedure of Bolted Timber Connection Design for the Masonry Building Strengthening Purposes" at the Malaysia Technology Expo 2019 **(MTE 2019)**. The 18th International Expo on Inventions and Innovations was featured more than 500 inventions by leading researchers and innovators, academicians, research institutions, young entrepreneurs and industries. The prestigious event organized by Professional Trade Exhibitions and Meeting Planners (PROTEMP) and Malaysian Association of Research Scientists (MARS) was held at the Putra World Trade Centre (PWTC) in Kuala Lumpur from 21 – 23 February 2019.

Triumph Continues in MTE 2020

On 20 – 22 February 2020 at the Malaysia Technology Expo 2020 **(MTE 2020)** organized by Professional Trade Exhibitions and Meeting Planners (PROTEMP), Ir. Dr Abdul Razak Abdul Karim won a gold award for the research project entitled "W-D Joints: The Masonry Building Retrofit Solutions". In the 19th international expo that attracted 566 entries from 21 countries, he also bagged a special invention & innovation award of building category from the Croatian Inventors Network presented at the Putra World Trade Centre (PWTC) in Kuala Lumpur.

Innovate Sarawak 2020 Competition

A final year project entitled "Design and Implementation of Smart Home Control System Based on Internet of Things" led by supervisor Dr. Yonis.M. Yonis Buswig and undergraduate student Liu Wen Yee won a 3Third prize in innovate Sarawak 2020 competition 2020 in Track: IoT. Innovate Malaysia Design Competition is an engineering design competition open to all final year degree engineering, computer science, and science/mathematics students in Malaysia.

Artificial Intelligence Algorithm of Retinal Microvasculature Feature Extraction for Early Detection of Cardiovascular Disease – Research Accomplisments and Activities

This research was funded under Unimas Fusionex research grant (RG/F02/FUSX/01/2019) and led by Dr Kuryati Kipli. Under the project, awards received were Gold Medal Award at UNIMAS Innovation & Technology Exposition 2019 (InTEX19, Gold Medal Award at 19th Malaysia Technology Expo (MTE2020), and International Merit Award from The Republic of Croatia in conjunction with The Malaysia-Croatia Technology Exchange at MTE2020.

Smoked Fish Processing Centre Project at Kampung Tebelu, Sebuyau, Sarawak

Smoked Fish Project was initiated in 2019 with the support from Dana Pembangunan Usahawan Bumiputera (DPUB), TERAJU to upgrade the Bombay duck (locally known as "ikan lumek") smoked fish industry in Kampung Tebelu, Sebuyau, Sarawak through modernization of smoked fish production in compliance with a minimum of MESTI requirements. The project scopes include development of smoked fish processing centre, marketing development and training. The project is aimed to increase the economic capacity and human resources capability of the community. The project is currently in progress.

Upon completion of this project, an integrated smoked fish processing centre will be ready in Kampung Tebelu, Sebuyau, Sarawak with the capability of producing smoked fish and its downstream products inclusive of management and marketing activities.

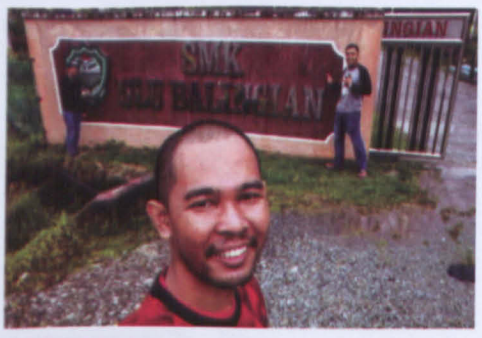
Initial meeting with community of Kampung Tebelu for project collaboration

Traditional process on "Salai Lumek" production

Initial site works at Kampung Tebelu, Sebuyau, Sarawak

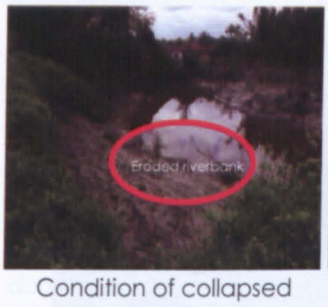
Mini Water Treatment Plant Project at Sekolah Menengah Kebangsaan Ulu Balingian, Sarawak

In 2019, Universiti Malaysia Sarawak has been awarded a consultation project by Ministry of Education Malaysia to design and build a feasible mini water treatment plant with the main aim to supply continuously treated water for the daily use of the students and the staffs at Sekolah Menengah Kebangsaan Ulu Balingian located at Sibu-Bintulu Road, Sarawak. This project is led by the Director of UNIMAS Community Sustainability Centre (USC), Noraziah Abdul Wahab and assisted by several engineering researchers namely Mohd Farid Atan, Ir Rudiyanto Philman Jong, Associate Professor Dr Thelaha Masri, Dr May Raksmey, and Dr Abang Mohammad Nizam Abang Kamaruddin. This project is also assisted by technical staffs namely Airul Azhar Jitai, Mohammad Amirul Nizam Amit, Mohd Fairudi Mohd Jamil, Rozaini Ahmad, and Wan Mohammad Haekal Wan Herdwat. This project consists of several stages which are site survey, water source sampling, laboratory testing, site construction, and installation and commissioning of the related equipment. Site survey and water source sampling have been conducted in May 2019 and followed by laboratory testing in September 2019. Then, site construction commenced in November 2019 and finally, all the tanks, piping system, control system, and ultrafiltration unit system have been completely installed in February 2020.



Mitigating Riverbank Erosion at Kampong Serpun Kelidi Asajaya

In mid-2018 the Department of Irrigation and Drainage(DID) Samarahan Office collaborated with Civil Engineering Department, Faculty of Engineering, UNIMAS in finding an innovative and sustainable solution to riverbank erosion problems. It is a continuous pilot research works to measure durability of design. Riverbank erosion is one of the commonly encountered occurrences in Sarawak especially after the monsoon season. As water flows through a meander its impact on the riverbank is sufficient to slowly weaken the soil physical structure especially in a highly saturated condition. One of DID's ring bunds at Kampong Serpun Kelidi Asajaya was in need of remedial works after a portion collapsed in December 2017. In this collaboration, our researchers were given the opportunity to design using precast foam concrete slabs with stabilized soil. Foam concrete slabs function as energy absorber to the approaching forces of flowing water while stabilized soil acts as light impermeable layer to avoid weakening of soil structure. Two main materials were used, viz Portland limestone cement (PLC) and SRS admixture. Both materials were subject of researches in the Department with industry grants from CMS Cement Industries Sdn Bhd and Hoi Fu Group Sdn Bhd.



Condition of collapsed bund

Current condition of bund after 2 years

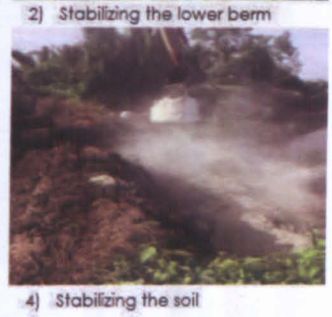
The total project cost was RM47,424.00 covering about 10m stretch of the bund. The period of construction was given as one month before the coming of next monsoon season. The contractor had to clear 400m access road to reach site. The volume of stabilization works on soft alluvial soil was 102m^3. The mixing formula based on laboratory experiments was 5% Portland limestone cement. The moisture content and specific gravity were targeted at less than 15% and below 1.5, respectively. PLC is a newly introduced binder product with high setting time and filling properties. It took an average of 5 hours to mix the soil in-situ and gain sufficient strength ready for the subsequent process to proceed. The foam concrete was precast in 0.6x0.6x0.2m block samples at a factory in MJC and brought to site. The slope was designed with three levels terrace and the precast concrete samples were arranged at the edge of each terrace. The foam concrete had pores that can absorb the water energy while the terraces were designed to break the water energy.

Two monsoon seasons had passed and the bund is still intact and functioning. Grasses and trees started to grow surrounding the repaired bund. Such healthy growth of plants is evidence that speed of water flow in that section has reduced and do not wash away young seedlings. Ironically, there is no plant growth on the stabilized soil. The precast foam concrete slabs are slightly displaced to different positions accommodating the impact of hydrostatic pressure. None of the slabs were swept away by the flowing water. The project was considered a success and the design can be applied to other areas with similar problems.

1) Installing bakau pile

2) Stabilizing the lower berm

3) Installing the precast foam concrete



4) Stabilizing the soil

5) Slope strengthening with bakau anchors

6) Completed works

Sesar Unjur Production using Solar PV System in Kampung Igan, Sarawak

Sesar unjur (smoked shrimp) is a Sarawak delicacy that can be found around Mukah, Sarikei and Igan. It has a high market value due to its unique taste. Currently, the production technique only uses the traditional method of burning white mangrove wood (*Laguncularia racemosa*) to smoke the fresh shrimp and give a unique taste to the *sesar unjur*. Traditional techniques lead to low quantity production making it difficult to penetrate a wider market. Therefore, automation-based and modern technologies should be applied to increase the production to time ratio. Indeed, modern machines can ensure that shrimp dehydration occurs at constant temperature and adequate airflow. This condition is difficult to achieve by using traditional techniques.

The main objective of this project is to design a reliable off-grid solar PV system (Stand Alone Solar PV system - SAPV) that supplies the electrical requirements of the automated machine. Activities to be carried out during the project include load demand profile, resource availability study, PV panel measurement, and hybrid solar PV inverter dimensions. Detailed calculation of component measurements is based on the guidelines of the Sustainable Energy Development Authorities (SEDA) and SIRIM standards. This project is undertaken under the collaboration between Faculty of Engineering and Persatuan Melanau Igan (PERMAI) and fully funded by Ministry of Science, Technology and Innovation (MOSTI) amounting to RM232,000.00.

Remote Monitoring and Control System for Solar Photovoltaic Power Plant in Rural Area

This research was funded by OSAKA Gas Foundation in Cultural Exchange (OGFICE) grant scheme with the duration of 18 months started from January 2019, led by Dr Kho Lee Chin. The aim of the research was to develop a remote monitoring and control system based on IoT to cover solar PV power plant in rural area. One of the research activities was organizing workshop on *Internet of Things (IoT) courseware – U3801A* and *Agricultural Soil Regulation Kit* which is conducted by TEKMARK Group Malaysia. Besides, a research paper was presented in 2019 International UNIMAS STEM 12th Engineering Conference.

Performance Test for Wenhong Stormwater Module

The WENHONG Stormwater Module (see Figure 1) can be used either as underground storm water storage vaults or as subsurface drainage module. These modules are made of plastic and can be part of a sustainable drainage and rainwater harvesting system. The purpose for this research is to test the suitability of WENHONG Stormwater Module to be used under our local condition. Test will be carried out to determine the detention capacity of the stormwater module and the reduction of peak discharge the outlet as well as the roughness coefficient of the module under different flow condition. The current stage of the setup onsite is as shown in Figure 2 which is almost completed and Figure 3 shows setup drawing for the experiment.

Figure 1 WENHONG Stormwater Module

Figure 2 Experimental setup onsite

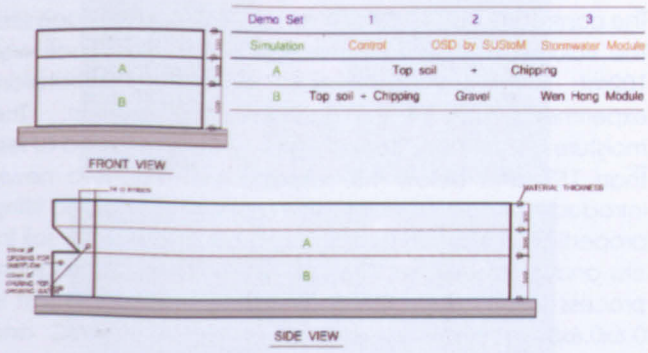


Figure 3 Experimental setup of the experiment

MOA with WENGHONG Plastics Industries Sdn. Bhd.

An Intellectual Exchange Knows No Border

A research collaboration was recently formed and conducted between Associate Professor Dr. Ahmad Kueh Beng Hong from the Department of Civil Engineering, Faculty of Engineering, UNIMAS and Professor Dr. Xiao-Hui Wang of the College of Ocean Science and Engineering, Shanghai Maritime University (SMU) of China beginning in 2019. This was a collaborative event realized through the grant awarded by the Shanghai Science, Technology and Innovation Action Plan 2018 under The Belt and Road Initiative of the Chinese government for the research entitled 'Service life prediction and life-cycle cost analysis of stainless steels reinforce concrete elements in marine environment'. It was a special grant offered to form a continual academic alliance between two higher education institutes with Prof. Wang and Dr. Kueh acting as the principal researchers from both nations. In fulfilling the grant work, Dr. Kueh was invited under the capacity of Young Foreign Scientist to carry out part of the research at SMU from July 25, 2019 – January 24, 2020, which coincided with the 110th anniversary of the university establishment.

In general, the still ongoing research aims to solve an often taken for granted material performance issue, that is, the formation of the cracks due to stainless steel rebar corrosion in reinforced concrete in the presence of a hostile maritime environment. Despite common belief, stainless steels can corrode too given the appropriate loading and environmental climates, albeit with a slower rate relative to normal steels. Only via a proper comprehension of the stainless steel rebar corrosion behaviors can a more realistic cracks formation in reinforced concrete structures under the dynamic exposure of sea loads be forecasted accurately, and thereby safeguarding the precise execution of the remedial and rehabilitative measures in preventing the eventual occurrence of a disastrous structural failure. For the research, Dr. Kueh has been tasked to numerically model various crack scenarios competing to dominate and reign as the mode that fails the reinforced concrete from the perspective of the stainless steel rebar corrosion and rust expansion with the surcharge of external loading. As for knowledge sharing, mentoring sessions on numerical modeling matters were periodically conducted by Dr. Kueh for the postgraduate students at SMU.

Findings from the collaborative effort have been forever cemented in an article entitled 'Contesting crack modes modeling of reinforced concrete structure threatened by the progressive rust expansion in rebars in the presence of external load' to appear in the December 2020 circulation of the highly reputed journal, *Construction and Building Materials*, with Dr. Kueh as the first and corresponding author. In the spirit of ensuring the sustainability of cooperation and permanence in a good relationship, several more papers are currently prepared by principal researchers from both sides in addition to continuity in various research endeavors. To reciprocate the goodwill, Prof. Wang also sits on the International Advisory Board of the 13th International UNIMAS Engineering Conference (EnCon 2020) to kick off via a virtual platform on October 27 – 28, 2020, which is amongst the first conference events perseveringly organized by the UNIMAS academicians to brave the storm of the COVID-19 pandemic. For further information, Dr. Kueh can be contacted via his permanently working email, kbhahmad@unimas.my.

Making a memorable appearance in front of a big billboard advertising the 110th-anniversary commemoration of the founding of SMU

Group photo with Prof Wang (third from the left) and colleagues at the main entrance of the College of Ocean Science & Engineering, Shanghai Maritime University

Toyota Plant Visit

On 8th to 11th April 2019, UNIMAS has sent their representative to visit Toyota Plant in Klang, Selangor. UNIMAS has represented by Ir. Dr Danial from Faculty of Engineering to observe the system in the new plant. The visit was organized by Naizem Resources, a company located in Shah Alam, Selangor.

Visit to Mega Jati Academy, UEM Edgenta Perak Regional Office

On 25th and 26th February 2020, Ir Dr Danial, representative from Department Mechanical and Manufacturing Engineering, UNIMAS has been invited to give a talk with a title ` Variable Frequency Drive (VFD) Overview to Practical Application` in Mega Jati Academy, UEM Edgenta Perak Regional Office located in Hospital Raja Permaisuri Bainun, Ipoh, Perak, Malaysia.

Assoc. Prof. Dr. Mohamed Shabaan fruitful visits in Egypt

On August 2019, Assoc. Prof. Dr. Mohamed Shaaban was invited to visit the Faculty of Engineering, Tanta University, Tanta, Egypt. Dr Shaaban has met the Dean there and handed him UNIMAS souvenir. He has also delivered a lecture to introduce UNIMAS as well as his latest research on optimal scheduling of microgrids. He has also met academic staff and graduate students in the Faculty.

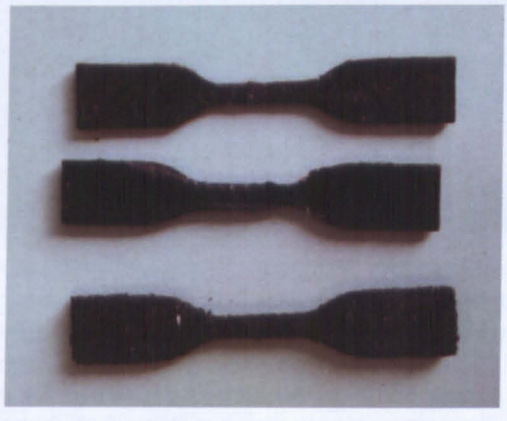
On January 2020, Assoc. Prof. Dr. Mohamed Shaaban was invited to visit the Faculty of Engineering, Arab Academy of Science, Technology & Maritime Transport (AASTMT), Alexandria, Egypt. Dr Shaaban has met the Dean there and exchanged with him UNIMAS souvenir. He has also delivered a lecture to introduce UNIMAS as well as his latest research findings in renewable energy integration. He has also toured the electrical engineering department labs in AASTMT.

On January 2020, Assoc. Prof. Dr. Mohamed Shaaban has visited the Faculty of Engineering, Tanta University, Tanta, Egypt. In this visit, however, Dr Shaaban signed an agreement with Tanta University to be appointed as visiting professor from 2020 – 2023.

Waste to Wealth

Many researches focus on "waste to wealth" concept, where agro-waste is converted into various valuable products especially on natural fiber polymeric composites. Selected fibers for this research were rice husk (RH) and coconut husk (CH). This research focused on the property enhancement of RH-CH fiber reinforced epoxy composites and comparison RH reinforced epoxy composites, CH reinforced epoxy composites, and RH-CH reinforced epoxy composites, carried out by FYP student during session 2019/2020, at BioProcess Laboratory. RH-CH reinforced epoxy composites were well-fabricated by mixing epoxy resin and different ratios of two types natural fibers via compression molding and stir casting methods. All the fabricated RH-CH reinforced epoxy composites were characterized using Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscopy (SEM),

Vickers Hardness Test (VHT), and tensile test (TT). Overall, it could be concluded that 10wt% RH-CH reinforced epoxy composites performed the best in terms of physical, mechanical, and morphological perspective than RH reinforced epoxy composites and CH reinforced epoxy composites. This proved that RH and CH could be well-introduced as reinforcing filler in epoxy matrix to fabricate better composites for structural application.



Collaboration

Faculty with the Industry: MoU with Minisry of Utilities, Sarawak

Universiti Malaysia Sarawak (Unimas) on 5th October 2020 signed a memorandum of understanding (MoU) with Ministry of Utilities, Sarawak to develop modules and organise competency courses related to low pressure gas distribution in the state, this year. In the ceremony at the university's campus, here, Unimas was represented by deputy vice chancellor (Research and Innovation) Professor Wan Hashim Wan Ibrahim while the ministry was represented by its Permanent Secretary Datuk Alice Jawan Empaling.

Vice chancellor Professor Datuk Mohamad Kadim Suaidi in his speech, read by Wan Hashim, said the collaboration would ensure that the gas supply industry in Sarawak would be on par with the gas industry in the Peninsula and Sabah. He said the university's Engineering Faculty would develop several competencies course modules on low pressure gas for the ministry's Gas Distribution division in line with the state's ordinance and regulations.

"Among the courses to be offered is the Responsible Person in Gas course, that is required to be attended by all businesses with gas systems installed (on their premises) such as restaurants, shopping complexes and laundry services. For jobs involving the installing of low pressure gas systems, Unimas offers Gas System Installation Competency Certificate level Three, Two and One," he said, adding that the certificates were among the ministry's requirements for any contractors involved in installing and maintaining low pressure gas systems in the state. — Bernama

CWorks Technologies Sdn Bhd to Strengthen Industrial Lab

The Department of Mechanical Engineering has afforded to have a tie-up with CWorks Technologies Sdn Bhd in a Memorandum of Agreement (October 2020). The MoA is specially developed to set up UNIMAS-CWorks Industrial Laboratory which is a collaboration between Universiti Malaysia Sarawak and CWorks - The CMMS Specialist. The laboratory is sited at UNIMAS Kota Samarahan campus and established to undertake forward looking, industry relevant, research in the area of proactive maintenance analytics for facilities and factories. This research aims to leverage UNIMAS' strengths in research and CWorks strengths in industrial maintenance data while employing Industrial Revolution 4.0 (IR4.0) technologies such as Big Data Analytics, Machine Learning, Internet of Things (IOT) and others. It is envisioned that the laboratory will produce thought leadership commercial products in the form of conferences, publications, courses, software tools and consulting services. Soon, the laboratory will empower itself by hiring postgraduate students to work with us in the relevant fields that is pertinent to the development of the state of Sarawak and Malaysia. This will be our eternal gift to Malaysians and the world.

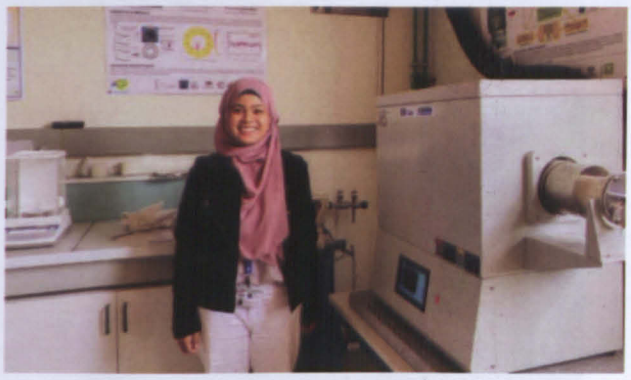
Discovering Best Solutions for Road Safety Problems

The department has signed an MoU in October 2020 with Malaysian Institute of Road Safety Research (MIROS) which is an agency under the Ministry of Transport Malaysia that serves as a central repository of knowledge and information on road safety. The findings derived from research and evidence-based intervention programmes provide the basis for the formulation of new strategies, legislations, policies, and enforcement measures, governing road safety at the national level. Principally engaged in research, UNIMAS and MIROS will work closely with local and international government agencies and private bodies to further the cause of road safety. Hence, researchers from UNIMAS and MIROS will collaborate among others in Research and Development, Academic staff attachment, collaboration in Research Projects and others. This will hope to find the best solutions in defining road safety problems and find ways to tackle them scientifically with the current development of the Pan Borneo Highway in mind. The department hopes that more collaboration in the future can be realized with local and international partners for the betterment of mankind.

Research Collaboration with Tokai University and Kyokuto Diecast Co Ltd

Ms. Tan Ger Lian, a representative from UNIMAS, was sent to Japan for an attachment in Tokai University for an international collaboration project between UNIMAS, HICOM, Tokai University and Kyokuto Diecast. The collaboration research aims to improve the diecasting process of aluminum and magnesium. The 6 months' attachment was fully funded by Tokai University, Micro Nano Technology Center and Kyokuto Diecast Co. Ltd. The collaboration still took place at the moment with a discussion and meeting is being held through webinar and online broadcast during this pandemic. Ir Dr Danial also visited Mizutani Sangyo in Gifu Prefecture for a research meeting to find collaborative work together with Tokai University, Kyokuto Diecast, UNIMAS and Hicom Diecasting during this trip.

Research Collaboration under Boursier du Gouvernment Francais (France Government Scholarship)



On 2nd September 2020, Sitti Aishah binti Najamudin, a postgraduate student under Ir Dr Danial supervision has been awarded French Government Scholarship from France Embassy in Malaysia which gave her an opportunity to do a collaborative research in France for 4 months period. The research took place in Univ UPJV, France and conducted a research with a title ` Bioinspired Surface For Energy Saving`. The Collaboration was fully funded by France government. The collaboration showed a commitment between two countries (France and Malaysia) to empower research activities even though the world is facing the dangerous Covid19 pandemic.

Faculty with the Community: Introducing Gula Apong to the World

A local Spaoh co-operative, the Koperasi Apong Saribas Berhad, plans to produce two Nipah palm-based products, Borneo Apong Honey and Borneo Apong Vinegar soon. According to its spokesman Rasli Muslimen, the co-operative has acquired a building at the Spaoh Agriculture Station for its factory. Rasli, a local from Spaoh, is also a senior lecturer in Mechanical Engineering and Manufacturing Faculty of Universiti Malaysia Sarawak (Unimas).

He said the co-operative is collaborating with the university's Apong Research Group (ARG) in the production of both products. Rasli said ARG had developed and patented a hybrid digital control cooking stove to process the raw Apong sap into honey.

"We are funded by Unimas, Teraju and the Sarawak Bumiputera Entrepreneurs Development for the two projects. The idea is to help the local Iban and Malay communities and others here generate income to raise their living standard," he said.

"We will need about six months to prepare including upgrading our premises at the Spaoh Agriculture Station. We need to follow MeSTI (*Makanan Selamat Tanggungjawab Industri*) standard besides the Good Manufacturing Practice (GMP) and the Hazard Analysis and Critical Control Point (HACCP) as well as the 'halal' certifications for our production. We will begin production after doing and acquiring all these. Our production will be hi-tech where the quality and hygiene aspects will be much better. As I have mentioned, our cooking stove will be digitally controlled," he added.

Rasli said although Gula Apong or Apong sugar was produced traditionally and using wood for heat source, the hygiene aspect is a major issue. Rasli added among others, the Borneo Apong Honey would be a good substitute for sugar while the Borneo Apong Vinegar can be used in food preparation. – Borneo Post.

And on the same project, on 21st September 2020, CEO`s TERAJU, Tn. Hj. Md Silmi Abd Rahman and other TERAJU members have visited faculty of engineering UNIMAS as a follow up for a TERAJU-Gula Apong project. The project is lead by Dr Ana Sakura Zainal Abidin which aims to provide an alternative and innovative method to produce the gula apong, Sarawak famous coconut sugar. During the visit, TERAJU member amaze with the progress of the project shown by UNIMAS team. The project will be a step stone of small medium enterprise (SME) for local community especially in Kg. Tambak, Tg. Apong and Kg. Spaoh. In the future, the SME will help the local community to generate bigger economy growth during the Covid19 pandemic season.

Advisor for Marine Police Wilayah LIMA, Kuching, Sarawak

Ir. Dr Danial from Mechanical and Manufacturing Engineering Department, UNIMAS was appointed as an advisor for Marine Police Wilayah LIMA, Kuching, Sarawak. The meeting was held on 25th June 2019 and the main objective of the meeting is to give an advice and facilitate on the utilization of Multipurpose Portable Outboard Engine Running Testing (m-POERT) in Royal Malaysia Police, Kuching Branch, Kuching, Sarawak.

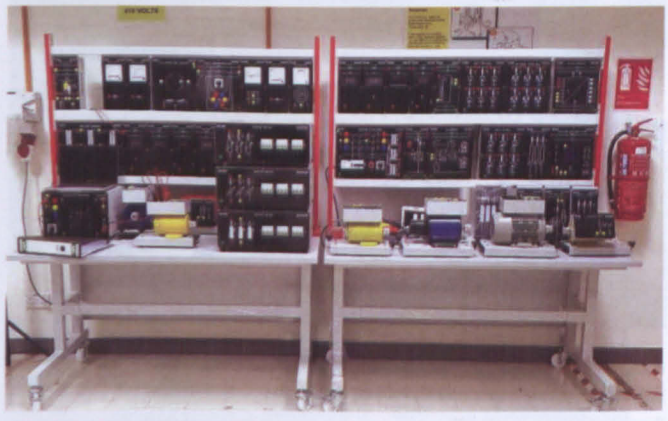
New Equipment and Services

Installation, Training, and Commissioning of the Electrical Laboratory (Power Electronics and Electromechanical System)

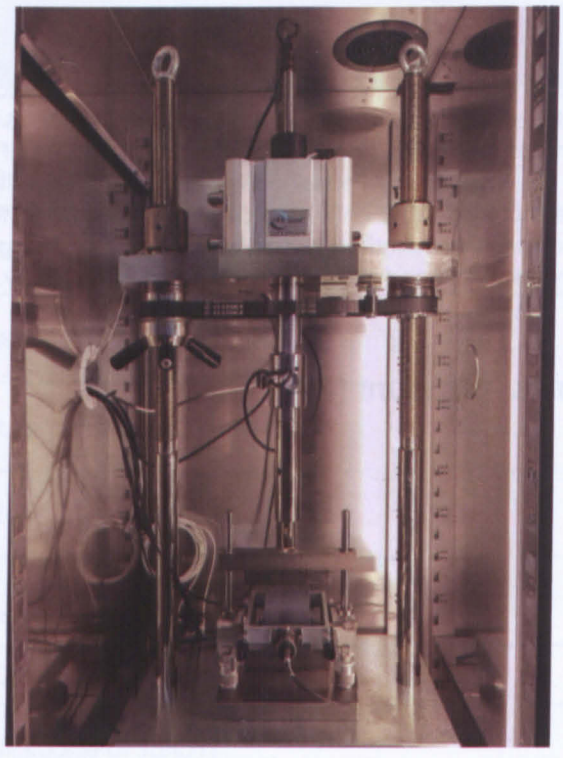
On September 29, 2020, the Department of Electrical and Electronics Engineering UNIMAS had acquired and Install sets of electrical laboratory equipment (Power Electronics and Electromechanical systems), allocated at Electrical Laboratory 1 (Level LG).

The laboratory has been equipped with the fundamental and modern power electronics and Electromechanical systems devices and measurement units such as (Variable AC and DC power supply, soft-switching control unit, Semiconductors devices, motor drive system, digital AC/DC voltmeter/ digital oscilloscope, single-phase transformer, Three-phase transformer, and RLC load bank) in order to expose, learn and understand the applications of the existing power electronics to undergraduate students.

Besides, on September 29-28, 2020, the lecturers and technicians staff of the Department of Electrical and Electronics Engineering had two days of training on the new electrical laboratory equipment in order to learn and understand the connections, operation, and safety process.



MATTA Machine at Civil Engineering Highway and Traffic Laboratory

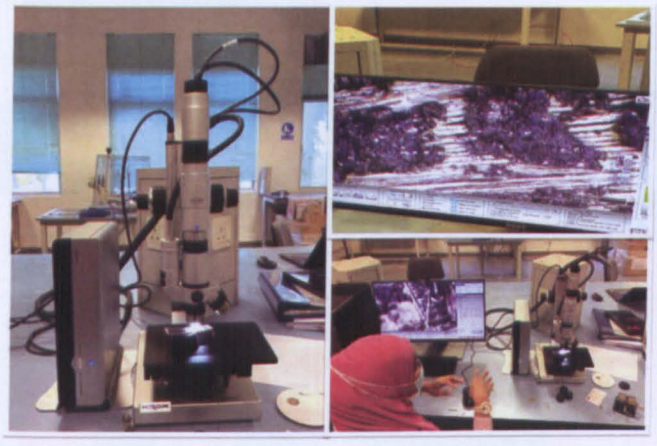


Material Testing Apparatus (MATTA) is the newest addition of equipment in Highway and Traffic Laboratory. Civil Engineering Department acquired this machine in Mid-August 2020 as an advancing plan in the research activities of pavement mixture. MATTA machine MODEL I.P.C GLOBAL PV7A02 with loading capability up to 16KN linked to advanced control and data acquisition system (CDAS) with ductless automatic control climatic chamber for sample conditioning.

MATTA machine main function is to determine the mixture performance for fatigue and rutting characteristic. Test normally conducted using MATTA machine are Indirect Tensile Fatigue Test(ITFT), Dynamic Creep, Dynamic Modulus Test and Four Point Bending Test. All test followed specification set in British Standard (BS) and JKR Malaysia.

Currently this machine used by final year student for pavement material research. Few consultation projects such as Sarawak Aggregate study and low volume road design also depending on this machine to run the Resilient Modulus Test.

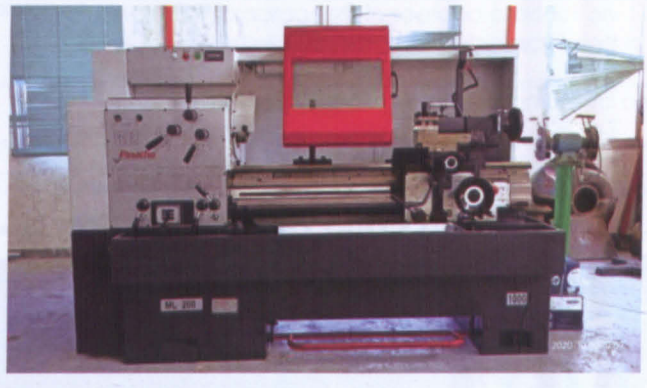
New Digital Microscpoe for Metallurgy Laboratory

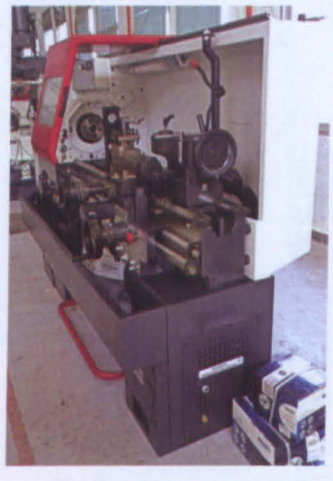


Department of Mechanical and Manufacturing Engineering received a HIROX RH-2000 Digital Microscope and assembled in Metallurgy Laboratory. The machine comes with new mounting system, CMOS high definition sensor and high intensity of LED lighting enable researcher to observe a material with high accuracy. With upgraded function of autofocus-multifocus, the machine can get a fully focussed image with one click button. The machine can provide a fastest way to create a 3D model with smoother and more accurate scanning with 0.05µm/pulse precision. Besides, the machine can provide various measurement such as point height measurement, profiling, volume and area, angle or radius in 3D and also roughness for the material. The existence of the machine can give huge opportunity for researchers to expand their research to a new dimension and view.

Arrival of Lathe Machine at CEES Department

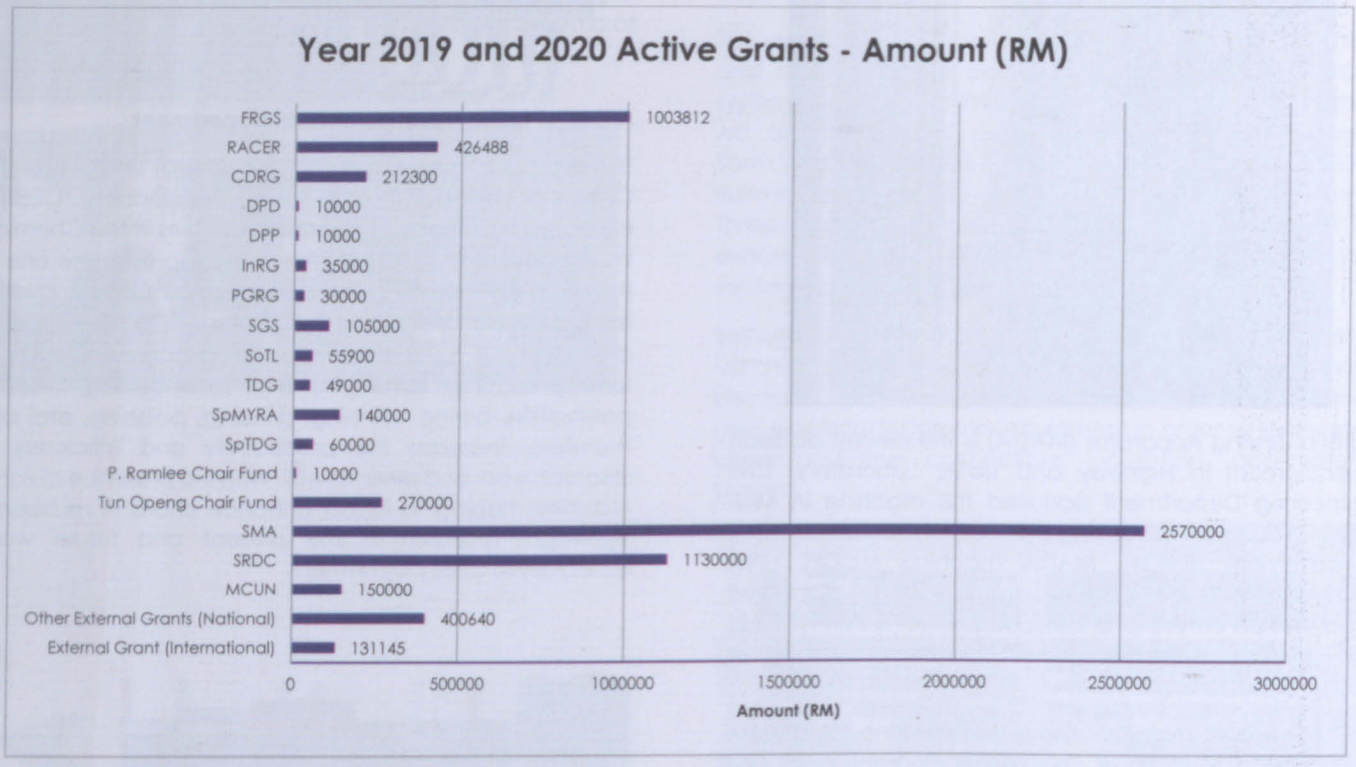
The arrival of Lathe Machine (Pinacho) at Department of Chemical Engineering and Energy Sustainability (CEES) is expected to enhance the existing facilities in the Chemical Workshop. Lathe Machine is expected to become one of the main equipment in the workshop. Famously known as the most versatile machine tools in the industry. It is capable of performing a variety of machining operations such as turning, tapping, forming turning, spiral cutting, finishing, passivation, boring, spinning, grinding, polishing, etc. and therefore, increase the productivity and efficiency of research work and other as well. With the presence of Lathe Machine, hoping to further enhance efforts in multiplying significant research in the present and future works especially in CEES Department.

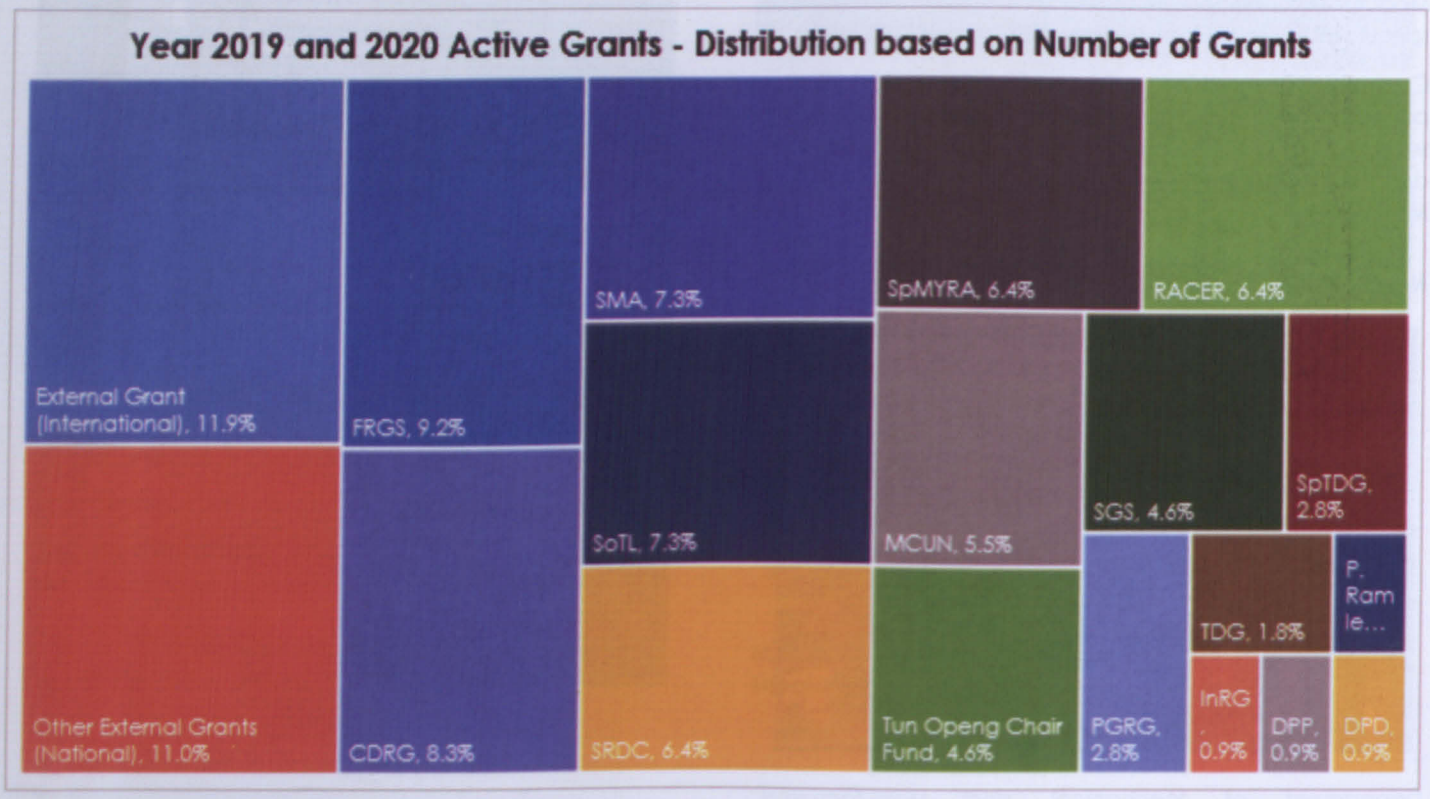




RESEARCH GRANTS

To date, in 2019 and 2020, Faculty of Engineering have managed to secure several internal and external grants with a total of RM6.8 million. Seven of our academics have secured MYRA grants and the ever competitive MOHE grants i.e. the FRGS are awarded to ten of our researchers. Sarawak Research and Development Council (SRDC) has been awarding members of the faculty with grants totaling to RM1.13 million to date. Internationally, the Osaka Gas Foundation of International Cultural Exchange (OGFICE) has been continuously supporting researches in the faculty and recently awarded twelve of the thirteen international external grants to the faculty with a value of RM120,000 of grants. Other various local and international counterparts have contributed, directly and indirectly, through support in grant money, materials and ideas to researchers in the faculty.





MOHE Grant - FRGS		
Project Leader	**Budget (RM)**	**Title**
Dr Lee Yee Yong	60,260	Porous Material with Thermal and Evaporation Properties for Thermal Comfort Evaluation
Ir. Dr Norazzlina bt M. Sa'don	134,000	Strength Optimization of Fiber Reinforced Peat using Scrap Tire for the Subgrade Embankment
Mr Ron Aldrino Chan@Ron Buking	107,200	Micro-structural and mechanical properties of locally available limestone and river gravels in asphalt pavement
Dr Abdul Rahman bin Kram	98,000	Receiver Scintillation Enrichment Using Zero Optimum Decision (ZOD) Technique In Free Space Optical Communication Transmission
Prof. Dr Musse Mohamud Ahmed	120,000	Simulation of Smart Grid based Two-Way Communication Framework for the Wide Area Measurement
Dr Yonis. M.Yonis Buswig	93,500	A Novel Multi input DC-DC Power Converter for Integrated Solar PV-Micro Hydro Hybrid Renewable Energy System
Assoc. Prof. Dr Mohamed Abdelmoneim Shaaban Mohamed	73,000	A New Smart Microgrid Scheduling Approach for Flexibility Provision to Central Utility Grid Using Disjunctive Programming
Dr Charles Bong Hin Joo	91,892	Fuzzy FMEA risk assessment of hydraulic flushing in managing sedimentation in open storm drain
Dr Siti Kudnie bt Sahari	93,200	Study on the Effect of TiO2 Doped Graphene Oxide and Reduced Graphene Oxide for Perovskite Solar Cell Application
Prof. Dr Mohammad Omar Abdullah	132,760	Prototyping of an affordable modular Solar-Powered Absorption Cooling System integrated with Waste Heat Regeneration Reactor and Passive Cooling.

MOHE Grant - RACER		
Project Leader	**Budget (RM)**	**Title**
Dr Dyg Norkhairunnisa binti Abang Zaidel	60,070	Influence of microorganism in seafood product on dielectric properties and resonant frequency using a fabricated microstrip patch antenna
Dr Tengku Mohd Afendi bin Zulcaffle	50,160	An Algorithm for Plant Disease Classification Based on Leaf Depth Features
Dr Hafizah binti Abdul Halim Yun	62,690	Development and Characterization of Activated Hydrophilic Biocarbon of Wood Waste Reinforced Bio-composites
Dr Josephine Lai Chang Hui	60,900	Modelling and Investigation on Optimum Drying Kinetics and Conditions of Okara
Dr Dayang Nur Salmi Dharmiza binti Awang Salleh	59,800	Visual Odometry Performance Analysis in Accurate Positioning for Autonomous Vehicle Complemented with Data Fusion
Dr Lidyana binti Roslan	58,960	Dabai nutshell as activated carbon for filtering of domestic wastewater
Dr Dayang Azra binti Awang Mat	73,908	PARAMETRIC STUDY OF DEFECTED STRUCTURE TOWARDS INCREASING THE PERFORMANCE OF INTEGRATED FILTER-ANTENNA FOR MICROWAVE IMAGING SYSTEM

Internal Grant - CDRG		
Project Leader	**Budget (RM)**	**Title**
Dr Ibrahim bin Yakub	20,000	Structure-performance correlation and predictive model for biomass-derived catalysts in a hydrogen-selective catalytic reduction of toxic nitric oxide
Dr Raudhah binti Ahmadi	22,500	A framework for systematic land use planning based on Seismic Microzonation Assessment: A Case Study on Miri Division
Dr Kasumawati bt. Lias	20,000	Modelling of a Modified Microstrip Applicator to Control Focus Position Distance for Cancer Treatment in Breast Region
Dr Md. Rezaur Rahman	21,000	Development of Activated Cellulose filler Reinforced Composites for Biomedical Applications

Dr Nicholas Kuan Hoo Tien	26,500	Characterisation of Fibre Metal Laminates bio-composites based on environmentally-friendly local plant fibre
Dr Khairul Fikri bin Tamrin	28,000	Development of compact laser glucometer and app for nationwide diabetes screening and monitoring
Dr Idawati binti Ismail	25,500	Prediction of mechanical strength and durability of geopolymer concrete by neural network
Assoc. Prof. Dr Ahmad Kueh Beng Hong	24,800	Acoustic and mechanical performance of natural fiber reinforced concrete mixed with silica aerogel: Characterization for model formulation
Ir. Dr Ivy Tan Ai Wei	24,000	Enhanced bioelectricity generation in a hybrid microbial fuel cell-adsorption system using electron mediator and electrode modification

Internal Grant - DPD & DPP		
Project Leader	**Budget (RM)**	**Title**
Prof. Dr Musse Mohamud Ahmed	10,000	Design and Development of Two-Way Wireless Communication System for Medium Voltage Electrical Distribution Networks
Assoc. Prof. Ir. Ts. Dr Kismet anak Hong Ping	10,000	A Novel Algorithm for the Detection of Buried Objects with Arbitrary Shapes

Internal Grant - InRG		
Project Leader	**Budget (RM)**	**Title**
Prof. Dr Mohammad Abdul Mannan	35,000	ResLiCop on Permanent Formwork cum Corrosion Retrofitting for Coastal Structure

Internal Grant - PGRG		
Project Leader	**Budget (RM)**	**Title**
Assoc. Prof. Ir. Dr Siti Noor Linda bt Taib	10,000	Geotechnical Performance of Combined Stone Columns/Piles Capped with Reinforced Concrete Raft Foundation in Soft Clay Soil
Dr Mah Yau Seng	10,000	Field Testing of On-Site Detention Using StormPav Green Pavement System
Prof. Ir. Dr Amir Azam Khan	10,000	Parametric study and simulation of Titanium carbide-supported, platinum-doped tetrahedral amorphous carbon ''TiC – ta-C'' electrodes for Hydrogen Evolution Reactions (HER)

Internal Grant - SGS		
Project Leader	**Budget (RM)**	**Title**
Miss Hasmida Binti Hamza	20,000	Sediment Accretion and Wave Dissipation Using Perforated Polymer Concrete Plate (PPCP) as Sediment Trapper and Wave Breaker for Coastal Erosion Control
Dr Lee Yee Yong	20,000	THERMAL COMFORT ASSESSMENT FOR DIFFERENT THERMAL BEHAVIOR OF OUTDOOR TROPICAL CLIMATE
Miss Shamsiah bt. Suhaili	20,000	Design and Implementation of RIPEMD-160 Hash Function using Unfolding Transformation
Dr Yanuar Zulardiansyah Arief	20,000	EXPERIMENTAL INVESTIGATION ON ELECTRICAL PROPERTIES OF PALM-BASED ESTER OIL AS ALTERNATIVE POWER TRANSFORMER OIL APPLICATION
Dr Dayang Salyani binti Abang Mahmod	25,000	Effects of laser surface treatment on microstructure and mechanical properties of Ni-Cr composites

Internal Grant - SoTL		
Project Leader	**Budget (RM)**	**Title**
Mr Mohd Farid bin Atan	5,000	Strategic Development, Implementation and Assessment on Chemical Engineering Programme
Dr Jethro Anak Henry Adam	5,000	Enhancing Current Civil Engineering Undergraduate Programme towards Nurturing Future Ready Graduates

Dr Nur Tahirah binti Razali	5,000	Strategic Development, Implementation and Assessment of Mechanical and Manufacturing Engineering Undergraduate Programme.
Dr Kho Lee Chin	5,000	Engaging Students by Using Gamification Approach: Case Study of Electrical Engineering Technology (KNR2443)
Mr Mohd Ridhuan bin Mohd Sharip	5,000	Strategic Development, Implementation and Assessment of Electrical and Electronic Programme in Universiti Malaysia Sarawak
Dr Ade Syaheda Wani bt Marzuki	11,000	Post COVID19: Quality Assurance Internal Monitoring for Remote Learning in UNIMAS
Dr Rohana Sapawi	12,000	Effective Learning Activities Towards Achievement of MQF Learning Domain: UNIMAS Students' and Lecturers' Perspectives
Dr Kasumawati Lias	7,900	Collaborative Teaching-Learning and Assessment through Face to Face (F2F) and Online Distance Learning (ODL) in Engineering Courses

Internal Grant - TDG		
Project Leader	**Budget (RM)**	**Title**
Dr Rohana binti Sapawi	25,000	Monitoring the Implementation of IR 4.0 Criteria for UNIMAS Academic Programs
Assoc. Prof. Dr Shanti Faridah binti Salleh	24,000	UNIMAS readiness and challenges in implementing self accreditation of its Academic Programmes

MYRA Grant - SpMYRA		
Project Leader	**Budget (RM)**	**Title**
Dr Mohamad Faizrizwan bin Mohd Sabri	20,000	Modeling and development of energy management strategy controller for a split-axle hybrid electric vehicle
Dr Josephine Lai Chang Hui	20,000	Study of production of biofertilizer using organic wastes
Mr Abdul Azim bin Abdullah	20,000	Investigation on the Flexural Behavior of Concrete Filled Steel Tube (CFST) Beam with Embedded Steel Plates
Dr Shirley anak Johnathan Tanjong	20,000	EVALUATING DATA ACQUISITION STRATEGIES IN A SELECTED SME MANUFACTURING ENVIRONMENT
Mrs Ervina bt Junaidi	20,000	Electrophoretic deposition of hybrid graphene nanoplatelets-carbon nanotubes onto carbon fiber fabric: Effect of suspension medium, applied fields and deposition time.
Dr Tengku Mohd Afendi bin Zulcaffle	20,000	Unobtrusive Individual Identification Based on Fusion of Multiple Gait Features and Covariate Invariant Techniques.
Mr Ahmad Kamal B Abdul Aziz	20,000	THE IMPACT OF THE ODEOMETER INCREMENTAL LOAD (IL) SAMPLE SIZE ON THE COMPRESSIBILITY PARAMETERS OF PEAT.

MYRA Grant - SpTDG		
Project Leader	**Budget (RM)**	**Title**
Dr Annie anak Joseph	20,000	Online Feature Extraction for multitask Person Tracking System
Prof. Dr Wan Azlan bin Wan Zainal Abidin	20,000	Assessment of Onshore/Offshore Wind Energy Potential and Mapping Via Topographical NARX Neural Networks
Assoc. Prof. Dr Thelaha bin Hj Masri	20,000	HIGH-GAIN ANTIPODAL VIVALDI ANTENNA WITH FRACTAL ELECTROMAGNETIC BAND GAP STRUCTURE FOR ULTRA WIDEBAND APPLICATIONS

Chair Fund - P. Ramlee		
Project Leader	**Budget (RM)**	**Title**
Dr Khairul Fikri bin Tamrin	10,000	Laser discolouration - A new technique in acrylic painting of visual art

Chair Fund - Tun Openg		
Project Leader	**Budget (RM)**	**Title**
Assoc. Prof. Dr Rubiyah bt Hj Baini	54,000	Study on the performance of bio-based adhesive using sago starch
Ir. Dr David Chua Sing Ngie	54,000	MONITORING OF SAGO PALM PLANTATION USING MULTISENSORS APPROACH
Dr Josephine Lai Chang Hui	54,000	Development of Biodegradable Sago Materials for Food Packaging Application
Assoc. Prof Ir. Dr Lim Soh Fong	54,000	Utilization of Sago Bark to Produce Magnetic Biochar
Dr Khairul Fikri bin Tamrin	54,000	Experimental investigation of sago starch as green cutting/lubricating fluid in laser-assisted machining

External Grant (National) - Fusionex		
Project Leader	**Budget (RM)**	**Title**
Dr Dayang Azra binti Awang Mat	60,000	Analytical Solution for Early Detection of Skin Cancer among Malaysian using Deep Learning Algorithm
Dr Kuryati bt Kipli	60,000	Artificial Intelligence Algorithm of Retinal Microvasculature Feature Extraction for Early Detection of Cardiovascular Disease

External Grant (National) - JKR		
Project Leader	**Budget (RM)**	**Title**
Ir. Dr Ting Sim Nee	20,000	Integrating Project Scheduling with Risk Assessment Procedures
Dr Alsidqi Hasan	19,998	Geotechnical Characterization of Sarawak Soft Marine Clay
Ir. Dr Ting Sim Nee	20,000	Formulation of Construction Duration Index for Project in Sarawak

External Grant (National) - Matching grant (UTM)		
Project Leader	**Budget (RM)**	**Title**
Assoc. Prof. Dr Ahmad Kueh Beng Hong	20,000	Blast and Ballistic Behaviour of Tin Slag Polymer Concrete Strengthened with FRP for Bunkers and Command Posts in Army

External Grant (National) - MCUN		
Project Leader	**Budget (RM)**	**Title**
Assoc. Prof. Dr Shanti Faridah binti Salleh	25,000	Assessing the Sustainability performance for Agriculture Activities in Sarawak via Agriculture Sustainability Index.
Dr Gaddafi bin Ismaili	25,000	Studies on engineering properties of solid and laminated fast-growing Acacia hybrid wood of Sarawak using small clear method.
Dr Siti Kudnie bt Sahari	25,000	Electricity Generation from Coconut Waste Microbial Fuel Cell using Graphene Modified Electrodes
Ir. Dr Mohd Danial Bin Ibrahim	25,000	Tribological Properties Assessment of Biomimicked Nanosheets for Anti-viral Printed Electronics
Dr Charles Bong Hin Joo	25,000	Rainfall Trend Analysis due to Climate Change for IDF Curve and Temporal Rainfall Pattern Development for Major Cities in Sabah and Sarawak.
Dr Mah Yau Seng	25,000	A Design Research Readdressing Sarawak's Urban Infrastructure for Flood Resilience

External Grant (National) - MRUN		
Project Leader	**Budget (RM)**	**Title**
Assoc. Prof. Dr Rubiyah bt Hj Baini	70,560	Nanocellulose-reinforced Photocatalytic Thin Films for Antimicrobial Surface Coating

External Grant (National) - SALCRA		
Project Leader	**Budget (RM)**	**Title**
Prof. Dr M. Shahidul Islam	35,000	Model Development on Methane Capture and Potable Water Production Optimization from Palm Oil Mill Effluent for Achieving Economic and Environmental Sustainability of Sarawak

External Grant (National) - SMA		
Project Leader	**Budget (RM)**	**Title**
Prof. Dr Wan Hashim bin Wan Ibrahim	800,000	Developing Tourism Logistic Management and Planning Platform: A Study on Sarawak Tourism Industry
Dr Annisa binti Jamali	300,000	Smart Health System for Post Stroke Rehabilitation
Ir. Dr Norazzlina bt M. Sa'don	100,000	Consolidated SI Information for Sarawak Soil Database
Prof. Dr Wan Hashim bin Wan Ibrahim	220,000	Digital Apps for Dynamic Monitoring and Management of Public Transportation
Ir. Dr Hazrul bin Mohamed Basri	250,000	REAL-TIME REMOTE POWER MONITORING OF SINGLE-PHASE SOLAR PV INVERTER FOR RURAL AGRICULTURAL FOOD PROCESSING.
Assoc. Prof. Dr Hushairi Zain	200,000	Automated Smart Precise Agriculture System Using IoT and Big Data Analysis for Optimizing Pepper Yield
Dr Mah Yau Seng	400,000	Automated Manufacturing of Green Pavement System for Rural Roads in Sarawak
Prof. Dr Musse Mohamud Ahmed	300,000	DEVELOPMENT OF NEW DIGITAL POWER INFRASTRUCTURE FOR NEW DIGITAL SOCIO-ECONOMY IN SARAWAK STATE

External Grant (National) - SRDC		
Project Leader	**Budget (RM)**	**Title**
Prof Dr Ng Chee Khoon	160,000	Performance of Manganese Slag-Cement Concrete: Mechanical Properties and Durability
Prof. Dr M. Shahidul Islam	250,000	Pilot Study on Fresh Water and Biogas Production from Palm Oil Mill Effluent Toward Achieving Economic and Environmental Sustainability in Sarawak.
Prof. Ir. Dr Andrew Ragai Henry Rigit	190,000	Tidal Stream Power Assessment and Design of Tidal Current Turbine for Pulau Triso
Dr Annisa binti Jamali	210,000	Modelling and Adaptive Control of Home-based Lower Limb Rehabilitation Robot
Dr Lidyana binti Roslan	50,000	Parametric Study of Human Muscle using Functional Electrical Stimulation (FES) for Lower Limb Rehabilitation
Dr Lee Yee Yong	50,000	Characterization of Recycled Polymer Materials in Construction Piles Application for Civil Works
Assoc. Prof. Ir. Ts. Dr Kismet anak Hong Ping	220,000	The Development of Microwave Breast Screening System Using Multiple Sensors

External Grant (National) - Trinekens		
Project Leader	**Budget (RM)**	**Title**
Mrs Noraziah Binti Abdul Wahab	18,000	Phycoremediation of Landfill
Assoc. Prof. Ir. Dr Lim Soh Fong	23,000	Solid Waste Characterization using Experimental & Analytical Methods

External Grant (National) - USM		
Project Leader	**Budget (RM)**	**Title**
Ir. Dr Leonard Lim Lik Pueh	25,000	The Mechanism and Behaviour of sewage sludge and Red Gypsum Mixture as Alternative Temporary Landfill Cover in the tropics

External Grant (National) - WenHong Plastics Industries		
Project Leader	**Budget (RM)**	**Title**
Dr Charles Bong Hin Joo	29,082	Performance Test for WenHong Stormwater Module

External Grant (International) - JASTIP		
Project Leader	**Budget (RM)**	**Title**
Dr Lidyana binti Roslan	11,145	Risk-Assessment of Hydropower Plant Susceptible to Seismic Hazard by 3D Spectrum Analysis

External Grant (International) - OSAKA		
Project Leader	**Budget (RM)**	**Title**
Dr Noor Hisyam bin Noor Mohamed	10,000	Mechanical Testing of Cellulose Nanofiber Reinforced PLA Polymer for Environmentally Friendly 3D Printer Filaments Application
Dr Abang Mohammad Nizam bin Abang Kamaruddin	10,000	Performance of 3D Printed Environmental Friendly Multi-Nozzle Minimum Quantity Lubrication Nozzle Design
Dr Nur Tahirah binti Razali	10,000	Study on Pushing-coating Method for Functional Layer in Organic Solar Cells
Encik Mohd Farid bin Atan	10,000	Advanced Strategies for Modeling and Optimization of Hydrogen Production from Photo-Fermentation Microbial Electrolysis Cell using Sago Waste
Dr Raudhah binti Ahmadi	10,000	Analysis of penstock structures using a new adaptive vibration envelope in 3-D non-linear FEM for hydro-seismic-included failure mechanism
Dr Norhuzaimin bin Julai	10,000	Hybrid Renewable Energy Storage System
Mrs Norazlina bt. Bateni	10,000	Performance of StormPav: A Stormwater detention pond permeable pavement using precast Honeycomb Structure for Green Pavement in Parking lot area for rainwater harvesting
Mr Azfar Satari bin Abdullah	10,000	Smart Electrical Energy Monitoring System (SEEMS) for single phase house
Dr Kho Lee Chin	10,000	Remote monitoring and control system for solar photo-voltaic power field in rural area
Dr Ana Sakura binti Zainal Abidin	10,000	Development of Energy Efficient Pepper Dryer
Ts. Mohd Azrin bin Mohd Said	10,000	Smart Device evaluation of Occupational Noise Exposure and Environmental Monitoring among workers at Factory in Sarawak
Dr Nazeri Abdul Rahman	10,000	Low Cost Continuous Solar Powered Electrocoagulation Water Treatment System for Sarawak Peat Water

RESEARCH PUBLICATIONS IN 2019 & 2020

Journal Articles

1. Zulcaffle T.M.A., Kurugollu F., Crookes D., Bouridane A., Farid M. (2019). Frontal view gait recognition with fusion of depth features from a time of flight camera. IEEE Transactions on Information Forensics and Security, 14(4), 1067-1082.

2. Nagaratnam B.H., Mannan M.A., Rahman M.E., Mirasa A.K., Richardson A., Nabinejad O. (2019). Strength and microstructural characteristics of palm oil fuel ash and fly ash as binary and ternary blends in Self-Compacting concrete. Construction and Building Materials, 202, 103-120.

3. Tharima A.F., Rahman M.M., Yusoff M.Z., Kueh A.B.H. (2019). Multi-objective optimization of underground car park design for tenability under fire-induced smoke. Tunnelling and Underground Space Technology. 85, 220-230.

4. Thangavelu S.K., Rajkumar T., Pandi D.K., Ahmed A.S., Ani F.N. (2019). Microwave assisted acid hydrolysis for bioethanol fuel production from sago pith waste. Waste Management, 86, 80-86.

5. Jobli M.I., Yao R., Luo Z., Shahrestani M., Li N., Liu H. (2019). Numerical and experimental studies of a Capillary-Tube embedded PCM component for improving indoor thermal environment. Applied Thermal Engineering, 148, 466-477.

6. Ervina J., Ghaleb Z.A., Hamdan S., Mariatti M. (2019). Colloidal stability of water-based carbon nanotube suspensions in electrophoretic deposition process: Effect of applied voltage and deposition time. Composites Part A: Applied Science and Manufacturing, 117, 1-10.

7. Mat, N.C., Lipscomb, G.G. (2019). Global sensitivity analysis for hybrid membrane-cryogenic post combustion carbon capture process. International Journal of Greenhouse Gas Control, 81, 157-169.

8. Bin Rahman A.K., Rashidi C.B.M., Aljunid S.A., Tamrin K.F., Jong R.P., Zaidel D.N.A., Samat Y.S. (2019). Spectral coding performance under free space optical medium. Indonesian Journal of Electrical Engineering and Computer Science,14(1), 290-294.

9. Bin Rahman A.K., Julai N., Rashidi C.B.M., Zamhari N., Sahari S.K., Mohtadzar N.A.A., Sharip M.R.M. (2019). Impact of rain weather over free space optic communication transmission. Indonesian Journal of Electrical Engineering and Computer Science, 14(1), 303-310.

10. Hasan M.K., Ismail A.F., Islam S., Hashim W., Ahmed M.M., Memon I. (2019). A Novel HGBBDSA-CTI Approach for Subcarrier Allocation in Heterogeneous Network Telecommunication Systems. 70(2). 245-262.

11. Samad N.A., Zaidel D.N.A., Salleh E., Yusof A.H.M., Dailin D.J., Zaidel D.N.A. (2019). Optimization of plectranthus amboinicus (Lour.) spreng extraction process using microwave-assisted technique. Chemical Engineering Transactions, 72, 397-402.

12. Bin Bakri, M.K., Jayamani, E., Hamdan, S., Rahman, M.R., Kakar, A., Soon, K.H. (2019). Potential of Borneo Acacia wood in fully biodegradable bio-composites' commercial production and application, Polymer Bulletin, 76(2),1059.

13. Nikmatin, S., Hermawan, B., Irmansyah, I., Indro, M.N., Kueh, A.B.H., Syafiuddin, A. (2019). Evaluation of the Performance of Helmet Prototypes Fabricated from Acrylonitrile Butadiene Styrene Composites Filled with Natural Resource. Materials, 12(1).

14. David Chua S.N., Chan B.K., Lim S.F. (2019). Experimental and simulation study of thermal accumulation in an enclosed vehicle Proceedings of the Institution of Mechanical Engineers, Part D: Journal of Automobile Engineering, 233(14). 3621.

15. Binti Zahid L., Jusoh M., Ghazali N.H., Sabapathy T., Mustapa M., Rahman A.K. (2019). Single-layer performance of sugarcane bagasse-and rubber tire dust microwave absorber in narrow band frequency of 3.85 GHz to 8.2GHz. Indonesian Journal of Electrical Engineering and Computer Science,13(2), 737-743.

16. Amuda A.G., Sahdi F., Hasan A., Taib S.N.L., Boylan N., Mohamad A. (2019). Measurement of Amorphous Peat Shear Strength in the Direct Shear Box at High Displacement Rates. Geotechnical and Geological Engineering, 37(2), 1059-1072.

17. Ahmad Afip I., Taib S.N.L., Jusoff K., Afip L.A. (2019). Measurement of Peat Soil Shear Strength Using Wenner Four-Point Probes and Vane Shear Strength Methods. International Journal of Geophysics.

18. Tan Y.H., Abdullah M.O., Kansedo J., Mubarak N.M., Chan Y.S., Nolasco-Hipolito C. (2019). Biodiesel production from used cooking oil using green solid catalyst derived from calcined fusion waste chicken and fish bones. Renewable Energy, 139, 696-706

19. Jaffar N.A., Buniyamin N., Lias K. (2019). An overview of available metamaterial-based antenna for non-invasive hyperthermia cancer treatment. Indonesian Journal of Electrical Engineering and Computer Science, 14(2), 697-705.

20. Kinidi L., Salleh S.F., Wahab N.B.A., Bin Tamrin K.F., Hipolito C.N., Tan I.A.W. (2019). Recent Development in Ammonia Stripping Process for Industrial Wastewater Treatment. International Journal of Chemical Engineering.

21. Atan M.F., Hussain M.A., Abbasi M.R., Hossain Khan M.J., Abdul Patah M.F. (2019). Advances in mathematical modeling of gas-phase olefin polymerization, Processes, 7(2), 67.

22. Hoque M.E., Kipli K., Afendi Zulcaffle T.M., Sapawi R., Joseph A., Abidin W.A.W.Z., Sahari S.K. (2019). Feature extraction method of retinal vessel diameter. Conference on Biomedical Engineering and Sciences, 279-283.

23. Haidar A.M.A., Julai N. (2019). An improved scheme for enhancing the ride-through capability of grid-connected photovoltaic systems towards meeting the recent grid codes requirements. Energy for Sustainable Development, 50, 38-49.

24. Liow C.V., Mah D.Y.S., bin Mohd Arif Zainol M.R.R. (2019). Modelling of Stormpav green pavement: Inlet and outlet of integrated permeable road and stormwater detention system. International Journal of Civil Engineering and Technology, 10(2), 966-976.

25. Muhammad A., Rahman M.R., Hamdan S., Sanaullah K. Recent developments in bamboo fiber-based composites: a review, Polymer Bulletin, 76(5), 2655-2682.

26. Kiprawi, M.A., Yassin, A., Kamaruddin, A.M.N.A., Shazali, S.T.S., Islam M.S., Said M.A.M. (2019). Development of a cutting-edge temperature measurement of end mill tool by using infrared radiation technique, Journal of Mechanical Engineering and Sciences, 13(2), 737-743.

27. Rahman M.R., Hamdan S., Jayamani E., Kakar A., Bin Bakri M. K., Yusof F.A.B. (2019). Tert-butyl catechol/alkaline-treated kenaf/jute polyethylene hybrid composites: impact on physico-mechanical, thermal, and morphological properties, Polymer Bulletin, 76(2), 763-784.

28. Abidin A.S.Z., Sawing T.B., Mohamaddan S., Halim H.H.A., Annisa J., Muslimen R., Ashari M.F., Jamaludin M.S. (2019). Energy Harvesting from Rotating Motion of In-Pipe Robot Cleaning Device, International Journal of Automotive and Mechanical Engineering,16(1), 6427-6436.

29. Sharip M.R.M., Haidar A.M.A., Jimel A.C. (2019). Optimum Configuration of Solar PV Topologies for DC Microgrid Connected to the Longhouse Communities in Sarawak, Malaysia, International Journal of Photoenergy,1-13.

30. Roslan M.K.A., Ismail M., Kueh A.B.H., Zin M.R.M. (2019). High-density concrete: Exploring Ferro boron effects in neutron and gamma radiation shielding, Construction and Building Materials, 215, 718-725.

31. Syafiuddin A., Salmiati S., Hadibarata T., Salim M.R., Kueh A.B.H., Suhartono S. (2019). Removal of Silver Nanoparticles from Water Environment: Experimental, Mathematical Formulation, and Cost Analysis, 230.

32. Siong Ling-Chee S., Carvajal-Zarrabal O., Nolasco-Hipólito C., Abdullah M.O., Shoji E., Aguilar-Uscanga M.G., Al-Abideen Gregory Z., Samawi S. (2019). Separation of sago starch from model suspensions by tangential flow filtration, Chemical Engineering Communications, 206 (8), 1058-1071.

33. Shafqat S.S., Khan A.A., Zafar M.N., Alhaji M.H., Sanaullah K., Shafqat S.R., Murtaza S., Pang S.C. (2019). Development of amino-functionalized silica nanoparticles for efficient and rapid removal of COD from pre-treated palm oil effluent. Journal of Materials Research and Technology, 18(1), 385-395.

34. Al Naeem M.A., Yusoff I., Ng T., Alias Y., May R., Haniffa M. (2019). An integrated multi-techniques approach for hydrogeochemical evaluation of ion exchange processes and identification of water types based on statistical analysis: Application to the Gaza coastal aquifer, Gaza Strip, Palestine, Groundwater for Sustainable Development, 9.

35. Rashid A.S.A., Shirazi M.G., Nazir R., Mohamad H., Sahdi F., Horpibulsuk S. (2019). Bearing capacity performance of soft cohesive soil treated by kenaf limited life geotextile, Marine Georesources and Geotechnology.

36. Shaaban M., Zeynal H., Nor K. (2019). MILP-based short-term thermal unit commitment and hydrothermal scheduling including cascaded reservoirs and fuel constraints, International Journal of Electrical and Computer Engineering, 9(4), 2373-2742.

37. Hasan, Mohammad Kamrul; Yousoff, Siti Hajar; Ahmed, Musse Mohamud; Hashim, Aisha Hassan Abdalla; Ismail, Ahmad Fadzil; Islam, Shayla. (2019). Phase Offset Analysis of Asymmetric Communications Infrastructure in Smart Grid, Elektronika Ir Elektrotechnika, 25(2), 67-71.

38. Hesna Y., Hasan A., Nurhamidah N., Atharika Yosa F. (2019). The effect of local crime on construction projects in Padang City, International Journal on Advanced Science, Engineering, and Information Technology, 9(5), 1550-1555.

39. Z.S. Lui, D.Y.S. Mah. and F.Y. Teo. (2019). Stormwater detention in road shoulder using stormpav green pavement system. International Journal of Civil Engineering and Technology (IJCIET), 4(10), 400-409.

40. Liow C.V., Mah D.Y.S., Malek M.A. (2019). Flow characteristics of stormpav green pavement system, International Journal of Innovative Technology and Exploring Engineering, 8(8), 1288-1292.

41. Tan W.-S., Shaaban M., Ab Kadir M.Z.A. (2019). Stochastic generation scheduling with variable renewable generation: Methods, applications, and future trends, IET Generation, Transmission and Distribution, 13(9), 1467-1480.

42. El-Abidi K.M.A., Ofori G., Zakaria S.A.S., Mannan M.A., Abas N.F. (2019). Identifying and Evaluating Critical Success Factors for Industrialized Building Systems Implementation: Malaysia Study, Arabian Journal for Science and Engineering.

43. Sahdi F., Gaudin C., Tom J.G., Tong F. (2019). Mechanisms of soil flow during submarine slide-pipe impact, Ocean Engineering, 186.

44. Rahman M.R., Hamdan S., Ngaini Z.B., Jayamani E., Kakar A., Bakri M.K.B., Yusof F.A.B.M. (2019). Cellulose fiber-reinforced thermosetting composites: impact of cyanoethyl modification on mechanical, thermal, and morphological properties, Polymer Bulletin, 76(8), 4295-4311.

45. Kumar A., Pandey B., Hussain D.M.A., Hasan M.K., Kumar P., Ahmad S., (2019). Hustle and frequency analysis based High speed and energy efficient art Design on spartan-6 fugal, International Journal of Innovative Technology and Exploring Engineering, 8(5), 1234-1239.

46. Hasim N.S., Ping K.A.H., Islam M.T., Mahmud M.Z., Sahrani S., Mat D.A.A., Zaidel D.N.A. (2019). A Slotted UWB Antipodal Vivaldi Antenna for Microwave Imaging Applications, Progress in Electromagnetics Research M, 80.

47. S.K. Sahari et. al. (2019). Effects of Post-Deposition Annealing Temperatures on the Composition of Interfacial Layer at Germanium (Ge) /Aluminium Oxide (Al2O3), Sains Malaysiana, 48(6), 1195-1199.

48. D.Y.S. Mah, M.A. Malek and F. J. Putuhena (2019). Digitizing Hydrological Patterns for River Traffic Safety, International Journal of Civil Engineering & Technology, 10(6), 263-271.

49. Chua S.N.D., Lim S.F., Lai S.N., Chang T.K. (2019). Development of a Child Detection System with Artificial Intelligence Using Object Detection Method, Journal of Electrical Engineering and Technology.

50. Abo Sabah S.H., Kueh A.B.H., Bunnori N.M. (2019). Failure mode maps of bio-inspired sandwich beams under repeated low-velocity impact, Composites Science and Technology, 182.

51. Adamu M., Rahman M.R., Hamdan S. (2019). Formulation optimization and characterization of bamboo/polyvinyl alcohol/clay nanocomposite by response surface methodology, Composites Part B: Engineering, 176.

52. Bong C.H.J., Liow C.V. (2019). Hydraulic characteristics of flow through angled baffle-plates in an open channel, International Journal of River Basin Management.

53. Bateni N., Lai S.H., Putuhena F.J., Mah D.Y.S., Mannan M.A., Chin R.J. (2019). Hydrological Performances on the Modified Permeable Pavement with Precast Hollow Cylinder Micro Detention Pond Structure, KSCE Journal of Civil Engineering, 23(9), 3951-3960.

54. Lawan S.M., Abidin W.A.W.Z., Masri T. (2019). Implementation of a topographic artificial neural network wind speed prediction model for assessing onshore wind power potential in Sibu, Sarawak, Egyptian Journal of Remote Sensing and Space Science.

55. Islam S., Hashim A.H.A., Hasan M.K., Razzaque A., (2019). MM-PNEMO: A mathematical model to assess handoff delay and packet loss, Bulletin of Electrical Engineering, and Informatics, 8(2), 611-621.

56. Petinrin J.O., Shaaban M. (2019). Multiperiod Coordination of Local Voltage Controllers and Energy Storage for Voltage Regulation in Distribution Feeder-Connected Renewable Energy Sources, Iranian Journal of Science and Technology - Transactions of Electrical Engineering, 43(3), 531-544.

57. Jaafar E., Kashif M., Sahari S.K., Ngaini Z. (2019). Effects of reduction temperatures on morphological, optical, and electrical properties of reduced graphene oxide (rGO) thin films, MATERIALS TODAY-PROCEEDINGS, 16, 1702-1707.

58. Zauzi, N.S.A, Ariff, Z.M., Khimi, S.R. (2019). Foamability of Natural Rubber via Microwave Assisted Foaming with Azodicarbonamide (ADC) as Blowing Agent, MATERIALS TODAY-PROCEEDINGS, 17, 1001-1007.

59. Eugene and Shahidul, (2019). Optimizing organic materials reduction from hazardous industrial bio-effluent by the aid of c/n enriched inoculum: an approach to use traditional anaerobic reactor to achieve environmental sustainability, Science International (Lahore), 31(4), 649-654.

60. Shahrol Mohamaddan, Lew Hao Xian, Mohd Fadzliashari, Marini Sawawi, Mohamad Syazwan Zafwan Mohamad Suffian. (2019). Conceptual Design of a Sago Drying Machine and Structural Simulation Using Finite Element Analysis, International Journal of Research in Engineering and Advanced Technology 14(4), 86-93.

61. Jong L.Y., Teo D.C.L., Mannan M.A. (2019). Characteristics of Artificial Lightweight Aggregates Produced from Palm Oil Fuel Ash Using Cold-Bonding, International Journal of Research in Engineering and Advanced Technology, 7(4), 1-8.

62. Nur Tahirah Razali, Dominic Sanchez Merom, Marini Sawawi, Magdalene Andrew Munot, Shahrol Mohamaddan, Mahsuri Yusof, Siti Kusnie Sahari (2019). Effect of Surfactants to the Electrical Properties of the Hole Transporting Layer of Organic Solar Cells, International Journal of Research in Engineering and Advanced Technology.

63. Patrick M., Mah D.Y.S., Putuhena F.J., Wang Y.C., Selaman O.S. (2019). Constructing depth-area-duration curves using public domain satellite-based precipitation data, International Journal of Hydrology Science and Technology 9(3), 281-302.

64. Chung Z.L., Tan Y.H., Chan Y.S., Kansedo J., Mubarak N.M., Ghasemi M., Abdullah M.O. (2019). Life cycle assessment of waste cooking oil for biodiesel production using waste chicken eggshell derived CaO as catalyst via transesterification, Biocatalysis and Agricultural Biotechnology.

65. Ab Kadir M.A., Khiyon M.I., Mohd. Sam A.R., Kueh A.B.H., Abdul Shukor Lim N.H., Mohamad Ali Mastor M.N., Zuhan N., Mohamed R.N. (2019). Performance of spent garnet as a sand replacement in high-strength concrete exposed to high temperature, Journal of Structural Fire Engineering.

66. Rosli N.A.B., Aziz H.A., Selamat M.R., Pueh L.L.I.M.L. (2019). Physical, mechanical, and chemical properties of dewatered sewage sludge and red gypsum mix as a potential recycling product, Solid State Phenomena, 24-29.

67. Amuda A.G., Hasan A., Unoi D.N.D., Linda S.N. (2019). Strength and compressibility characteristics of amorphous tropical peat, Journal of GeoEngineering, 14(2), 85-96.

68. Rahman M.R., Hamdan S., Jayamani E., Kakar A., Bakri M.K.B., Md Yusof F.A.B. (2019). The effect of palm oil fuel ash (POFA) and polyvinyl alcohol (PVA) on the physico-mechanical, thermal, and morphological properties of hybrid bio-composites, Polymer Bulletin

69. Khan A., Takriff M.S., Rosli M.I., Othman N.T.A., Sanaullah K., Rigit A.R.H., Shah A., Ullah A., Mushtaq M.U. (2019). Turbulence dissipation & its induced entrainment in subsonic swirling steam injected in cocurrent flowing water, International Journal of Heat and Mass Transfer, 145.

70. Hyuga, Kikuchi and Mohd Danial, Bin Ibrahim and Masayuki, Ochiai, (2019). Evaluation of Lubrication Performance of Foil Bearings with New Texturing Tribology Online, 14(5), 339-344.

71. Kueh A.B.H., Kho V.T. (2019). Strut waviness and load orientation affected fracture toughness knockdown in biaxially woven square lattices, International Journal of Mechanical Sciences, 164(1), 1-6

72. Kabit M.R., Tan M.C.N., Wan Ibrahim W.I., An evaluation of signal metering application to mitigate roundabout's unbalanced flow conditions: A case study in Kuching Malaysian Construction Research Journal, 27(1), 1-9.

73. Mahsen M.F., Ping K.A.H., Sahrani S. (2019). Detection and localization of an object behind wall using an inverse scattering technique with wall direct subtraction method, Progress in Electromagnetics Research C, 94, 247-259.

74. Hamdan S., Musib A.F., Musoddiq I.A., Wahid H.A. (2019). Some studies on the understanding the different tones quality in a bonang set Journal of Engineering Science and Technology, 14(4), 1960-1973.

75. D.Y.S. Mah, C.V. Liow and M.A. Mannan. (2019). Application of StormPav Green Pavement System in a Government Buildings Redevelopment Scheme, International Journal of Innovative Technology and Exploring Engineering (IJITEE) 8(9), 723-727.

76. S.T. Ha, W.H.W. Ibrahim, M.C. Lo and Y.S. Mah., (2019). Factors Affecting Satisfaction and Loyalty in Public Transport using Partial Least Squares Structural Equation Modeling (PLS-SEM), International Journal of Innovative Technology and Exploring Engineering 8(12), 569-575.

77. Suud, Jamaah; Zen, Hushairi; Othman, Al-Khalid; Hamid, Khairuddin Ab. (2019). Variable Global Optimization min-sum (VGOMS) algorithm of decode-and-forward protocol for the relay node in the cooperative channel, Wireless Networks,1-6.

78. Silahuddin, S. M.; Aizuddin, A. M.; Mohamaddan, S.; Shazali, S. T. Syed; Suffian, M. S. Z. M.; Tazuddin, A.M.; Abdullah, A. S. (2019). Design and development of a modular vibration test rig for combination types of fault in rotating machinery health diagnosis, Journal of Mechanical Engineering and Sciences, 13(3), 5323-5333.

79. Ngu J.O.K., Mah D.Y.S., Liow C.V., Ngu I.T. (2019). Modelling of on-site stormwater detention underneath a car porch, International Journal of Innovative Technology and Exploring Engineering 8(12), 4304-4307.

80. Liow, C. V., Mah, D. Y. S., & Malek, M. A. (2019). Modelling of stormpav green pavement system using storm water management model and solidworks flow simulation, International Journal of Recent Technology and Engineering, 8(2), 4673-4679.

81. Asrani Lit, M. S. Rusli, M. N. Marsono. (2019). Comparative performance evaluation of routing algorithm and topology size for wireless network-on-chip, Bulletin of Electrical Engineering, and Informatics, 8(4), 1239-1250.

82. Kerk Y.W., Tay K.M., Lim C.P. (2019), Monotone Interval Fuzzy Inference Systems, IEEE Transactions on Fuzzy Systems, 27(11), 2255-2264.

83. Ahmadi R., Lucas D.E., Saiful M.S., Mannan M.A., Ismail I. (2019). Effect of fibre (Polypropylene) volume in mortar mixed with POFA, International Journal of Innovative Technology and Exploring Engineering, 9(1), 1870-1873.

84. Entuni C.J.A., Zulcaffle T.M.A. (2019). Simple screening method of maize disease using machine learning, International Journal of Innovative Technology and Exploring Engineering, 9(1), 464-467.

85. Murad, Sohiful Anuar Zainol; Azizan, Anishaziela; Sapawi, Rohana; Zulkifli, Tun Zainal Azni. (2019). Ultra-Low Power 0.55 mW 2.4 GHz CMOS Low-Noise Amplifier for Wireless Sensor Network, IETE Journal of Research, 1-7.

86. Shahidul, M.I., Malcolm, M.L. and Eugene, J.J, Sharafatul, M.I. (2019). A Novel Study on Biogas Production from Palm Oil Mill Effluent with Two-Stage Anaerobic Digester and Nano Membrane, Science International (Lahore), 31(6), 811-819.

87. Adedayo Sheri Adeniyi, Bilal Anjum Ahmed, Abbas Saeed Hakeem, Faheemuddin Patel, Akolade Idris Bakare, Anwar Ul-Hamid, Amir Azam Khan, Muhammad Ali Ehsan and Tahir Irfan Khan. (2019). The Property Characterization of a-Sialon/Ni Composites Synthesized by Spark Plasma Sintering, Nanomaterials, 9(12), 2-12.

88. Ahmed M. A. Haidar, Heng Wei Hau. (2019). A Framework for Placement Assessment of Synchrophasor Measurement in Practical Power Grid: A Case Study from Borneo, Journal of Electrical and Electronics Engineering, 12(2), 11-16.

89. Haidarab A.M.A., Fakhar A., Muttaqi K.M. (2019). An Effective Power Dispatch Strategy for Clustered Micro-grids while Implementing Optimal Energy Management and Power Sharing Control using Power Line Communication,

90. Hasan M.K., Ahmed M.M., Musa S.S., Lee D. (2019). Calibration of dynamic line rating model for phasor measurement unit based wide area measurement system in smart grid application, International Journal of Recent Technology and Engineering, 8(4), 1879-1883

91. Buswig Y.M., Affam A., Albalawi H., Julai N.B., Othman A.-K.B.H., Qays O. (2019). Development and modelling of three phase inverter for harmonic improvement using sinusoidal pulse width modulation (SPWM) control technique, International Journal of Recent Technology and Engineering, 8(4), 1897-1902.

92. Shaaban M., Benedict C.E.A. (2019). Effect of distributed wind generation on the voltage sag of distribution networks, International Journal of Recent Technology and Engineering, 8(4), 1884-1889.

93. Salleh S.F., Saree S., Sanaullah K., Khan A., Yunus R., Sawawi M., Rajaee N., Fadzli N.A.M., Alhaji M.H. (2019). Mathematical modelling and & simulation of thresher operation in Palm Oil Mill, Journal of Sustainability Science and Management, 14(5), 43-54.

94. Lee S.L., Mannan M.A., Wan Ibrahim W.H. (2019). Shear strength evaluation of composite pavement with geotextile as reinforcement at the interface, Geotextiles and Geomembranes.

95. Mohammed Enamul Hoque, Kuryati Kipli, Tengku Mohd Afendi Zulcaffle, Dayang Azra Awang Mat, Annie Joseph, Nurdiani Zamhari, Rohana Sapawi and Mohammad Yasin (2019). Segmentation of Retinal Microvasculature Based on Iterative Self-Organizing Data Analysis Technique (ISODATA) 2019, 59-64.

96. S. N. Ting, C. K. Ng. (2019). Quantitative Model for the Systematic Evaluation of Standard Form of Civil Engineering Contract, International Journal of Recent Technology and Engineering (IJRTE), 8(4), 1635-1641.

97. Ibrahim, M.D., Tan, G.L., Roslan L., Kashiwabara, Y., Jendia, J. and Sunami Y. (2019). Numerical and Experimental Analysis on Runner and Gate Positioning for Magnesium Alloy Die-casted Test Piece, Materials Science Forum, 975, 1-6.

98. Ohirul Qays, Yonis Buswig, Martin Anyi. (2019). Active Cell Balancing Control Method for Series-Connected Lithium-Ion Battery, International Journal of Innovative Technology and Exploring Engineering (IJITEE), 8(9), 2424-2430.

99. Mohammed Najeh Nemah, C. Y. Low, A. Jamali, S. Mohamad, A. K. Kareem, and O M Fakhri (2019). A Hybrid Haptic Feedback Stimulation Prosthetic Device to Recover the Missing Sensation of Upper Extremity Amputees, Test Engineering and Management, 649-665.

100. Abdullah, A.H., Lee, Y.Y., Aminudin, E., Lee, Y.H. (2019). Indoor Air Quality Assessment for a Multistorey University Office Building in Malaysia, Journal of green Building, 14(4), 93-109.

101. Moghadasi, K. and Tamrin, K.F. (2019). Experimental Investigation and Parameter Optimization of Low Power CO2 Laser Cutting of a Carbon/Kevlar Fibre-reinforced Hybrid Composite, Lasers in Engineering, 45(1), 1-24.

102. Hani Albalawi, Sherif A. Zaid, and Yonis. M.Buswig (2019). Simulation Study of Two Torque Optimization Methods for Direct Torque-Controlled Induction Motors, Applied Sciences-Basel, 9(24), 1-13.

103. Kamal, Mustafa M.; Baini, R.; Lim, S. F.; Rahman, M. R.; Mohamaddan, S.; Hussain, H. (2019). Drying effect on the properties of traditionally processed sago starch, International Food Research Journal, 26(6), 1861-1869.

104. Saleh, A.A., Reddy, A.N.R., Nadia, N.A., Charyulu, D.K.2 and Hamdan, S. (2019). Evaluation of ubi gajah for bioethanol via Hydrolysis and fermentation, Evaluation of ubi gajah for bioethanol via Hydrolysis and fermentation, 48(5), 59-65.

105. C.V. Liow, D.Y.S. Mah and M.R.R. bin Mohd Arif Zainol (2019). Modelling of StormPav Green Pavement System with Storm Water Management Model and InfoWorks Collection System. International Journal of Recent Technology and Engineering (IJRTE), 8(2), 1449-1452.

106. Salleh S.F., Ujir H., Sapawi R., Hashim H.F. (2020). Accreditation document tracking system using scrum approach, International Journal of Evaluation and Research in Education, 9(1), 153-161

107. Yun H.A.H., RamÃrez-SolÃs S., Dupont V. (2020). Bio-CH4 from palm empty fruit bunch via pyrolysis-direct methanation: Full plant model and experiments with bio-oil surrogate, Journal of Cleaner Production, 244.

108. Albert Daud F.A., Ismail I., Ahmadi R., Binti Abdul Samat N.A.S. (2020). Characterization of alkali-activated palm oil fuel ash pastes as a function of calcination temperatures of raw precursor, Materials Performance and Characterization 9(1), 36-49.

109. Hamid I.R.A., Sani N.S.M., Abdullah Z., Foozy C.F.M., Kipli K. (2020). Classification of Metamorphic Virus Using N-Grams Signatures, Advances in Intelligent Systems and Computing, 978, 140-149.

110. Hui T.L., Khoon N.C. (2020). Comparative study on precast building construction and conventional building construction for housing project in Sarawak, Jurnal Teknologi, 82(1), 75-84.

111. Atan M.F., Hussain M.A. (2020). Dynamic modeling: The influence of the improved solid elutriation correlation on the two-phase mathematical model of polyolefin polymerization in a gas-phase fluidized bed reactor, Asia-Pacific Journal of Chemical Engineering.

112. Kamal M.M., Baini R., Fong L.S., Hussain M.H.M., Mohamaddan S. (2020). Effect of Drying Temperature to the Thin Layer Drying Model of Sago Starch, Smart Innovation, Systems and Technologies, 169, 575-585

113. Amin M.A.M., Goh P.S., Ismail A.F. (2020). Effect of organoclay on the performance of reverse osmosis membrane, Journal of Membrane Science and Research, 6(1), 13-19.

114. Ibrahim M.D., Ismail Z.F., Musa S.S., Lam S.S. (2020) Energy Savings in Manufacturing Plant: Pump System Optimization Case Study in Johor and Sarawak, Malaysia, Lecture Notes in Mechanical Engineering, 197-206

115. Al-Fasih M.Y., Kueh A.B.H., Ibrahim M.H.W. (2020). Failure behavior of sandwich honeycomb composite beam containing crack at the skin, PLoS ONE, 15(2).

116. Khan A., Takriff M.S., Rosli M.I., Othman N.T.A., Sanaullah K., Rigit A.R.H., Shah A., Ullah A. (2020) Flow characteristics within the wall boundary layers of swirling steam flow in a pipe comprising horizontal and inclined sections, Korean Journal of Chemical Engineering 37(1), 19-36

117. Ibrahim M.D., Mohamad M.R., Roslan L., Sunami Y., Lam S.S. (2020). High Pressure Die Casting Porosity Defect Analysis and Experimental Validation for Power Steering Columns and DVVTs, Lecture Notes in Mechanical Engineering, 187-196

118. Lee Y.Y., Md Din M.F., Iwao K., Lee Y.H., Anting N. (2020). Impact of thermal behaviour of different environmental conditions on ambient environment and thermal discomfort in Malaysia, Indoor and Built Environment,

119. Mohamaddan S., Rahman A., Jamali A., Hazmi H., Limbai M.M. (2020). Musculoskeletal Simulation and Analysis of Upper Limb Rehabilitation Device, Smart Innovation, Systems and Technologies, 169, 739-748.

120. Ibrahim M.D., Tan G.L., Roslan L., Kashiwabara Y., Jendia J., Sunami Y. (2020). Numerical and experimental analysis on runner and gate positioning for magnesium alloy die-casted test piece, Materials Science Forum, 975, 242-247.

121. Khan A., Takriff M.S., Sanaullah K., Zwawi M., Algarni M., Felemban B.F., Bahadar A., Shah A., Rigit A.R.H. (2020). Periodic compression and cavitation induced shear between steam-water two-phase flows for biomaterials degradation, International Journal of Environmental Science and Technology 17(3), 1594-1626.

122. Lee S.L., Mannan M.A., Wan Ibrahim W.H. (2020). Polishing resistance of polymer concrete pavement using limestone aggregate, International Journal of Pavement Engineering, 21(4), 474-482

123. Loh S.L., Mah D.Y.S. (2020). Potential of roundabout as a stormwater detention basin in equatorial region, International Journal of Hydrology Science and Technology, 10(1), 90-101.

124. Syafiuddin A., Fulazzaky M.A., Salmiati S., Kueh A.B.H., Fulazzaky M., Salim M.R. (2020). Silver nanoparticles adsorption by the synthetic and natural adsorbent materials: an exclusive review, Nanotechnology for Environmental Engineering, 5(1)

125. Baharin A., Sahari S.K., Kemat R., Azhar N.E.A. (2020). The effects of titanium dioxide (Tio2) and reduced graphene oxide (rgo) doping ratio variation to the performance of dye-sensitized solar cell (dssc), International Journal of Nanoelectronics and Materials 13(1), 159-168.

126. Suud J., Zen H., Othman A.-K., Hamid K.A. (2020). Variable Global Optimization min-sum (VGOMS) algorithm of decode-and-forward protocol for the relay node in the cooperative channel, Wireless Networks, 26(1) 531-541.

127. Utomo W.M., Isa N.A.A., Bakar A.A., Gani A.F.H.A., Noor M.K.R., Yi S.S., Prasetyo B.E., Elmunsyah H., Buswig Y.M.Y. (2020). Voltage tracking of bridgeless PFC cuk converter using PI controller, International Journal of Power Electronics and Drive Systems, 11(1), 367-373

128. Norhuzaimin Julai, Shamsiah Suhaili, Yonis M Yonis Buswig. (2020). Design of Completion Detectors in Asynchronous Communication System, International Journal of Innovative Technology and Exploring Engineering (IJITEE), 9(3).

129. Lee Chin Kho, S. S. Ngu, A. Joseph, D. A. A. Mat, K. Kuryati. (2020). A Classification of Lossless and Lossy Data Compression Schemes, IJITEE, Vol. 9 (3), pp. 3393-3398, January 2020 9(3), 3393-3398

130. Wee Kiet T., Hasan A., Bin Sahdi F., Binti Taib S., Binti Mohamed Sutan N., Bin Abdul Aziz B. and Andy F. (2020). A Narrow Wall System to Capture Temperature-Stress-Strain Behavior in Paste Backfill, Geotechnical Testing Journal, 43(2), 1-38.

131. Musse Mohamud Ahmed, Mohammad Kamrul Hasan, Jong F. Chen, Denis Lee (2020). Genetic Algorithm Based Lightning Estimation Model, Journal of Mechanics of Continua and Mathematical Sciences, 15(6), 1-14.

132. Mahmud F. and Tamrin K.F. (2020). Method for determining mixing index in microfluidics by RGB color model, Asia-Pacific Journal of Chemical Engineering, 15(2), 1-12

133. Yong Ling Gwee, Suzana Yusup, Raymond R. Tan, Chung Loong Yiin (2020). Techno-economic and life-cycle assessment of volatile oil extracted from Aquilaria sinensis using supercritical carbon dioxide, Journal of CO2 Utilization, 38(1), 158-167.

134. Shahid Ullah, Ahmed M. A. Haidar, Hushairi Zen, (2020). Assessment of technical and financial benefits of AC and DC microgrids based on solar photovoltaic, Electrical Engineering, 1-14.

135. Tamrin, K. F., Moghadasi, K. and Sheikh, N. A. (2020). Experimental and numerical investigation on multi-pass laser cutting of natural fiber composite, The International Journal of Advanced Manufacturing Technology, 107(1), 1-49.

136. Zainal M.T., Mohd Yasin M.F., Wan Ali W.F.F., Tamrin K.F. and Ani M.H. (2020). Carbon precursor analysis for catalytic growth of carbon nanotube in flame synthesis based on semi-empirical approach, Carbon Letters, 30(1), 1-9

137. Affandi N.N., Tamrin K.F., Khan A.A., Moghadasi K., Sharip M.R.M., Mohamaddan S., Hossain A. (2020). A feasibility study of low-power laser trepanning drilling of composite using modified DVD writer, International Journal of Integrated Engineering, 12(3), 187-196.

138. Lamoh M.M., Joy E.J., Rashid M., Islam S., Hashmi S. (2020). Biogas production optimization from palm oil mill effluent: Experiments with anaerobic reactor, International Journal of Integrated Engineering, 12(3), 261-270.

139. Lim S.F., Lee A.Y.W., Chua S.N.D., Lim B.H., Jain P. (2020). Kinetic study on heavy metal divalent ions removal using zirconium-based magnetic sorbent, International Journal of Integrated Engineering, 12(3), 225-234.

140. Yi S.S., Utomo W.M., Hwang G.H., Kai C.S., Siang A.J.L.M., Zambri N.A., Buswig Y.M.Y., Law K.H., Yi S.G. (2020). Loss minimization DTC electric motor drive system based on adaptive ANN strategy, International Journal of Power Electronics and Drive Systems, 11(2), 618-624.

141. Edwin D.A., Sahrani S., Ping K.A.H. (2020). Overset grid generation with inverse scattering technique for object and crack detection, Telkomnika (Telecommunication Computing Electronics and Control), 1-9.

142. Adamu, M., Rahman, M. R., and Hamdan, S. (2020). Bamboo nanocomposite: Impact of poly (ethylene-alt-maleic anhydride) and nanoclay on physicochemical, mechanical, and thermal properties, Bioresources, 15(1), 331-346.

143. Md. Rezaur Rahman, Sinin Hamdan, Rubiyah Binti Baini, Muhammad Khusairy Bin Bakri, Muhammad Adamu, Perry Law Nyuk Khui, Akshay Kakar Khairuddin Sanaullah (2020). Chemically Treated Borneo Sago (Metroxylon sagu) Starch Reinforced Poly Lactic Acid Bio-composites, Bioresources, 15(1), 1641-1655.

144. Perry Law Nyuk Khui, Md. Rezaur Rahman, Sinin Hamdan, Elammaran Jayamani, Muhammad Khusairy Bin Bakri, and Khairuddin Sanaullah, (2020). Synthesis and characterization of micro-nano carbon filler from Jatropha seeds, Bioresources, 15(1), 3237-3251.

145. Al-Fasih, M. Y., Kueh, A. B. H., & Wan Ibrahim, M. H. (2020). Flexural behavior of sandwich beams with novel triaxially woven fabric composite skins, Steel and Composite Structures, 34(2), 299-308.

146. Nor Azalina Rosli, Hamidi Abdul Aziz, Mohamad Razip Selamat, Leonard Lik Pueh Lim. (2020). A mixture of sewage sludge and red gypsum as an alternative material for temporary landfill cover, Journal of Environmental Management 263(1), 1-10.

147. Lawan S.M., Abidin W.A.W.Z., Masri T. (2020). Implementation of a topographic artificial neural network wind speed prediction model for assessing onshore wind power potential in Sibu, Sarawak, Egyptian Journal of Remote Sensing and Space Science, 23(1), 21-34.

148. Lee S.L., Mannan M.A., Wan Ibrahim W.H. (2020). Shear strength evaluation of composite pavement with geotextile as reinforcement at the interface, Geotextiles and Geomembranes 48(3), 230-235.

Conference/Proceedings Paper

1. Hasan M.K., Ahmed M.M., Janin Z., Khan S., Abdalla A.-H., Islam S. (2019) Delay Analysis of Two-way Synchronization Scheme for Phasor Measurement Unit based Digital Smart Grid Applications, 2018 IEEE 5th International Conference on Smart Instrumentation, Measurement and Application, ICSIMA 2018

2. Inyang, John; Andrew-Munot, Magdalene; Shazali, Syed Tarmizi Syed; Tanjong, Shirley Johnathan. (2019). A Model to Manage Crude Palm Oil Production System, ENGINEERING APPLICATION OF ARTIFICIAL INTELLIGENCE CONFERENCE 2018 (EAAIC 2018), 255.

3. Awang Ismail D.S.B., Kassim A., Bin Mohamad H., A Rashid A.S., Bunawan A.R. (2019). Monitoring strain development of soil slope using distributed optical fibre sensor, IOP Conference Series: Materials Science and Engineering, 527(1).

4. Ismail A., Binti Siat Sirat Q.A., Kassim A.B., Mohamad H.B. (2019). Strain and temperature calibration of Brillouin Optical Time Domain Analysis (BOTDA) sensing system, IOP Conference Series: Materials Science and Engineering, 527(1).

5. Hasan N., Hussain N.S.M., Faudzi A.A.M., Shaharum S.M., Yusof N.A.T., Noordin N.H., Mohtadzar N.A.A., Karim M.S.A. (2019). Cured epoxy resin dielectric characterization based on accurate waveguide technique, AIP Conference Proceedings, 2129.

6. Aizuddin A.M., Jalil N.A.A., Rezali K.A.M., Ng Y.G. (2019). Development of Vibration Test System to Measure Human Biodynamic Responses to Hand-Transmitted Vibration (HTV), Journal of Physics: Conference Series, 1262.

7. Manas N.H.A., Drus M.N.A.M., Zulkharnain A., Hui J.L.C., Azelee N.I.W., Dailin D.J. (2019). Transport phenomena of carbazole biodegradation by immobilized Thalassospira profundimaris cell and mechanical properties, AIP Conference Proceedings, 2155

8. Putri E.E., Rewani F.J.H., Mannan M.A., Ibrahim W.H.W., Kabit M.R., Tirau L.S., Chan R.A., Buking R. (2019). Sensitivity analysis of stormpav composite pavement, IOP Conference Series: Materials Science and Engineering 602(1).

9. Kasumawati Lias, Nabilah Abdul Jaffar, Norlida Buniyamin, Hazrul Mohamed Basri, Wan Azlan Wan Zainal Abidin, Kuryati Kipli, Nur Alia Athirah Mohtadzar. (2019). Simulation Study of a Modified Rectangular Microstrip for the Hyperthermia Breast Cancer Procedure with SEMCAD X Solver, Journal of Physics: Conference Series, 12.

10. Jumaat H., Ali M.T., Ping K.H., Faudzi N.M., Miswadi N., Yon H. (2019). A Review of Frequency Selection and Antenna Arrangement System for Microwave Imaging in Early Breast Cancer Detection, Journal of Physics: Conference Series, 1372(1).

11. Loh W.-T., Bong D.B.L. (2019). Quality Assessment for Natural and Screen Visual Contents, Proceedings - International Conference on Image Processing, ICIP, 2019, 3025-3026.

12. Shahid Ullah, Ahmed M.A. Haidar, Kashem M. Muttaqi, Tony Ahfock (2019). A Distributed Secondary Control Strategy for Power Sharing and Voltage Regulation by Multiple Converters in DC Micro-grids, International Conference on Electrical, Control and Instrumentation Engineering, 1-8.

13. A. Jamali, I. Z. Mat Darus, H. M. Yatim, M. H. A. Talib and M. S. Hadi (2019). Optimization of PID Controller for Double-Link Flexible Robotic Manipulator using Metaheuristic Algorithms, Proceedings of the 22nd International Conference on Climbing and Walking Robots and Support Technologies for Mobile Machines (CLAWAR 2019), 141-150.

14. S. Hadi, H. M. Yatim, M. H. A. Talib, I. Z. Mat Darus and A. Jamali. (2019). Fuzzy-PID based controller for active vibration control of nonlinear dynamic systems, Proceedings of the 22nd International Conference on Climbing and Walking Robots and Support Technologies for Mobile Machines (CLAWAR 2019, 151-158.

15. W. T. Loh, A. Joseph, B. B. L. David. (2019). "Quality Assessment for Natural and Screen Content Images", Proc. of the 2019 IEEE International Conference on Signal and Image Processing Applications (IEEE ICSIPA 2019), 204-207.

16. T.K. Jong, D.B.L. Bong. (2019. Evaluation of Local Features for Near-Uniform Scene Images, Proceedings of IEEE International Conference on Signal, and Image Processing Applications, 2019, 95-99.

17. W.T. Loh, D.B.L. Bong (2019). A Modified Structural Similarity Index with Low Computational Complexity, Proceedings of 2019 International Symposium on Intelligent Signal Processing and Communication Systems 2019, 1-2.

18. Basri, H. M., Lias, K., & Mekhilef, S. (20190> Digital Predictive Current Control Fed by Three-Level Indirect Matrix Converter under Unbalanced Power Supply Condition, International UNIMAS STEM 12th Engineering Conference (EnCon) 2019, 1-6.

19. Basri, H. M., Lias, K., & Mekhilef, S. (2019). Predictive Current Control of Three Level Neutral Point Clamped Based Indirect Matrix Converter, International UNIMAS STEM 12th Engineering Conference (EnCon) 2019, 1-6.

20. Yanuar Z. Arief, Nur Anisah Aziera Abdul Halim and Mohd Hafiez Izzwan Saad. (2019). Optimization of Hybrid Renewable Energy in Sarawak Remote Rural Area Using HOMER Software, International UNIMAS STEM Engineering Conference 2019, 59-64.

21. Lee, B.C., Pandian, A., Rethinasamy, Souba, Tan, D.A.L. (2019). Optimization of Hybrid Renewable Energy in Malaysia Remote Rural Area Using HOMER Software, International UNIMAS STEM Engineering Conference 2019, 1-5.

22. Matarul J., Mannan M.A., Yussop N., Endut M.Z., Ibrahim A. (2019). Optimising concrete enhancement of local ready-mix concrete partially replaced with local fly-Ash, Journal of Physics: Conference Series, 1349(1), 1-5.

23. Islam S., Hashim A.H.A., Hasan M.K. (2019). A Resource-efficient Mobility Management Scheme to Analyze Handoff Performance in PNEMO Environment, 7th International Conference on Mechatronics Engineering, ICOM 2019.

24. Jong F.C., Ahmed M.M., Aik D.L.H. (2019). Integration of Renewable Energy Sources Optimization in Sarawak Using GIS and MCDM-AHP, International UNIMAS STEM 12th Engineering Conference, EnCon 2019 – Proceedings, 65-70.

25. Dweekat A.A., Shaaban M. (2019). Optimal Microgrid Energy Scheduling with Variable Solar PV Generation, International UNIMAS STEM 12th Engineering Conference, EnCon 2019 – Proceedings, 22-27.

26. Jack R., Mohidin H., Tamrin K.F., Banchit A., Khan M.Y.M.A., Narawi A., Dollah N. (2019). Soil pH mapping of pineapple crop: A feasibility study using aerial photo, Proceedings - 2019 International Conference on Computer and Drone Applications, IConDA 2019,1, 5-8.

27. Murad S.A.Z., Harun A., Isa M.N.M., Mohyar S.N., Sapawi R., Karim J. (2020). Design of CMOS low-dropout voltage regulator for power management integrated circuit in 0.18-Î¼m technology, AIP Conference Proceedings, 2203.

28. Peter P., Nik Soh N.M.Z., Akasah Z.A., Mannan M.A. (2020). Durability Evaluation of Cement Board produced from Untreated and Pre-treated Empty Fruit Bunch Fibre through Accelerating Ageing, IOP Conference Series: Materials Science and Engineering 713(1).

29. Sin K.Y., Jusoh M.S., Mardani A. (2020). Proposing an integrated multi-criteria decision-making approach to evaluate total quality management best practices in Malaysia hotel industry, Journal of Physics: Conference Series 1432(1).

30. Sadia T., Rahman M.E., Raudhah A., Doh S.I. (2020). The Effectiveness of Palm Oil Fuel Ash Cement Paste to Control Degradation in Ammonium Nitrate Solution, IOP Conference Series: Materials Science and Engineering.

31. Rahman A.K., Tom A.L., Mohtadzar N.A.A., Buswig Y.M.Y., Zamhari N., Zaidel D.N.A., Sahari S.K., Julai N. (2020). A New Modulation Technique to Improve Received Power under Turbulence Effects for Free Space Optical Communication, IOP Conference Series: Materials Science and Engineering, 767(1).

32. Rahman A.K., Tom A.L., Mohtadzar N.A.A., Buswig Y.M.Y., Zamhari N., Sharip M.R.M., Sahari S.K. (2020). Investigation to Reduce Flux Variance Effects Using Partial Coherent Beam in Free Space Optical Communication, IOP Conference Series: Materials Science and Engineering, 767(1).

COMMERCIALIZATION, CONSULTANCY AND SERVICES

UNIMAS in capability of being a university promotes research activities that mainly contribute towards strengthening the university's R&D agenda to enhance research publications in high impact journals and most importantly to expedite the development of R&D products that have potential for commercialization as a whole. Commercialization is considered a prime example for generating academic impact because it constitutes immediate, measureable market acceptance for outputs of academic research. Whilst commercialization clearly represents an important way fo academic research to contribute to economy and society, there are multiple other ways in which university research is transferred. Here, we are presenting a few selected knowledge-related collaborations by FENG academic researchers with various stakeholders. FENG welcome collaborations with the industries and do contact us.

Analytical Solution for Early Detection of Skin Cancer among Malaysians using Deep Learning Algorithms

UNIMAS-FUSIONEX GRANT

Dayang Azra Awang Mat, Kuryati Kipli, Kismet anak Hong Ping, Shafrida Sahrani, Dyg Norkhairunnisa Abg Zaidel, Ehfa Bujang Safawi

Research Assistant Master Student: Chee Ka Chin

The skin is the largest organ of the body and it has many purposes, including protecting the body, regulating temperature and controlling fluid loss. As the human often approach with ultraviolet (UV) radiation exposure, there are risk factors that can increase or decrease a person's chance of getting a disease (related to skin) such as cancer. Extensive sun exposure during childhood or adolescence increase the probability of skin cancer in adulthood. Skin cancer is a widely spreading cause of mortality among the people specifically living on or near the equatorial belt. In National Cancer Registry data, Malaysia's reported that skin cancers account for 2.6% cancer cases in the country [1]. The two major types of cancers are; non-melanoma (including basal cell carcinoma and squamous cell carcinoma) and melanoma (can be highly lethal due to high risk of spread). Since the manual examination by dermatologists directly from dermoscopy images that collected via dermoscopy are complex and fault prone, researchers tends to use Computer-Aided Decision (CAD) systems to solve the skin cancer early detection problems. Therefore, deep learning algorithm especially Convolutional Neural Network (CNN) have become the best choice for skin cancer early detection in the recent era. Besides that, AI program shows that "at least" 91 percent as good and suggested that could be used to create a mobile app for spotting skin cancer at home [2]. Consequently, mobile applications will be designed via ANDROID platform which ease users and save patients life for earlier treatment of skin cancer early detection. This contract research is supported by Fusionex International, the company that established multi-award-winning data technology provider specializing in Analytics, Big Data, Machine Learning and Artificial Intelligence with total funding of RM 60 000. The research is still on-going and the research progress with Fusionex International was conducted through Skype in last October 2019.

Deep learning workshop at UTM KL with researchers and lecturers from other universities

Progress presentation with Fusionex International via online

Feasibility Study on the Potential Use of Non-standard Materials for Road Construction in Sarawak

Ron Aldrino Chan @ Ron Buking (Project Leader)

In July 2019, a collaboration project was initiated between CMS Roads Sdn Bhd (CMSR) and Faculty of Engineering Unimas, Department of Civil Engineering with Public Work Department (PWD) of Sarawak (on behalf of Government of Sarawak) to conduct the *Feasibility study on the potential use of non-standard materials for road construction in Sarawak*. The aim of the study was to investigate the effectiveness of locally available non-standard materials to a specified standard for potential use in road construction, specifically in Sarawak. The study only covers the Northern Region of Sarawak, namely the Bintulu Division, the Miri Division and the Limbang and Lawas Division, due to the limited scope and duration of the study. The project was completed and concluded in February 2020 with a recommendation to extend the study to other divisions in Sarawak as a whole.

Project Teams:

1) Project leader/Coordinator: Ron Aldrino Chan @ Ron Buking
2) Project Advisor: Prof. Dr. Wan Hashim Wan Ibrahim
3) Project Technical Advisor: Prof. Dr Mohammad Abdul Manan
4) Team members: Dr Zamri Bujang (Traffic and GIS)
   Larry Silas Tirau (Pavement and Pavement Materials)
   Dr. Lee Shyue Leong (Pavement Analysist)

MoUs/MoAs (Signed and Stamped)

International

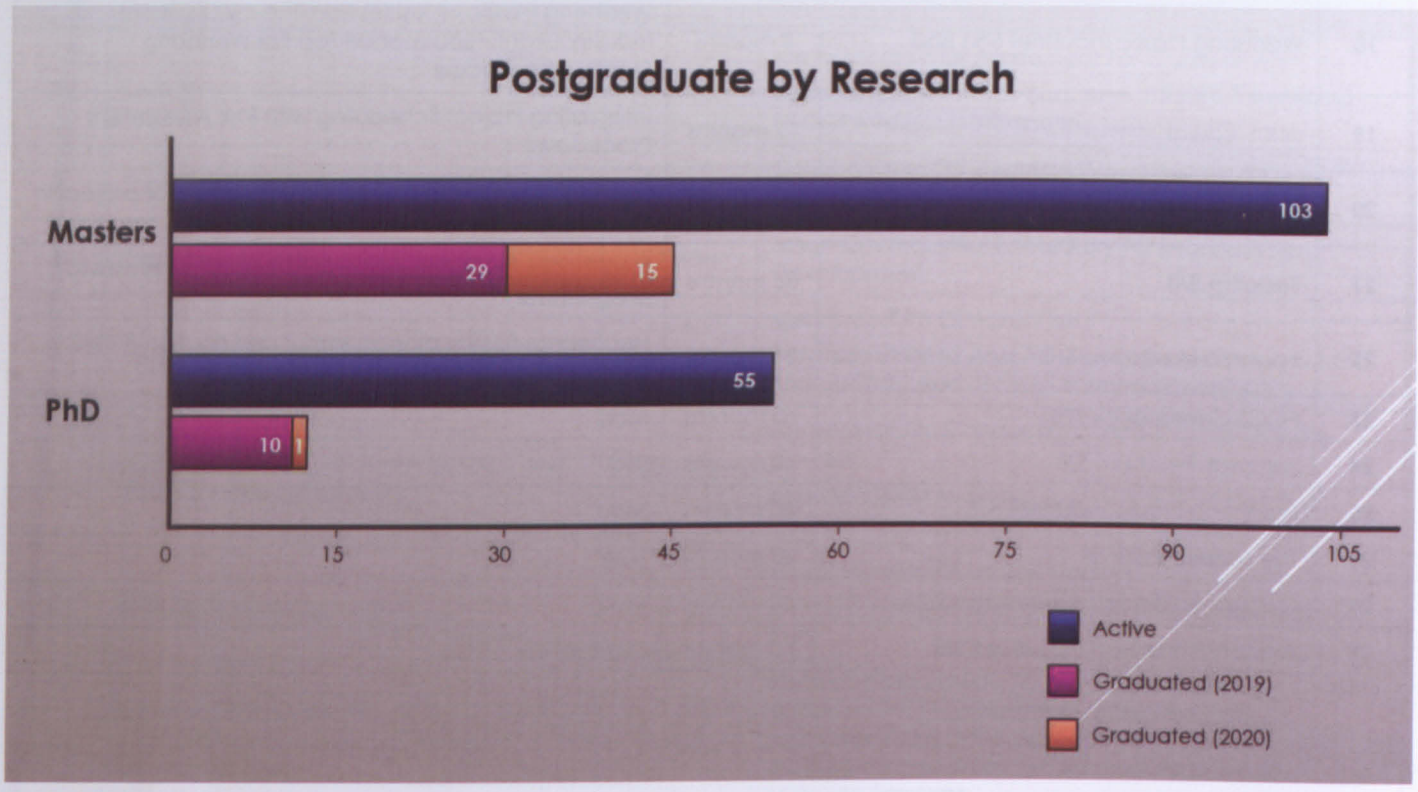
NO.	ORGANISATION	COUNTRY	PERIOD	PROGRAMME TITLE
Memorandum Of Agreement (MOA)				
1	Shibaura Institute of Technology (SIT)	Japan	5 years	Memorandum Of Agreement On Student Exchanges Program Between Shibaura Institute Of Technology And UNIMAS
2	Universite 'Nice Sophia Antipolis France	France	4years	Memorandum Of Agreement Between Universite 'Nice Sophia Antipolis France
3	Malla Reddy College of Engineering and Technologhy (MRCET)	India	5 years	Memorandum Of Agreement Between Universiti Malaysia Sarawak (UNIMAS) And Malla Reddy College Of Engineering And Technologhy (MRCET)
4	Universite De Limoges, France	France	4 years	Memorandum Of Agreement For The Joint Supervision Of Thesis
Memorandum Of Understanding (MOU)				
1	Limoges University	France	5 years	Memorandum Of Understanding Between UNIMAS And Universite De Limoges, France
2	Universite 'Nice Sophia Antipolis France	France	5 years	Memorandum Of Understanding Between UNIMAS And Universite Nice Sophia Antipolis, France
3	Institut Teknologi Nasional (ITENAS) Bandung, Indonesia	Indonesia	5 years	Memorandum Of Understanding Between UNIMAS And Institut Teknologi Nasional (ITENAS) Bandung, Indonesia
4	The Welding Institute (TWI)	UK	5 years	Memorandum Of Understanding Between TWI And Universiti Malaysia Sarawak
5	UNIVERSITAS PANCA BHAKTI (UPB)	Indonesia	5 years	Memorandum Of Understanding Between Universitas Panca Bhakti And Universiti Malaysia Sarawak
6	Pakistan Institute of Engineering and Applied Sciences (PIEAS)	Pakistan	3 years	Memorandum Of Understanding Between Pakistan Institute Of Engineering And Applied Sciences And Universiti Malaysia Sarawak
7	Kano University of Science and Technology, Wudil	Nigeria	3 years	Memorandum Of Understanding Between Kano University Of Science And Technology, Wudil And Universiti Malaysia Sarawak
8	University of Kracheh, Cambodia	Cambodia	3 years	Memorandum Of Understanding Between University Of Kracheh, Cambodia And Universiti Malaysia Sarawak
9	Micro/Nano Technology Center, Tokai University, Japan	Japan	5 years	Memorandum Of Understanding Between Micro/Nano Technology Center , Tokai University, Japan And UNIMAS
10	King Mongkut's University of Thonburi, Thailand	Thailand		Memorandum Of Understanding Between King Mongkut's University Of Thonburi, Thailand And UNIMAS
11	Kulna University of Engineering & Technology, Bangladesh	Bangladesh		Memorandum Of Understanding Between UNIMAS And Kulna University Of Engineering & Technology, Bangladesh
12	SRM Institute of Science and Technology, India	India		MOU

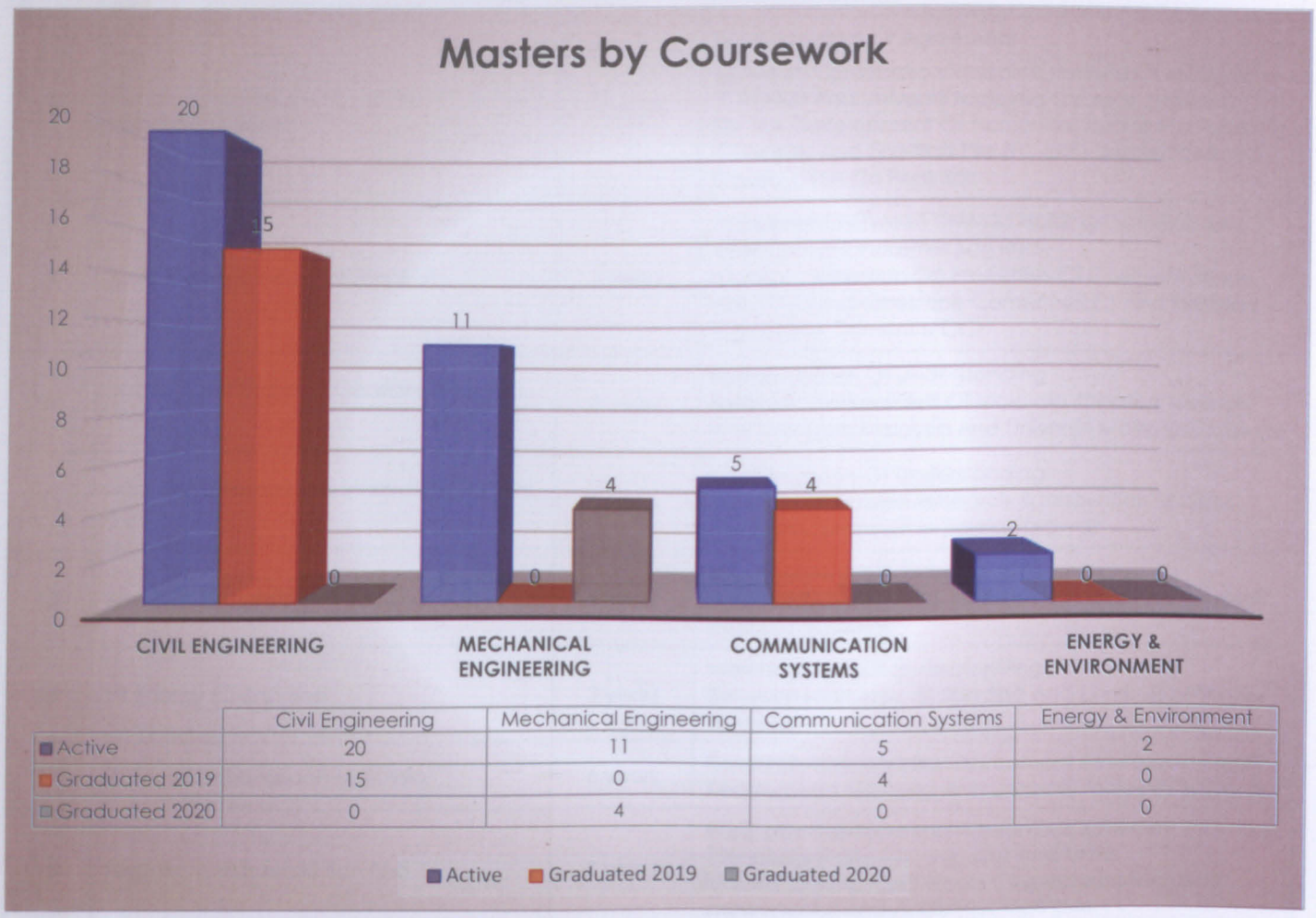
National

NO.	ORGANISATION	PERIOD	PROGRAMME TITLE
1	SACOFA	5 years	Memorandum Of Agreement For Collaboration Between SACOFA Sdn Bhd. And UNIMAS For UNIMAS-SACOFA Telecommunication Laboration
2	Shorefield Sdn Bhd	5 years	Collaboration On Electrical Power System (EPS) Industrial Based Laboratory
3	Kiwitech Sdn Bhd	5 Years	Smart City Industrial Laboratory For Research And Development
4	ACME Integrated Services Sdn. Bhd.	3 years	Memorandum Of Agreement Between UNIMAS And ACME Integrated Services Sdn. Bhd. (UCME) And UNIMAS Business School (UBS)
5	UNIMAS Elcorp Technology Sdn Bhd and UNIMAS Holdings Sdn Bhd	5 years	Agreement On Conducting Certified Solar Training Courses Between UNIMAS Elcorp Technology Sdn Bhd And UNIMAS Holdings Sdn Bhd
6	Infra Tech Geo Solutions (M) Sdn Bhd	5 years	Memorandum Of Understanding Between UNIMAS And Infra Tech Geo Solutions (M) Sdn Bhd
7	Universiti Sains Malaysia (Collaborative Microelectronic Design Excellence Centre, CEDEC)	2 years	Cedec Standard Eda Tools Rental / Silterra Multi-Project Wafer (MPW) Programme / Cedec Test And Measurement Service Agreement Between Universiti Sains Malaysia And Universiti Malaysia Sarawak
8	Construction Research Institute of Malaysia, CREAM	5 years	Memorandum Of Agreement Between Construction Research Institute Of Malaysia (CREAM) And Universiti Malaysia Sarawak (UNIMAS) For The Development Of Numerical Studies For Foam Concrete And Eco-Raft Pile (FC-ERP) System For Road Construction On Peat Soil
9	CMS Cement Industries Sdn Bhd	1 years	Agreement Between UNIMAS Holdings Sdn Bhd And CMS Cement Industries Sdn Bhd Contract Research On Properties Of Concrete Made From Portland-Limestone Cement (PLC) And Portland Composite Cement (PCC)
10	Jabatan Mineral and Geosains Malaysia, JMG	5 years	Memorandum Of Understanding Between Government Of Malaysia Jabatan Mineral And Geosains Malaysia And Universiti Malaysia Sarawak
11	Malaysian Research & Innovation Society, MyRIS	5 years	Memorandum Of Understanding Between Malaysian Research & Innovation Society, MyRIS And Universiti Malaysia Sarawak
12	Samalaju Downstream Sdn Bhd	1 years	Memorandum Of Understanding Between Samalaju Downstream Sdn Bhd And Universiti Malaysia Sarawak
13	HT Energy (S) Sdn Bhd	3 years	Memorandum Of Understanding Between HT Energy (S) Sdn Bhd And Universiti Malaysia Sarawak
14	Universiti Kebangsaan Malaysia	6 years	Research Collaboration Agreement Between Universiti Kebangsaan Malaysia And Universiti Malaysia Sarawak
15	Trienekens (Sarawak) Sdn Bhd	2 years	Research Collaboration Agreement Between Trienekens (Sarawak) Sdn Bhd And UHSB Industry Grants: Solid Waste Characterisation Using Experimental And Analytical Methods
16	Trienekens (Sarawak) Sdn Bhd	2 years	Research Collaboration Agreement Between Trienekens (Sarawak) Sdn Bhd And UHSB Industry Grants: Phycoremedation Of Landfill Leacate

17	JKR Sarawak	1 year	Research Collaboration Agreement Between JKR Sarawak And UHSB – Industry Grant: Geotechnical Characterization Of Sarawak Soft Marine Clay
18	WenHong Plastic Industries Sdn Bhd	8 months	Wenhong Plastic Industries Sdn Bhd (*With UHSB) Industry Grant:Performance Test For Wenhong Stormwater Module
19	JKR Sarawak	12 months	Integrating Project Scheduling with Risk Assessment Procedures
20	JKR Sarawak	12 months	Formulation of construction duration index for project in Sarawak
21	Sedafiat S/B	36 months	Healthcare facility management certification (HFMC) programme
22	Edgenta Mediserve S/B	36 months	Healthcare facility management certification (HFMC) programme
23	PCCS Consultancy S/B	60 months	MoU
24	Sarawak Petchem S/B	60 months	MoU
25	Wenhong Plastic Industries S/B	60 months	MoU
26	The Learning Curve	60 months	MoU
27	Gabungan Binaan Jurutenaga S/B	60 months	MoU
28	Amcan Integrated Industrues S/B	60 months	MoU

Postgraduate Students Statistics





	Civil Engineering	Mechanical Engineering	Communication Systems	Energy & Environment
Active	20	11	5	2
Graduated 2019	15	0	4	0
Graduated 2020	0	4	0	0

IMPORTANT CONTACTS

Dean
Assoc. Prof Ir. Dr Hjh Siti Noor Linda Hj Taib
tlinda@unimas.my Tel: +6082-583325
Fax: +6082-583410

Deputy Dean (Research and Commercialization)
Dr Norhuzaimin Julai
jnorhuza@unimas.my
Tel: +6082-583339
Fax: +6082-583410

Deputy Dean (Undergraduate)
Dr Nordiana Rajaee
rnordiana@unimas.my
Tel: +6082-583324
Fax: +6082-583410

Deputy Dean (Industry and Community Engagement)
Prof Ir. Dr Andrew Ragai Henry Rigit
sflim@unimas.my
Tel: +6082-583209
Fax: +6082-583410

Deputy Dean (Student Affairs and Alumni)
Dr Nazeri Abdul Rahman
arnazeri@unimas.my
Tel: +6082-583479
Fax: +6082-583410

Postgraduate by Research Coordinator
Dr Shirely Jonathan Tanjong
arnazeri@unimas.my
Tel: +6082-592620
Fax: +6082-583410

Department of Mechanical & Manufacturing Engineering

Head of Department
Dr Noor Hisyam Noor Mohamed
nmnhisyam@unimas.my
Tel: +6082-583340
Fax: +6082-583410

Department of Chemical Engineering & Energy Sustainability

Head of Department
Assoc. Prof. Dr Rubiyah Baini
ruby@unimas.my
Tel: +6082-583338
Fax: +6082-583410

Department of Civil Engineering

Head of Department
Assoc. Prof. Dr Mohammad Ibrahim Safawi bin Mohammad Zain
mzmisafawi@unimas.my
Tel: +6082-581022
Fax: +6082-583410

Department of Electrical & Electronics Engineering

Head of Department
Assoc. Prof Ir. Dr Kismet anak Hong Ping
hpkismet@unimas.my
Tel: +6082-583339
Fax: +6082-583410

Research Cluster

Resilient Infrastructure
Leader: Prof Dr Mohammad Abdul Mannan
mannan@unimas.my
Tel: +6082-583223

Renewable Energy and Sustainability
Leader: Prof. Dr Musse Mohamud Ahmed
mamusse@unimas.my
Tel: +6082-583280

Emerging Materials and Smart Manufacturing
Leader: Prof. Dr Sinin Hamdan
hsinin@unimas.my
Tel: +6082-582333

Centre for Renewable Energy (CREN)

Director
Ir. Dr Hazrul Bin Mohamed Basri
email:mbhazrul@unimas.my
Tel: +6082583380

Deputy Director
Dr Abang Mohammad Nizam
akamnizam@unimas.my
Tel: +6082583254

Contacts for research groups:

Solar
Assoc. Prof. Dr Wan Azlan Wan Zainal Abidin
wzaazlan@unimas.my
+6082581057

Hydro
Assoc. Prof. Dr Thelaha Hj Masri
mthelaha@unimas.my

Biomass
Dr Ivy Tan Ai Wei
awitan@unimas.my
+6082583312

Wave and Tidal
Prof. Ir. Dr Andrew Ragai Henry Rigit
arigit@unimas.my
+6082583220

Energy Efficiency
Assoc. Prof. Dr Siti Halipah Ibrahim
ihalipah@unimas.my
+6082583283

Wind
Ir. Rudiyanto Philman Jong
jprudiyanto@unimas.my
+6082584232

Fuel Cell
Prof. Dr Mohammad Omar Abdullah
amomar@unimas.my
+6082583349

For further information about the programme, please contact :

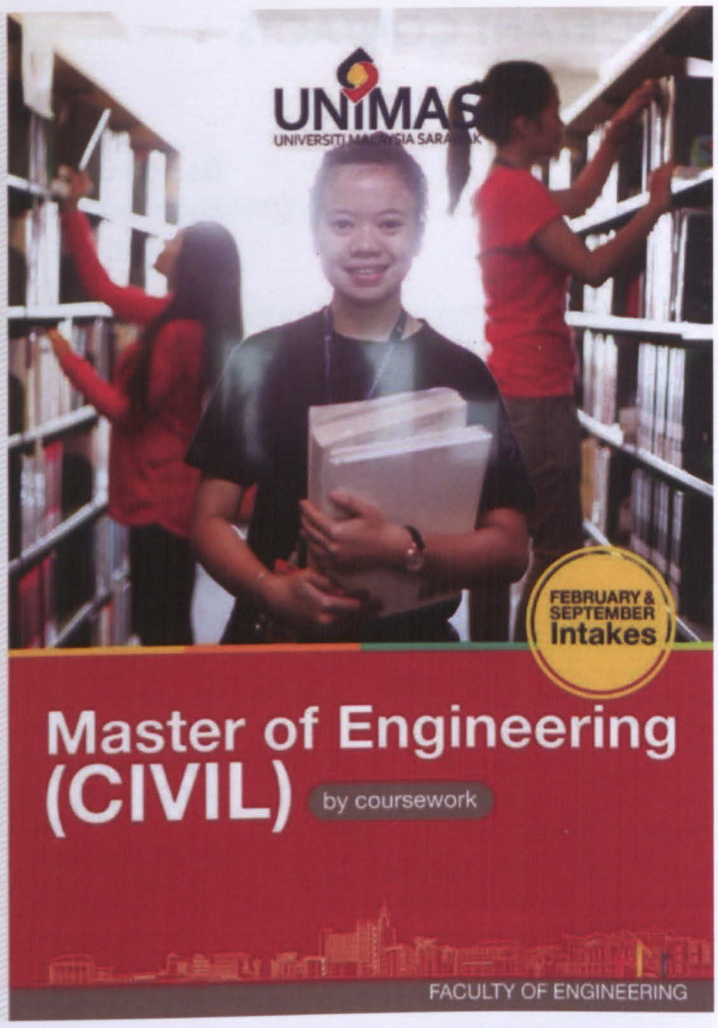
Centre for Graduate Studies
Universiti Malaysia Sarawak (UNIMAS)
94300 Kota Samarahan
Sarawak, Malaysia
Tel: +60 82 581000
http://www.postgrad.unimas.my

MEng (Civil Programme Coordinator
Faculty of Engineering
Universiti Malaysia Sarawak (UNIMAS)
94300 Kota Samarahan
Sarawak, Malaysia
http://www.feng.unimas.my
meng@pps.unimas.my

+60 82 583305

+60 82 583410

meng@pps.unimas.my



INTRODUCTION

Master of Engineering (Civil) programme by coursework is specifically tailored to help fresh graduates, practicing engineers and academicians gain advanced Civil Engineering knowledge. The programme offers a comprehensive course structure, which emphasises on recent engineering practices and industrial-based research projects. This programme also focusses on improving the existing civil engineering issues in Sarawak such as soil problems, traffic congestion and building construction technology.

ADMISSION

The Master of Engineering (Civil) programme starts in September and February every year. Application is open throughout the year and can be done online via: https://cgsweb.unimas.my/PGApplication/

PROGRAMME STRUCTURE

CORE (Compulsory)

KNS 6053	Advanced Soil Mechanics
KNS 6013	Advanced Reinforced Concrete Design
KNS 6033	Advanced Surface and Groundwater Hydrology
KNS 6092	Research Methodology
KNS 6063	Transportation Planning
KNS 6102	Research Project (Part 1)
KNS 6043	Wastewater Engineering
KNS 6163	Soft Soil Engineering
KNS 6023	Advanced Concrete Technology
KNS 6083	Civil Engineering Project Management
KNS 6143	Research Project (Part 2)
KNS 6156	Research Project (Part 3)

Elective (Choose One)

KNS6313	River Engineering
KNS6183	Traffic Engineering and Safety
KNS6XX3	Pavement Analysis and Design
KNS6XX3	Earthquake Engineering

TOTAL CREDIT 40

PROGRAMME

DURATION OF THE PROGRAMME

The Master of Engineering (Civil) is a master programme by coursework over a minimum duration of 12 months on full time to a maximum period of 24 months.

COURSE FEES

Malaysian student RM 16,171.00
International student RM 30,571.00

Fees include administrative, tuition and course materials for the duration of the programme. Further payment will be required if the students extend their studies.

FACILITIES AND RESOURCES

- Geotechnical Laboratory
- Heavy Structure Laboratory
- Light Structure Laboratory
- Concrete Laboratory
- Highway Engineering Laboratory
- Survey Laboratory
- Traffic Engineering Laboratory
- Hydraulics and Hydrology Laboratory
- Environmental Engineering Laboratory
- Building Services Laboratory
- Graphics Lab
- Computer Aided Design (CAD) / Computer Aided Engineering (CAE) Laboratory
- Lecture theater
- CAIS (library)

WHO SHOULD APPLY

The programme aims at providing opportunities to various group of potential candidates such as:

- Fresh graduates
- Practicing engineers
- Academicians

ENTRY REQUIREMENTS

For admission into the programme, a candidate must meet the following criteria:

- A Bachelor's Degree with a minimum CGPA of 2.50 or;
- A Bachelor's degree or equivalent but CGPA less than 2.50 may be accepted subject to a minimum of five years working experience in the relevant field or,
- Other equivalent qualifications approved by Senate
- For international students, an IELTS score of 6.0 is required in addition to the entry requirements.

PROGRAMME SCHEDULE

The Programme requires students to accumulate 40 credit hours of their studies in which preferably 16 and 15 credit hours are completed in Semester 1 and Semester 2 respectively and 9 credit hours to complete the thesis in the intersession semester. Teaching and learning activities for the programme are conducted on weekends.

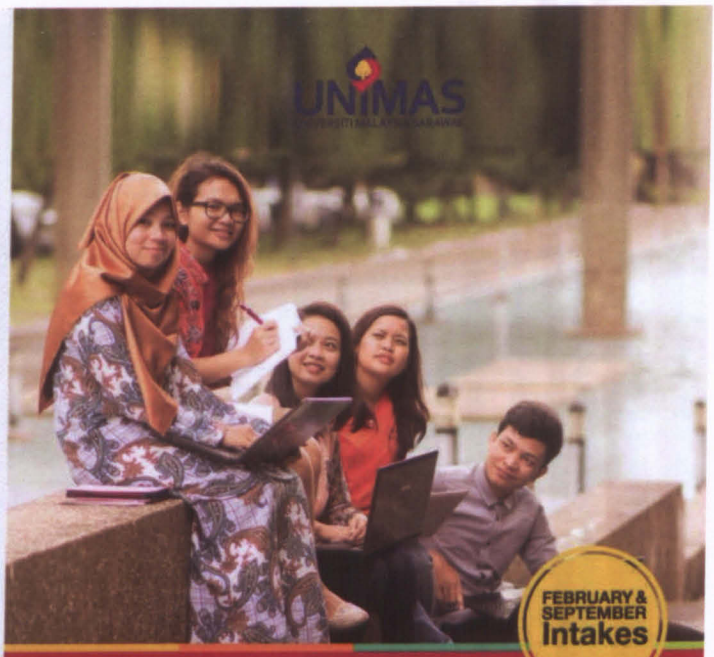
For further information about the programme, please contact :

Centre for Graduate Studies
Universiti Malaysia Sarawak (UNIMAS)
94300 Kota Samarahan
Sarawak, Malaysia
Tel: +60 82 581000
http://www.postgrad.unimas.my

MEng (Mechanical) Programme Coordinator
Faculty of Engineering
Universiti Malaysia Sarawak (UNIMAS)
94300 Kota Samarahan
Sarawak, Malaysia
http://www.feng.unimas.my
smarini@unimas.my

082-5883303, 082-583340

smarini@unimas.my, mshahrol@unimas.my



FEBRUARY & SEPTEMBER Intakes

Master of Engineering (MECHANICAL)

by coursework

FACULTY OF ENGINEERING

INTRODUCTION

This new program is suitable for fresh graduates, practicing engineers and academicians with primary degrees in Mechanical Engineering who wish to extend in depth and breadth the knowledge and skills gain from their engineering graduate studies.
The programme offers two specialization areas in mechanical engineering field which are **Mechanical & Energy Sustainability and Design & Manufacturing** in the elective courses that enable the students to choose their area of interest. These areas of specialization are in line with the current needs of the industry.

ADMISSION

The Master of Engineering (Mechanical) programme starts in September and February every year. Application is open throughout the year and can be done online via: https://cgsweb.unimas.my/PGApplication/

PROGRAMME STRUCTURE

Semester 1

KNJ 6023	Computational Method in Solid Mechanics
KNJ 6043	Engineering Management
KNJ 6012	Research Methodology
KNJ 6054	Project 1
	Elective 1
	Elective 2

Semester 2

KNJ 6033	Thermodynamics in Energy Conversion
KNJ6067	Project 2
	Elective 3
	Elective 4

Intersession

Elective 3
Elective 4

TOTAL CREDIT 40

Common for both area of specialization

KNJ6233 Computer Aided Design and Applications
KNJ6373 Introduction to Multivariate Modelling and Data Analysis
KNJ6303 Safety & Health

List of Elective Courses*

Mechanical & Energy Sustainability

KNJ6073 Tribology
KNJ6133 Mechanical Behaviour of Materials
KNJ6183 Combustion Engineering
KNJ6193 Advance Heat Transfer
KNJ6103 Vibration
KNJ6113 Applied Biomechanics
KNJ6163 Fracture Mechanics
KNJ6223 Solar Energy
KNJ6213 Energy Optimization and Management
KNJ6093 Acoustics
KNJ6203 Heat, Ventilation and Air Conditioning
KNJ6083 Structural Dynamics

Design & Manufacturing

KNJ6243 Engineering Design Optimization
KNJ6253 Product Realization
KNJ6313 Production Operations Management
KNJ6323 Reliability and Quality Control Engineering
KNJ6123 Characterisation of Materials
KNJ6273 Lean Manufacturing
KNJ6283 Industrial Ergonomics
KNJ6293 Industrial Automation
KNJ6353 Computer Integrated Manufacturing
KNJ6383 Probability and Statistics for Quality Analysis
KNJ6153 Polymer and Composites
KNJ6263 Supply Chain Management
KNJ6343 Metal Cutting and High Speed Machining
KNJ6363 System Modelling and Simulation
KNJ6143 Materials Selection and Processing
KNJ6173 Corrosion and Prevention

PROGRAMME

DURATION OF THE PROGRAMME

The minimum of study is 1 year on full time to a maximum period of 3 years. Teaching and learning activities for the programme are conducted in weekends.

COURSE FEES

Malaysian student RM 18,726
International student RM 30,626

Fees include administrative, tuition and course materials for the duration of the programme. Further payment will be required if the students extend their studies.

FACILITIES AND RESOURCES

- Flexible Manufacturing System Laboratory
- Robotic and Automation Laboratory
- Mechanics Dynamic Laboratory
- Computer Numerical Control Laboratory
- Non Destructive Test Laboratory
- Energy Research Room Laboratory
- Advance Metrology/ Basic Metrology Laboratory
- Mechanical of Solid Laboratory
- Mechanical Metallurgy Laboratory
- Physical Metallurgy Laboratory
- Applied & Basic Thermodynamics Laboratory
- CAE Laboratory
- Computer Numerical Laboratory
- Control Laboratory
- Fluid Laboratory
- General and Training Workshop Laboratory
- Instrumentation Laboratory
- Mechanics Statics Laboratory

WHO SHOULD APPLY

The programme aims at providing opportunities to various group of potential candidate such as:

- Fresh graduates
- Practicing engineers
- Academicians

ENTRY REQUIREMENTS

For admission into the programme, a candidate must meet the following criteria:

- A Mechanical Engineering Bachelor's Degree with a minimum CGPA of 2.50 or;
- A Mechanical Engineering Bachelor's degree or equivalent but CGPA less than 2.50 may be admitted subject to a minimum of five years working experience in the relevant field or,
- Other equivalent qualifications approved by Senate
- For international students, an IELTS score of 6.0 is required in addition to the entry requirements

PROGRAMME SCHEDULE

The Programme requires students to accumulate 40 credit hours in their studies in which preferably 18 and 16 credit hours are completed in Semester 1 and Semester 2 respectively and 6 credit hours in the intersession semester.

For further information about the programme, please contact :

UNIMAS Graduate School
Universiti Malaysia Sarawak
94300 Kota Samarahan
Sarawak, Malaysia
http://www.postgrad.unimas.my

Master of Engineering (Communication Systems)
Programme Coordinator (via Coursework)
Department of Electrical and Electronic,
Faculty of Engineering,
Universiti Malaysia Sarawak (UNIMAS)
94300 Kota Samarahan
Sarawak, Malaysia
http://www.feng.unimas.my

+6082-583395 / 3339

+6082 583410

meng_cs@unimas.my, rnordiana@unimas.my

Disclaimer:
The Faculty of Engineering of Universiti Malaysia Sarawak has made every effort to ensure that the information presented in this document is accurate at the time of printing. This document is created for information only. UNIMAS reserves the right to change the content in this document at any time and without prior notice. Tuition fees are subject to an annual review.

Master of Engineering (COMMUNICATION SYSTEMS) by coursework

FACULTY OF ENGINEERING

INTRODUCTION

Master of Engineering (Communication Systems) programme by coursework is ideal for fresh graduates, practicing engineers and academicians with primary degrees in Engineering and Science who wish to focus on a career in the telecommunications industry. The programme offers a broad curriculum which focuses on solid theoretical core in communication systems engineering. It is designed to equip students with a detailed knowledge of modern communications technologies, telecommunications and data network systems. The programme also builds interdisciplinary skills in students, to meet current and future needs of telecommunication industry.

ADMISSION

The Master of Engineering (Communication Systems) programme starts in February and September every year. Application is open throughout the year and can be done online via:
https://cgsweb.unimas.my/PGApplication/

PROGRAMME STRUCTURE

Semester 1
- KNL 6002 Research Methodology
- KNL 6013 Thesis I
- KNL 6102 Industrial Entrepreneurship
- KNL 6203 Advanced Mobile and Wireless Communications
- KNL6223 KNL6223 Microwave, RF and Antenna Technology
- KNL6XXX Elective I

Semester 2
- KNL6023 Thesis 2
- KNL6243 Wireless Communication Networks and Protocols
- KNL6263 Satellite Technology
- KNL6122 Management for Engineers
- KNL6XXX Elective II

Antisemester
- KNL6113 Safety and Health for Engineers

Semester 3
- KNL6034 Thesis 3
- KNL6273 Advanced Signal Processing
- KNL6233 Telecommunication Law and Policy

TOTAL CREDIT 43

PROGRAMME

DURATION OF THE PROGRAMME

The minimum of study is 18 month (Semester 1, Semester 2, Semester 3 and InterSession) on full time to a maximum period of 4 years.

COURSE FEES

Malaysian student RM 20,377.00
International students RM 33,072.00

Fees include administrative, tuition and course materials for the duration of the programme. Futher payment will be required if the students extend their studies.

FACILITIES AND RESOURCES

To support your study, the university provides various facilities and resources:

- Centre for Academic Information Services (CAIS) – The University library houses more than 200,000 titles of books and journals, and it also provides access to thousands of resources online.
- Resources Rooms – Spaces are provided for students to discuss, collaborate and work on academic tasks within the faculty and throughout the campus.
- Laboratory Facilities – Faculty of Engineering is supported by many research groups, laboratories and equipment's that allow our students to conduct their research in a wide range of fields.

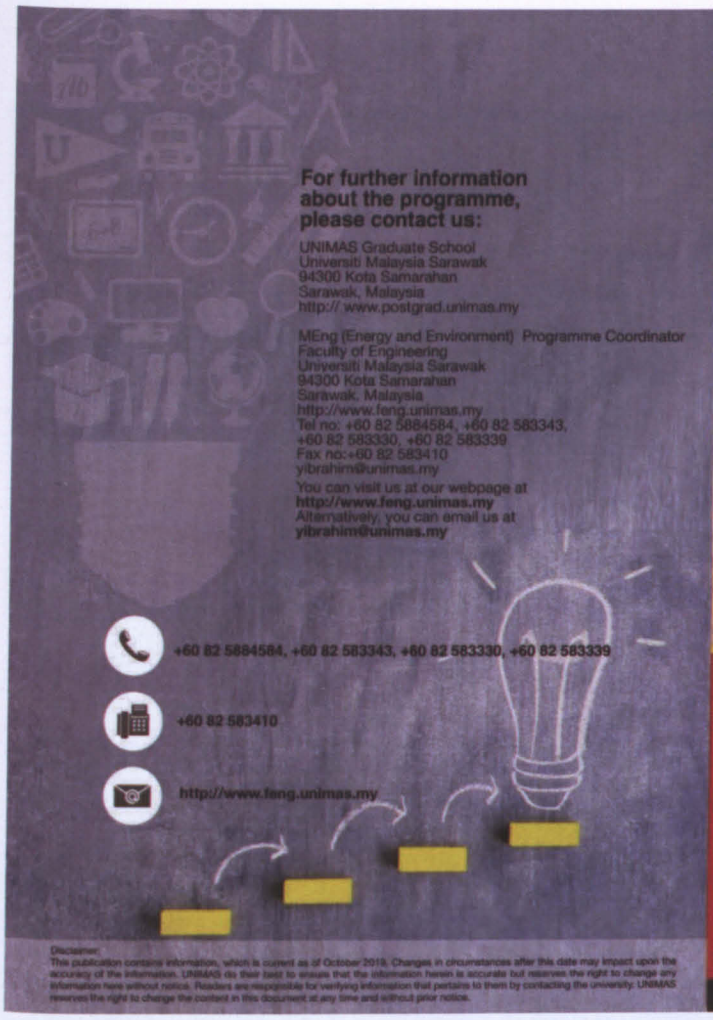
WHO SHOULD APPLY

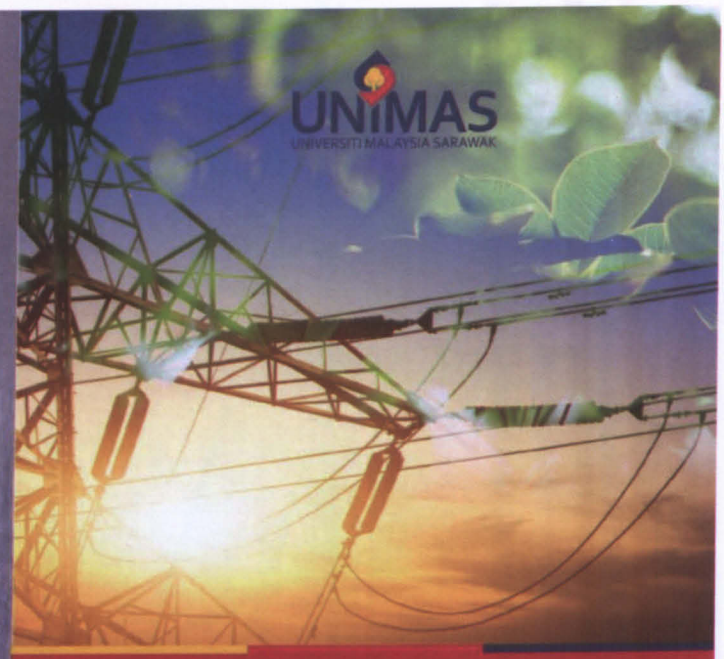
- Fresh graduates
- Practicing engineers and academicians with primary degrees in Engineering / Science who wish to focus on a career in telecommunication industry

ENTRY REQUIREMENTS

Candidates must possess at least one of the following qualifications:

- A Bachelor degree in related engineering discipline with a minimum CGPA of 2.50 or equivalent, as accepted by the Senate;
- A Bachelor degree or equivalent in related engineering discipline but with CGPA less than 2.50, may be admitted subject to a minimum of 5 years working experience in the relevant field; or
- Other equivalent qualifications approved by the Senate
- For international students, a minimum IELTS Score of 5.5 or its equivalent (e.g. TOEFL-525; TOEFL Computer Test -196; TOEFL Internet Test 69-70) is required.





Master of ENGINEERING (ENERGY AND ENVIRONMENT)

FACULTY OF ENGINEERING

UNIVERSITI MALAYSIA SARAWAK

INTRODUCTION

Master of Engineering (Energy & Environment) programme by coursework is specifically tailored to equip fresh graduates, practicing engineers and academicians with advanced knowledge and skills required in energy and environmental sectors. The programme offers a comprehensive course structure delivered by our experienced academicians and industrial partners, which emphasizes on recent engineering practices and industrial-based research projects. This is the first such programme has ever offered on Borneo.

PROGRAMME STRUCTURE

Semester 1

KNC6013	Advanced Conventional Energy System	3 credit hours
KNC6023	Advanced Renewable Energy System	3 credit hours
KNC6033	Energy and Environment Sustainability	3 credit hours
KNC6042	Research Methodology	2 credit hours
KNC6053	Research Project 1	3 credit hours
	Elective 1	3 credit hours

Semester 2

KNC6093	Urban and Rural Energy System	3 credit hours
KNC6103	Advanced Energy Optimisation and Economics	3 credit hours
KNC6113	Advanced Environmental Impact Assessment	3 credit hours
KNC6124	Research Project 2	3 credit hours
	Elective 2	4 credit hours
	Elective 3	3 credit hours

Intersession

KNC6164	Research Project 3	4 credit hours

List of Elective Courses*

KNC6063 Energy and Environment Law & Policy
KNC6073 Advanced Environmental Pollution Control
KNC6083 Risk and Hazard Management in Energy Sector
KNC6133 Sustainable Project Management
KNC6143 Industrial Hygiene in Energy Sector
KNC6153 Emerging Energy & EnvironmentTechnologies

*The elective courses offered in each semester are subject to the minimum number of students registering for the programme.

PROGRAMME

DURATION OF THE PROGRAMME

Master of Engineering (Energy and Environment) is a master programme by coursework with minimum of 12 months to a maximum of 24 months on full time.

COURSE FEE

Malaysian student: **RM 27,225.00**
International student: **RM 38,119.00**

Student supported by the government, employer or other sponsor should bring confirmation letter by addressing to UNIMAS that the fee will be paid directly by the sponsor.

FACILITIES AND RESOURCES

To support your studies, University provides various facilities and resources such as:

- Process Control Laboratory
- Analytical Chemistry Laboratory
- Computer Laboratory
- Simulation Laboratory I & II
- Chemistry Laboratory
- Environment and Energy Sustainability
- General Workshop
- Unit Operation (Heat & Mass Transfer Laboratory)

WHO SHOULD APPLY

The programme aims at providing opportunities to various group of potential candidate such as:

- Fresh graduates
- Practicing engineers
- Academicians

ENTRY REQUIREMENT

The minimum entry requirements for the programme are as follows:

- An Engineering Bachelor's Degree or any related Science Bachelor's Degree with a minimum CGPA of 2.50 or;
- An Engineering Bachelor's Degree or any related Science Bachelor's Degree but with CGPA less than 2.50 may be admitted subject to a minimum of five years working experience in the relevant field or;
- Other equivalent qualifications approved by Senate.
- For international students, an IELTS score of 5.5 is required in addition to the entry requirements

PROGRAMME SCHEDULE

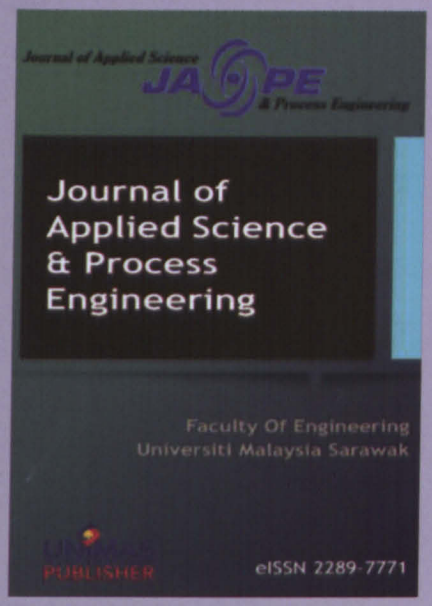
The Programme requires students to accumulate 40 credit hours in their studies in which preferably 17 and 19 credit hours are completed in Semester 1 and Semester 2 respectively, and 4 credit hours in the intersession semester.

Journal of Applied Science JASPE & Process Engineering

Journal of Applied Science & Process Engineering

eISSN 2289-7771

Indexed in: MyJurnal, MYCITE, ROAD, DOAJ Directory of Open Access Journals, publons, UDL Edge, Google, CAS A Division of the American Chemical Society, Ulrich's Periodicals Directory



Journal of Applied Science & Process Engineering or **JASPE** (**e-ISSN 2289-7771**) is a biannual peer-reviewed, an open-access online journal of Faculty of Engineering, Universiti Malaysia Sarawak. JASPE brings together multidisciplinary interests in one journal and offers a platform for the disseminate information in the field of applied science and process engineering.

JASPE invites original research, review, and comment papers from scholars for its upcoming journal issue.

Submit your article @
http://bit.ly/JASPE_submission

For more information, please visit http://www.jaspe.unimas.my

Contact us @ Journal of Applied Science & Process Engineering, Faculty of Engineering, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak.
Email: jaspe@event.unimas.my

Faculty of Engineering
Universiti Malaysia Sarawak
94300 Kota Samarahan
Sarawak Malaysia

Tel : +60 82-583330 Fax : +60 82-583410
http://www.feng.unimas.my