The 1st International Conference of The Nigerian Institution of Professional Engineers and Scientists

NIPES

Crossref
NIPES JOURNALS

Theme
Recent Developments and Emerging Trends in Science and Engineering Towards a Systematic Change in Sustainable Development and Ecologically Smart Future

From 7th to 8th October 2021
University of Benin, Benin City Edo State, Nigeria

Prof. (Mrs) Lilian I. Salami (Vice Chancellor, University of Benin, Nigeria)
Chief Host

Dr. Collins Chike Kwasi-Effah (Chairman, NIPES)
Host

Prof. Jude Iroh, University of Cincinnati, Ohio, USA
International Keynote speaker

Dr. Uche Onochie, Alex-Ekweme Federal University, Nigeria
National Keynote speaker

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Prof. (Mrs) Lilian I. Salami, FNSN
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Dr. Osarobo O. Ighodaro, FNIPES
Chief Executive Officer

Engr. Osamudiamen Efosa, FNIPES
Executive Secretary

Prof. Jude Iroh, FSAMPE
International Keynote

Dr. Uche Paul Onochie, MNIPES
National Keynote Speaker

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Prof. Albert I. Obanor, FNIPES
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Dr. Godwin E. Sadjere, FNIPES
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Prof. Godfrey O. Ariavie, FNIPES
Vice President (Research)

Dr. Sunday Ikpeseni, MNIPES
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Assistant Executive Secretary

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Programme

Day 1

Time

9:00 AM - 9:15AM	Arrival of Guests
9:16 AM - 9: 30AM	Opening Address by the Vice Chancellor, University of Benin
9:31:AM-9:40 AM	Address by the Chairman, NIPES
9:41AM to 10:20 AM	Keynote Presentations (International/National)
10:21AM to 11: 30 AM	1st Session Oral Presentations
11:31 AM -11:50 AM	Tea Break/Group Photos
11:51AM -4:00 PM	2nd Session Oral Presentations
4:01 PM -4:30 PM	Launch Break
4:31 PM1 - 5:59 PM	3rd Session Oral Presentations
6:00 PM	Closing

Day 2

Time

9:00AM - 9:15AM	Arrival of Guests
9:16 AM - 11: 30 AM	1st Session Oral Presentations
11:31 AM-11:50AM	Tea Break
11:51am -4:00 pm	2nd Session Oral Presentations
4:01 PM - 4:30PM	Launch break
4:31PM - 5:30PM	3rd Session Oral Presentations
5:31PM-6:00 PM	Closing Ceremony /Remark

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Background

The Nigerian Institution of Professional Engineers and Scientists under the circumstance of COVID-19 pandemic has decided that her first International Conference be held both physically and virtually on the 7th and 8th of October, 2021. The conference theme is entitled: *Recent Developments and Emerging Trends in Science and Engineering Towards a Systematic Change in Sustainable Development and Ecologically Smart Future*. The aim of the conference is to promote engineering science interaction on the current trends and research geared towards a systematic change and approach in achieving sustainable development and ecologically smart future within the shortest possible time. The thematic sessions are grouped under the following category:

➢ **Bioresources (BR)**

➢ **Chemical Process & Petroleum Engineering (CP)**

➢ **Energy and Power (EP)**

➢ **Environmental Sustainability (ES)**

➢ **Ecotoxicology (EC)**

➢ **Information Technology (IT)**

➢ **Materials and Industrial Process (MI)**

➢ **Mathematics-Industrial Physics (MP)**

➢ **Modelling, Simulations and Designs (MSD)**

Engineers and Scientists of all disciplines belonging to educational, research, industry, governmental or non-governmental organizations are welcome to participate in the conference.

Venue: Faculty of Engineering Board Room, University of Benin, Edo State Nigeria

Online Venue - Zoom ID: 82141829693 password- nipes

Organizing Committee
Dr. C.C. Kwasi-Effah
Dr. O.O. Ighodaro
Engr. P.O. Olagbegi
Mr. J. Madu
Dr. H. O. Egware
Engr. Mrs. M.O. Oisakede
Dr. Efe Orumwense
Miss T. Amanokhai
Mr. O. Omoyele
Mr. O. O. Omenu
Mr. O. Osaro

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Chairmanship:

Oral Presentation Faculty Board Room

Environmental Sustainability, Mathematics and Bioresources, Information Technology, Ecotoxicology

Chair- Prof. J.O. Osarenmwinda

Co-Chair - Dr. Ebuka Nwankwo

Co-Chair – Dr. Efe Orumwense

Oral Presentation LT-2

Energy and Power, Materials and Ind. Process

Chair- Prof. A.I Obanor

Co-Chair- Dr. S. A Aliu

Co-Chair -Dr. Godwin Sadjere

Oral Presentation Chemical Engineering Board Room

Chemical Process and Petroleum Engineering

Chair- Prof. Kessington Obahiagbon

Co-Chair. Dr. O.O. Ighodaro

Co-Chair Dr. David Onaiwo

Oral Presentation Met and Mat Building

Designs

Chair- Prof. P.O.B Ebunilo

Co- Chair – Dr. N. Enoma

Modelling and Simulations

Chair- Prof. Godfrey O. Ariavie

Co-Chair- P.O Olagbegi

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The Vice Chancellors Opening Address

It is with great pleasure as vice chancellor and chief host to declare open the 1st International Conference organized by the Nigerian Institution of Professional Engineers and Scientists and to welcome the participants from all over the world who are present both virtually and physically to exchange experience and work together on the exciting theme entitled 'Recent developments and emerging trends in science and engineering towards a systematic change in sustainable development and ecologically smart future'.

This conference seeks to promote engineering and science interaction on the current trends and research geared towards a systematic change and approach in achieving sustainable development and ecologically smart future within the shortest possible time. Various scientific communities and economic leadership have set goals to achieve global sustainability. However, the time to achieve this objective still remains uncertain. Thus, it is imperative to device methods to fast track this realization with a holistic approach.

In this conference we will be exchanging knowledge in the following thematic areas; Energy and Power, Environmental Sustainability, Bioresources, Chemical Process, Petroleum Engineering, Modelling, Designs, Simulations, Materials, Industrial Process, Information Technology, Ecotoxicology, Mathematics and Industrial physics.

Finally, I wish to extend my greetings to the invited key note speakers Prof. Jude Iroh, of University of Cincinnatti, USA, Dr. Uche Onochie of Alex-Ekweme Federal University and all specially invited guest. My warm regards also go to the chairman of the institution Dr. Collins Chike Kwasi-Effah, the executive council members, fellows, corporate members, associate members and the local organizing committee.

This time, calling for social scientific gathering is very important in the dissemination of knowledge towards achieving our goal.

I once again welcome you all to this great gathering of scholars and wish everyone a successful and enlightening conference.

Thank you.

Professor Mrs. Lilian I. Salami, FNSN, FIFHE

Vice Chancellor, University of Benin, Edo State, Nigeria

Chief Host

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Address by the Chairman, Nigerian Institution of Professional Engineers and Scientists

The Vice Chancellor University of Benin, Professor Mrs. Lilian I. Salami, Deputy Vice Chancellors, Registrar, Deans, Directors, HODs, Distinguished Guests of Honor, Distinguished Research Scholars Ladies and Gentlemen, on behalf of the Executive Council and Members of The Nigerian Institution of Professional Engineers and Scientists, I want to express my sincere pleasure at your presence this morning at the 1st International Conference, starting this day 7th of October, 2021 in the Faculty of Engineering, University of Benin, Edo State Nigeria. This conference has been organized as part to bridge the research communication gap and enhance the interaction of both scientists and engineers. This is in order to achieve a systematic change to towards finding solutions and breakthroughs of the present technological challenge faced in today's world. It will be a race against time if engineers and scientists recurrently interact and combine their knowledge base for a common course to achieve a technology break through. Thus, if every professional of concern sits on a round table like this to discuss and relate scientific issues the best form of solutions and ideology will systematically be achieved. Great scientists and Engineers between now and four centuries ago have immensely contributed to the current smart age we have today. In the past, Isaac Newton, the father of classical physics had more knowledge to be materialized but as human nature he was limited with time, Albert Einstein was also limited with time and the weariness of the human body to become weak. He once said 'Your Imagination is everything. It is the preview of life's coming attractions' Thus, the smart future we building together is as a consequence of our imaginations or ideas and physical interaction with the environment. On this note it is therefore important to have a once in a while round table scientific presentations and discussions like this in order to facilitate the re-invention of old ideas to achieve a systemic technology innovation and break throughs. Therefore, I would like all delegates who have come to observe or contribute their research results to sit with an open mind towards every other presenter to present their research findings and interact with each other in this international conference. It is my most sincere wish that the discussions and agreements resulting from this international conference will positively contribute to the consolidation of the aim of the conference and thereby to the philosophy underlying it.

Thank you.

Engr. Dr. Collins Chike Kwasi-Effah, *FNIPES, MNIMechE, R.Eng (COREN)*
Chairman, Nigerian Institution of Professional Engineers and Scientists
Host

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Brief Biography of Keynote Speakers

Professor Jude Iroh

After obtaining his Bachelor's degree in Applied Chemistry in 1980 from The University of Jos, Nigeria, he earned his Masters in Polymer Science and Engineering from The University of Manchester in England and completed his Ph.D. in Materials Science with Specialization in Polymers from the University of Connecticut at Storrs, CT. He is presently a Professor of Materials Engineering at the University of Cincinnati, Ohio and a Fellow of the Society for the Advancement of Materials and Process Engineering. He has published over 300 papers in peer reviewed journals, conference proceeding, book chapters and invited presentations. He was a recipient of the Office of Naval Research, ONR, Young Investigators Award and holds 4 US Patents, 1 World Intellectual Property patent.

Dr. Uche Paul Onochie

Engr. Dr. Uche P. Onochie obtained his first degree (B.Sc.) with Second Class (Hons) Upper Division in Mechanical Engineering from Lagos State University in 2006. His Masters (MEng) and PhD degrees, also in Mechanical Engineering, with Specialization in Thermal Power Engineering, were obtained from the great University of Benin in 2015 and 2018 respectively. He is a registered Engr. with the Council for the Regulation of Engineering in Nigeria, COREN, a Member of the Nigerian Society of Engineers (MNSE), Member and past Vice-Chairman of the Nigerian Institution of Mechanical Engineers (MNIMechE) Benin Branch, Member of the Nigeria Institution of Professional Engineers and Scientists (MNIPES) and also a Member of the Renewable and Alternative Energy Society of Nigeria (MRAESON). He is currently the Ag. Head, Department of Mechanical Engineering, Alex Ekwueme Federal University, Ndufu – Alike, Ebonyi State, Nigeria. He has published over 50 papers in peer reviewed journals, conferences and presentations. Some of his papers are indexed in Thompson Reuters, Scimago and Scopus Journals. He is happily married with kids.

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Additive Manufacturing of Polyimide Nanocomposites

By Prof. Jude Iroh, PhD, F.SAMPE, University of Cincinnati, Ohio, USA

International Keynote speaker

Abstract

Polyimide (PI) is an engineering polymer with excellent high temperature stability, and outstanding mechanical properties. The stiff and rigid backbone of PI makes it difficult to process by the convention melt casting method. This presentation addresses solutions to melt processibility by nanomaterials and polymer chemistry. The proposed solutions to improve melt processibility and 3Dprinting are: 1) to improve imidization via, (1) copolymerization and (2) use of 2D nanomaterials such as carbon nanotube (CNT) and nanographene sheets, NGS as nanoscale heaters.

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Recent Development and Emerging Trends in Science & Engineering Towards a Systematic Change in Sustainable Development and Ecologically Smart Future

Engr. Dr. Uche Paul Onochie

B.Sc. (LASU), M.Eng (UNIBEN), PhD (UNIBEN), R.COREN, MNSE, MNIMechE, MNIPES, MRAESON

National Keynote speaker

Protocol

The Vice Chancellor and Host, University of Benin; Chairman and Members, Nigerian Institution of Professional Engineers and Scientists (NIPES); Dean of Faculties; Heads of Departments; Distinguished Professors here present; other professionals here present; Fellow Engineers and Scientists, our Honourable Guests, Distinguished Ladies and Gentlemen, Good morning.

Intro

Let me start by expressing my exceptional deep gratitude to the organizers of the first international conference of the Nigerian Institution of Professional Engineers and Scientists (NIPES). It is a great pleasure to be invited as the National Keynote Speaker for this conference. I consider it a rare and unique opportunity for me to do so.

I am going to base my presentation on the synthesis of leading forecasts of some identified core science and engineering trends that will influence the world over the next 30 years as reported in ODASA (2016).

Some of the core science and engineering trends are:

1. ***Robotics and Autonomous Systems***

Robotics and autonomous systems are recently gaining more and more popularity globally. By the year 2045, robots and autonomous systems are likely to be seen and use in commonplaces. Autonomous vehicles will make transportation more efficient and safer, while possibly enhancing the rise of the sharing economy. Robots will harvest crops in the farms, maintain public infrastructure, care for the elderly, and provide many other services that touches everyday life.

However, given the rise of autonomous systems, this could lead to the displacement of hundreds of millions of labour and service workers, thereby creating economic instability and the risk of social unrest. Again, networked autonomous systems will also become an attractive target for adversaries and a new priority for cyber-defense.

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As robotic systems expand and gain mobility and intelligence, its use in military operations will increase as it becomes effective partners on battle fields. At the same time, adversaries will use robots and autonomous systems in ways that challenges people, both tactically and ethically.

2. Analytics

The world generated 4.4 trillion gigabytes of data in 2015. It is expected that this figure will roughly double every two years. This flood of data holds deep insights into climate change, consumer behaviour, public health and a range of other social, economic and political challenges. However, while "Big Data" has become a buzzword, less than 10% of data generated each year ever gets analyzed. In 30 years, our ability to make better use of massive and dynamic data sets will improve. As people gain the ability to apply big data to their personal lives, analytics will spread beyond the enterprise. People will have the ability to use data to hold major institutions and agents of governments accountable, leading to tensions over data access. The rise of hyper-personalized marketing, government surveillance of citizens' data trails, and high profile cases of data loss could fuel growing concerns over data ownership. Potential adversaries will use data that is stolen, purchased off dark networks, or accessed freely from open sources to compromise security.

3. Human Augmentation

Again, in the next 30 years, technology will expand and allow us to transcend biological limits on human potential. Exoskeletons and brain-interfaced prosthetics will make us stronger and restore mobility to the elderly and infirm. Wearable devices connected through the Internet of Things will deliver context-sensitive information overlaid directly onto our senses. Sensors and computers embedded in contact lenses and permanent implants will let us hear whispers behind walls, give us natural night vision, and allow us to immerse ourselves in virtual and augmented realities. Of course, this augmentation technology will come at a very huge cost, and those who cannot afford to upgrade their "human chassis" might find themselves unable to compete in the augmented economy. Networked augmentations will also be an appealing target for hackers looking to control over our very minds and bodies. The military will benefit from augmenting its soldiers. However, the force will face adversaries who are similarly enhanced, and an augmentation arms race could evolve.

4. Mobile & Cloud Computing

Mobile and cloud computing are transforming the way people interact with data. In Nigeria, an estimated 30 percent of Web browsing and 40 percent of social media use are currently done on mobile devices.

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By 2030, 75% of the world's population will have mobile connectivity and 60% would have broadband access. In recent times, mobile devices are becoming more feature-rich and powerful, with a growing variety of embedded sensors that can measure ambient light and sound, weather, biometrics and location. Working in tandem with mobile data access, cloud computing provides access to almost unlimited computational power that scales seamlessly without requiring massive investments in IT infrastructure. Over the next 30 years, cloud-based mobile computing has the potential to transform everything from health care to education. Cell phones will monitor vital signs and communicate directly with diagnostic applications, people will use online educational portals from mobile devices to learn new skills, and apps will allow farmers in developing nations to connect to real-time weather data and tools for optimizing their harvests. At the same time, mobile and cloud computing will put significant pressure on network security, reliability, and bandwidth, and both consumers and enterprises will have to grow more comfortable with relinquishing their data to the cloud.

5. Medical Advances

In the next 30 years, medicine will be advance by multiple technological breakthroughs. Artificial organs will be grown for transplantation from DNA samples, eliminating down times for life-saving transplants and the risk of organ rejection. Genomics will give rise to personalized medicine, with treatments for cancer, cardiovascular disease, Alzheimer's, and other diseases tailored to individual genetics. Prosthetics will be wired directly into the nervous system and will incorporate biologically based sensors that provide a near-normal sense of touch. As scientists unlock the keys to aging, people will live longer and stay healthy and active well into what today we consider "old age". At the same time, the cost of advanced medical care will stress many national health care systems and trigger rising inequality in access to life-saving treatments. The coming of medical revolution will also enable people to remain healthy and productive for more decades, amplifying competition for jobs between older and younger workers and creating additional strain on social safety nets.

6. Cyber

Cyber-defense is hardly a new trend. However, over the next 30 years, there will be rise in the internet of things and growing interdependence among connected aspects of everyday life will bring cyber-security to the forefront. While the number and scope of cyber-attacks is increasing, most will be targeted against individuals and institutions. As home appliances, streetlights, automobiles, power plants, and millions of other objects become networked, the potential for a truly devastating cyber-attack will grow.

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Individuals, institutions and nations will be challenged to secure their data from ever more insidious attacks, many of which may go undetected for many years.

7. Energy

The global demand for energy in the next 30 years is estimated to grow by 35%. The development of methods like fracking and directional drilling has opened vast new reserves of oil and natural gas. These technologies have up-ended global oil markets. At the same time, renewable energy sources such as solar, biomass and wind energy are approaching cost-parity with fossil fuels. In the past two decades, the cost of power produced by solar cells has dropped from nearly $8 per watt of capacity to less than one-tenth of that amount. Nuclear, while still the subject of intense public debate, is continuing to grow, with new reactor designed promising greater safety and less radioactive waste. While adoption of cleaner energy sources (i.e. renewable energy) would help combat global climate change, new frictions will emerge over access to rare materials used in batteries, solar cells, and other linchpins of the energy revolution. The fading of fossil fuels also carries significant risk of economic and social destabilization across the Middle East and Africa, presenting new security challenges for the nations and their allies.

8. Smart Cities

By 2045, approximately 6.4 billion people, about 65-70% of the world's population will live in cities. As urban population increases, the number of megacities with 10 million inhabitants or more will grow. Mass migration to cities will put significant pressure on urban food and water supplies, power and energy infrastructure, transportation systems, sanitation, and public safety. Information and communications (ICT) technology will support the growth of "smart cities" that use data and automation to make urban centers more efficient and sustainable. Distributed sensor systems will monitor water and power usage and automatically balance distribution via smart grids. Networked traffic systems and autonomous transportation options will ease gridlock. New materials and design techniques will be used to build smart buildings that maximize the efficiency of heating, cooling, and lighting. Rooftop solar panels, micro-wind turbines, thermal power, and other renewable energy sources will provide clean, distributed power generation. At the same time, cities that cannot afford to invest in these technologies (or that lack the political will to do so) could turn into congested, dirty, and dangerous flashpoints for instability and conflict.

9. Internet of Things

Based to projected estimates, there will be over 100 billion devices connected to the Internet by 2045.

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This will include mobile and wearable devices, appliances, medical devices, industrial sensors, security cameras, cars, clothing, and other technologies. All of these devices will produce and share vast amounts of information that will revolutionize how we work and live. People will use information generated through the Internet of Things (IoT) to make smarter decisions and gain deeper insight into their own lives and the world around them. At the same time, web-connected devices will also automate many monitoring, management, and repair tasks that currently require human labor. The intersection of the IoT, analytics, and artificial intelligence will create a global network of smart machines that conduct an enormous amount of critical business with no human intervention. While the IoT will improve many aspects of economic efficiency, public safety, and personal productivity, it will also exacerbate concerns over cybersecurity and privacy. Criminal organizations, terrorists, and adversarial nation states will use the IoT as a new vector for attacking countries and their allies. The immense amount of data generated through web-connected devices will also enable governments to conduct mass surveillance on populations, leading to ongoing tensions between digital freedom and security.

10. Food and Water Technology

Inadequate access to food and fresh water will become a crisis point in many parts of the world over the next 30 years. Roughly 25% of current farmland is already degraded from over-farming, drought, and air/water pollution. Under optimistic forecasts, prices for grains could rise by 30% over the coming decades. By 2045, 3.9 billion people, which is over 40% of the world's population could face water stress. Technology offers many potential solutions to food and water crises. Desalination, micro-irrigation, water reclamation, rainwater harvesting, and other technologies could relieve pressure on fresh water supplies. Genetically modified crops and automation could improve crop yields and allow farmers to produce more nutrition from less land. Food and water, long taken for granted in the developed world, will become a major focus for innovation, and could become a major flashpoint for conflict.

11. Social Empowerment

Approximately 65% of the world population adults now use social media. Social media has undoubtedly changed the way people connect online, but over the next 30 years, social technologies will become an engine for empowering individuals, especially the youths, to shape their own micro-cultures. Many traditional power structures will be overturned as people form Internet-based communities defined by technologically mediated social contracts. Governments will find it increasingly very difficult to control the political narrative as people continue to share eyewitness accounts of corruption and oppression directly, without the filter of mass media.

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While institutions will learn new techniques for engaging with consumers through social channels, those same consumers will use social platforms to cut through advertising noise and hold businesses accountable for their products and actions. Crowd sourcing and content streaming will further democratize content creation and blur the lines between media creators and consumers. Bitcoin and other cryptocurrencies could lead to definitions of currency and trade based on social consensus rather than government control.

12. Advanced Digital

Computers and other digital devices have transformed life so completely over the past six decades that it is almost impossible to remember that these technologies are relatively new. The first personal computers weren't sold until 1975, and were only available as kits that customers had to assemble and program on their own. However, four decade later, 68% of American population own smart phones that have more processing power than NASA did when it sent astronauts the moon in 1969. The next 30 years will likely continue the trajectory toward more computing power and wider availability of digital resources. Mobile and cloud computing will provide almost unlimited memory and processing speed. Virtualization and software-defined systems will allow governments and business to rapidly adapt IT infrastructure without costly and wasteful hardware upgrades. Digital will become integrated into an even wider array of everyday objects, from clothing to building materials. At the same time, technologies are emerging that will transform how we interact with our devices. Voice interfaces are already commonplace in smart phones, and will continue to improve. Gestural interfaces will allow us to communicate with computers through nonverbal behaviour.

Ultimately, brain-computer interfaces will allow us to control devices through thought, making digital systems as natural an extension of our bodies as our own limbs. All of these developments will open new opportunities and new challenges. The proliferation of advanced computing capabilities will increase the risk of crippling cyber-attacks.

13. Technology for Climate Change

Current data points to a rise in global surface temperatures of 2.5 to 5.4 degrees Fahrenheit by 2050. Even if dramatic steps were taken today to reduce greenhouse gas emissions, climate inertia guarantees that some warming will be inevitable. As a result, sea levels are definitely to rise, threatening coastal cities; crop yields could decline, leading to famine in parts of the developing world; drought could threaten millions of people with a lack of fresh water, and flooding could cause billions of dollars in damage to homes, businesses, and public infrastructure.

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Over the next 30 years, these risks will drive investment in technological solutions for mitigating the potential effects of climate change. In the near-term, climate change technologies will include systems for mapping flood hazards and genetically-modified crops engineered for drought resistance. Over the longer term, more ambitious technologies may emerge, such as carbon sequestration methods that can pull greenhouse gases like carbon dioxide and methane out of the atmosphere and store them safely underground. If climate change appears to be following worse case scenarios of 4-5 degrees of warming or more, there could be truly destabilizing effects on the Earth's climate that are impossible to mitigate. Under those conditions, serious efforts at geoengineering might become the only solution to avoiding catastrophic climate change. For example, scientists have estimated that seeding the atmosphere with sulphur or aluminum oxide particles to reduce the amount of solar radiation hitting the Earth. These interventions are still highly theoretical and could be extremely risky.

14. Advanced Materials

Materials science has led to impressive advances over the past ten years, such as smart materials that are self-healing and self-cleaning; memory metals that can return to their original shapes; piezoelectric ceramics that can be used to harvest energy from pressure; and nanomaterials that have remarkable structural and electrical properties. Nanomaterials in particular have tremendous potential across a wide range of applications. At nanoscale (less than 100 nanometers), ordinary materials such as carbon take on unique properties. For example, graphene, a lattice formed from individual carbon atoms, is 100 times stronger than steel, conducts heat and electricity efficiently, and is nearly transparent. Nanomaterials have applications in super-slick coatings for engines and other machines, stronger composites for aircraft and cars, lightweight body armor, and high efficiency photovoltaics. Beyond industrial applications, pharmaceutical companies are developing therapeutic nanoparticles that could one day deliver targeted drug treatments for cancer that greatly reduce side effects while enhancing treatment outcomes. Over the next 30 years, nanomaterials and other novel materials such as metallic foams and ceramic composites will be found in clothing, building materials, vehicles, roads and bridges, and countless other objects.

15. Novel Weaponry

Over the next 30 years, a number of novel weapon technologies could proliferate across future battlefields. In addition to technologies that are currently under development, such as nonlethal weapons and directed energy systems, a number of nations are investing in anti-access area denial (A2AD) technologies that could significantly impact on the ability of their military to be able to manoeuvre freely through operating environments.

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Emerging A2AD technologies include anti-ship ballistic missiles; precision guided antivehicle and anti-personnel munitions; counter rocket, artillery, and mortar (CRAM) systems, anti-satellite weapons; and electromagnetic pulse (EMP) systems. Some of these technologies, such as precision-guided munitions, will reflect innovation based on existing technologies. For example, China is developing advanced anti-ship ballistic missiles that have the potential to destroy aircraft carriers. As China, Russia, and other nations make larger investments in military modernization, countries like the U.S. is likely to face adversaries with capabilities that approach, and in certain cases possibly exceed their own.

Conclusion

The recent and emerging developments in science and technology in the past few decades as analysed, based on the synthesis of leading forecasts, show that the whole world is moving towards a systematic change. This change will create a sustainable development that will enable an ecological smart future for both developed and developing countries. Individuals, corporations and government institutions across the world will need mental, physical and intellectual capabilities to be able cope with the trend of this development. Essentially, countries that are prepared with this development will find it easier to move with this smart trend and be able to create for themselves suitable plans and ways of utilisation the opportunities and gains of the trend as well as mitigating the disadvantages associated with it for its citizens.

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BR-001

Quantitative Analysis of Phytochemical Constituents and Invitro Antioxidant Potentials of Poly-Herbal Formulation

Oshomoh, E. O., Uwaya, D. O. and Uzama-Avenbuan, O.

Department of Science Laboratory Technology, Faculty of Life Sciences, University of Benin. Edo State. Nigeria.
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ABSTRACT

Plants of medicinal value have contributed to the health of many individuals and to the world in general. Vernonia amygdalina, Greenwayodendron suaveolens, Euphorbia heterophylla and Xylopia aethiopica are all known to have medicinal values varying in their effect. The quantitative analysis of phytochemical constituents and some invitro antioxidant properties of Greenwayodendron suaveolens, Vernonia amygdalina, euphorbia heterophylla and Xylopia aethiopica leaves were determined. Phenols, flavonoids, tannins, saponins and tannins were the phytochemicals detected from the plants. The determination of the macro and micro elements such as iron, manganese, potassium, calcium, magnesium, copper, lead, cadmium, chromium, and nickel was made directly on each final solution using flame photometer and a Bulk Scientific 210 VGP, atomic absorption spectroscopy (AAS). The 1, 1-Diphenyl-2-picrylhydrazyl (DPPH), 2, 2-azino di-(3-ethylbenzothiazoline- 6-sulfonic acid) (ABTS), hydroxyl free radical (OH-) and ferric reducing antioxidant power (FRAP) were analyzed using one way analysis of variance (ANOVA), P<0.05 was obtained. In DPPH, ABTS, FRAP and OH- scavenging activities, Vernonia amygdalina, Greenwayodendron suaveolens and Euphorbia heterophylla was found to have scavenging activities which increased as their concentrations increase. The medicinal potential of these plants could be as a result of their phytochemicals, micro and macro elements and their free radical scavenging abilities. More research needs to be carried out to further prove their anti-oxidative potentials.

Keywords: *Invitro, antioxidant, poly-herbal, phytochemical, mineral elements*

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BR-002

Evaluation of the Effects of Rubber Effluent on the Growth, Yield of Glycine max (soybean) and Soil Nutrient

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ABSTRACT

Effluent is a complex organic material, with both advantages and inconveniences for its use. Industrial effluents contain a large number of both known and unknown substances formed during the production process. Rubber effluent is a liquid leftover which arises during latex processing. The practice of indiscriminate discharge of large volumes of rubber effluent onto soil and water sources as a means of disposal is wasteful in terms of resource utilization and contradicts the present day agricultural technical development. The controlled applications of rubber effluent on land have been reported to cause changes in soil properties. The trial was carried out in an experimental plot situated in the Department of Plant Biology and Biotechnology, faculty of life sciences, University of Benin, Benin city, Nigeria. The experiment was arranged in a randomized complete block design (RCBD) and each treatment were replicated three times. The treatment (rubber effluent) was applied at the rate of 0, 50, 100, 150, 200 and 250 ml/kg of soil. Results of the rubber effluent analysis revealed that it is rich in some plant nutrients and the effluent also had positive effect on some soil chemical properties as well as the growth of soybean. The number of leaves, stem girth and plant height were statistically significant at P < 0.05. The soil enriched (mixed) with various concentration of rubber effluent was better than the control. The increase in plant height, number of leaves and stem girth is attributed to the presence of high soil nutrient content provided by the rubber effluent applied. The electrical conductivity, zinc, phosphorus, iron and calcium of the soil were significantly higher (P < 0.05) in the rubber effluent treated soils than the control. Conclusively, rubber effluents contain vital plant nutrients which may be favorable to soil fertility improvement and soybean growth at the application rates.

Keywords: Rubber effluent, resource utilization, soybean, growth, yield

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BR-003

Effect of Bacterial Bio-Calcination on the Strength and Durability of Cement Mortar

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ABSTRACT

This work investigated the effect of growth media on the strength development and microstructure of cement mortar. The bacterium called Bacillus Coagulans was incorporated at different cell concentrations of $1.5x10^8$, $6.0x10^8$ and $1.2x10^9$ suspension density with varying percentage replacement of Nutrient Broth Medium (NBM) at 30%, 40% and 50% and mixing water to the dry mix of cement and sand (fine aggregate). Mix ratio of 1:3 was used with water cement (w/c) ratio of 0.5. To establish the objective of gain in strength, mortar cubes were tested at 3, 7, 14 and 28 curing duration and the results compared with controlled cement mortar. Compressive strength obtained for control cement mortar was $24.08N/mm^2$ and optimal bio-cement mortar was $28.02N/mm^2$ at 28days curing age was achieved with the addition of $1.5x10^8$B. Coagulans suspension density with 50% NBM. The strength improvement is due to the growth of calcite crystals within the pores of the cement sand matrix as indicated from the microstructure obtained from Scanning Electron Microscopy (SEM) examination. It also indicates 3.46% improvement of water absorption at 28days for $1.5x10^8$ B. Coagulans suspension density with 50% NBM as against 5.98% water absorption at 28days curing age for control.

Keywords: *Bacillus Coagulans*, Bio-cement mortar, Compressive strength, Nutrient Broth growth Medium (NBM), Scanning Electron Microscopy (SEM).

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BR-004

Influence of Heat Treatment and Biological Coagulant Types on The Microbiological Properties of Nigerian Soft Soy Cheese

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ABSTRACT

The study examines the microbiological properties of cheese from soy milk as influenced by heat treatment durations and biological coagulant types. The soy milk was pasteurized at 65°C and subjected to further heat treatment for 15, 20, and 25 minutes with the addition of coagulants (lime juice, tamarind pulp and moringa seed paste) to respective samples and allowed to cool for 30 minutes before pressing out the whey. The initial properties of raw soy milk were determined to serve as control and the nine produced soy cheese samples were determined using a 3x3 factorial treatment design. The microbiological properties of the cheese were determined using standard methods. Results obtained were analyzed statistically to determine the influence of heat treatment duration and coagulant sample. The microbial analysis revealed that there was Coliform in soy cheese samples which were all less than 1.0 x 10^2 cfu/g except in F_{15}, F_{20}, and E_{25} which had 4.2×10^2, 4.3×10^2, and 2.1×10^2 cfu/g which are within the permissible limit of consumption. There were no Coliform bacteria in all samples except E_{15}, F_{20}, and F_{25} which had $1.6x10^3$, $1.4 x10^3$, and $4.0 x10^2$ cfu/g, respectively which are also within the permissible limit of consumption. There was no yeast and mould growth on all the samples except E_{25} which is $<1.0x10^2$ cfu/g. This study is initiated to determine the effect of heat treatment and local coagulants on the microbial properties of Nigerian soft soy cheese. Hence, investigating the hygienic quality and safety of consuming the food product.
Keywords: Soy-cheese, lime, tamarind, moringa, microbial.

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CP-001

A Review of Studies on Castor Seed (Ricinus Communis L.) Shrub and Potential Utilization of its Oil

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ABSTRACT

Castor bean plant (Ricinus Communis L.) is one of the oldest cultivated crops, but at present the oil produced from the seed represents only 0.15% of the vegetable oil produced in the world. Castor seed is an industrial oilseed crop belonging to the Euphorbiaceae family, widespread in the tropical region as a spontaneous plant, having its main cultivated area in India, China, and Brazil. As a crop, the main advantage of castor is its tolerance to drought stress and adaptation to several growing conditions. As an industrial product, castor oil composition is different in many respects from any other oil because it consists largely (up to 90%) of the unusual ricinoleic fatty acid. This review was conducted to provide a collation of the most relevant historic research information published by global community of researchers and define the remarkable future potential of castor seed oil. This article was also prepared to give a general overview of the industrial and domestic importance of castor seed oil to the world at large. The topics discussed in this review include: (i) Applications of castor seed oil in various field of study; (ii) phytochemical studies on Castor bean; (iii) Pharmacological studies on Castor bean; (iv) Evaluation of previous research; (v) Nature of existing research; (vi) Merit of previous studies; (vii) Potential and challenges of castor seed oil production. It is the believe of the author that this review will serve as a baseline for researchers who intend to venture into castor seed oil production.

Keywords: *Ricinus communis, Phytochemical, Pharmacological, Industrial application.*

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CP-002

Performance Evaluation of Biogas Production from the Blend of Sea Weeds and Biodegradable Household Waste

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ABSTRACT

Nigeria is face with serious energy problem and this has to do with our increasing population culminating in high energy demand and a limited fasted depleting energy resource which has resulted in severe energy crisis. The major need for industrial and commercial sectors of any country is availability of energy, and access to affordable energy for lighting and heating is vital for human development. Energy is needed for economic growth, national development and improved standard of living. Access to energy for heating and lighting in Nigeria is low; about 40% on the average and as low as 18% in the rural areas. In this research, biodegradable household solid and water hyacinth were co-digested to generate energy through biogas production. A 0.03 m^3 anaerobic digester was fabricated and used to digest the composition of cow dung, water hyacinth and food waste. The ratio of mixture of cow dung to both food waste and water hyacinth was 1:2. The mixture was properly ground, mixed and charged into the mild steel digester under mesophilic temperature and a pH range around neutral position. The analysis of biogas yields showed that an average of 0.00707m^3 of biogas was generated.

Keywords: *Biogas, pH, Biodegradable Solid Waste, Anaerobic Digester, Pressure Readings*

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CP-003

Strategies in Petrochemical Processes Part-I: Case of Peruvian Oil

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ABSTRACT

The great importance of oil in today's world economy is based on their contribution the total energy supply. In 2020, the world consumed 91.3 million barrels of oil per day. Depending on the quality of the crude (chemical and physical properties), the different types of oil are commercialized around the world. For two decades ago, approximately, there are tendencies up to lower or free Sulphur fuels (content under 50 ppm) for vehicles in order to reduce the emissions generated. The sulfur content of crudes is important for the determination of commercial values. Peru exports most of their crude, due to this is too heavy in Sulphur content (2000-5000 ppm) for their refineries. Peru has undergone changes in the last three decades that increased the pressure about environmental issues. The transport is considered one of the main causes of air pollution in several Peruvian cities. For this reason, it is imperative the development strategies in order to reduce the emissions of Sulphur compounds and/or improve the existent chemical processes of petrochemical industry. We present an alternative process design, corresponding to the Sulphur desorption unit for Peruvian crude oil, in order to minimize their content, previous to the distillation units.

Keywords: Petrochemical Processes, crude oil, alternative process design

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EP-001

Public-Private Partnership (PPP), A Veritable Tool for A Sustainable Energy Mix in Subnational and Municipal Public Infrastructure Projects

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ABSTRACT

The aim of this study is to comprehensively investigate the public-private partnership (PPP) model that can be used to fund subnational and municipal public infrastructure projects as well as using it as a veritable tool for a sustainable energy mix in the contemporary socio-political era. Concurrent Triangulation Design (CTD) was used to gather data, analyze and merge final results. The model had phase 1 and 2 comprising of the quantitative and qualitative phases respectively. The four PPP models: Design, Build Finance Operator and Transfer (DBFOT), Operate Maintain and Transfer (OMT), Build Lease Operate and Transfer (BLOT) and Build Operate and Transfer (BOT) selected were analyzed using regression coefficient. a Standard deviation of 0.19508 showing that the Standard Deviation is less than 1, CV < 1. The low variance recorded showed that DBFOT recorded the highest response showing that DBFOT model as the chosen in the model can be used as a veritable tool for a sustainable energy mix in municipal Public private infrastructure project. DBFOT recorded 83.92% of respondents, BLOT had 8.93%, OMT had 5.36% and BOT had 1.79%, of respondents. The established funding model DBFOT in this study will be adequate in constructions of industrial waste facility, operate, maintain and provide a sound financial mechanism for industrial waste project.

Keywords:

Sustainable energy mix, PPP: Public-private partnership, DBFOT: Design Build Finance Operate and Transfer, BLOT: Build Lease Operate Transfer, OMT: Operate Maintain Transfer, BOT: Build Operate Transfer and Concurrent triangulation design (CTD)

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EP-002

Empirical Modelling for Estimation of Solar Radiation from Tilted Surfaces Relative to Angular Solar Relations

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ABSTRACT

Interest in solar energy has prompted the accurate measurement and mapping of solar energy resources of the globe. Solar radiation data are available in several forms. Most radiation data available for horizontal surfaces include both direct and diffuse radiation. This is normally done by using solar-meters. Most solar-meters measurements are recorded simply as total energy (global radiation) incident on the horizontal surface; other measurements separate the direct (beam) and the scattered (diffuse) radiation. Radiation data are the best source of information for estimating average incident radiation and for the proper designing of a solar water heating system. A precise analysis and design of a solar water heating system requires knowledge of the solar energy obtained from the sun and the availability of global solar radiation and its components at the location of project site. Since the solar radiation reaching the earth's surface depends upon climatic conditions of the place, a study of solar radiation under local climatic conditions is essential. Due to absence or malfunction of measuring instruments, reliable solar radiation data is difficult to obtain. In the absence and scarcity of trustworthy solar radiation data, the use of an empirical model to predict and estimate solar radiation seems inevitable. The highest value of solar radiation were obtained in April and the average horizontal radiation on a surface and radiation on a tilted surface was obtained to be $966.12W/m^2$ and $1055.99W/m^2$ respectively.

Keywords: Solar radiation, Solar energy, Tilted surfaces, horizontal surface, Solar collector.

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EP- 003

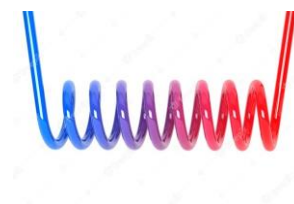# Computation of Heat Transfer in a Flat Plate Solar Collector System Using Energy Balance Method

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ABSTRACT

Input parameters measured from a prototype designed flat plate solar collector system in Benin Metropolis was employed in this study. A model was developed using energy balance method, the developed model was then computed using Explicit Finite Difference Method in MATLAB to predict the thermal behavior of the system. The principles and laws of thermodynamics were considered in the modelling process. From the model developed, 330K, 370K and 320K were obtained as outlet water temperature, absorber plate temperature and glass temperature. An optimal insulation thickness of 0.05m, 0.06m and 0.07m were achieved, 0.020m, 0.024m and 0.026m were obtained as optimal design condition for thickness of housing and this is with respect to the input parameters considered.

Keywords: Solar energy, Heat transfer, Flat plate, Solar collector, Glass cover, Absorber plate

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EP-004

Policy and Standards for Energy Efficiency in Nigeria - A Systematic Review

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ABSTRACT

Energy issues is a global concern in this era of Industry 4.0. This systematic review presents policy and standards for energy efficiency in Nigeria. This issue has become very significant especially as government, researchers, strategists and professionals continue to combat climate change. The issue of climate change in Nigeria is on the increase as a result of inefficient use of energy especially in the oil and gas sector. This has led to increase in environmental pollution, amount of greenhouse gases, and general health issues. This must be significantly reduced to embrace green environment and sustainable energy process. Nigeria is still struggling with the energy sector because there are energy obstacles to be eradicated. These barriers to energy efficiency include hoary technology, inefficient electrical facilities, thermal utilities, power infrastructure, and others. To achieve sustainable standard for energy efficiency, energy analysis and auditing, energy modelling, and energy monitoring are usually implemented. This can be deterministically analysed and presented in four major areas which include: standards for energy efficiency management, climate change and energy efficiency, possible barriers to energy efficiency, and policies for energy efficiency. In this study, further elaboration of the enlisted areas are detailed focusing on the standard put in place for sustainable energy efficiency, and possibility of boosting and implementing energy efficiency.

Keywords: *Policies, Standards for Energy Efficiency, Energy Sustainability*

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EP-005

Promoting Investment in Renewable Energy in Nigeria, A Systematic Approach

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ABSTRACT

Investment in renewable energy is becoming worthwhile especially in African Countries where there are abundant of wastes required for the alternative energy source. Renewable energy resources are promising in Nigeria for the development of remote regions of the country. Over 85 per cent of the contemporary primary energy consumption in Nigeria is met by the petroleum industry. Overdependence on fossil fuel has called for a serious concern in the country. Interestingly, the commercial use of renewable energy in Nigeria has not developed in proportion to its large resource base. Therefore, the utilization of renewable energy requires effective plan in order to make it commercially attractive. To establish a successful long-term strategy for investment in renewable energy, it has become necessary to investigate the possible approaches to support such policy which would be useful to individuals and government. This is possible by investigating the effective analysis of current policies, considering the potential of the energy supply and demand. In this study, systematic approach for estimation of renewable energy for sustainable national energy needs has been estimated. An effective planning model for anticipation of possible investment policy for renewable energy platforms is recommended. Also, the noteworthy renewable resources such as biomass, agricultural wastes and manure and others have been discussed. Some practical approaches to accommodate the policies of investment in the renewable energy by stakeholders are equally investigated. There is no doubt that promoting investment in renewable energy in Nigeria will go a long way to provide job for young people and equally boost the economy of Nigeria.

Keywords: Systematic Approach, Renewable Energy, Biogas, Wind and Solar Energy.

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EP-006

Hybrid Alternative Energy System Potentials in Remote Areas of Delta State, Nigeria

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ABSTRACT

The traditional, classical or conventional energy system such as the use of hydropower plant has been used extensively to support electricity in some parts of the state. This in no doubt is not adequately sufficient to meet the increasing demand for electricity in Delta State, Nigeria. Consequently, this study is focused on the investigation of a hybrid alternative by taking into consideration the accessible renewable resources (majorly biomass, solar and wind) these resources are readily available in remote area of the state. To achieve this, a techno-economic analysis is conducted. The results demonstrate showed that the hybrid system produces a robust output power with adequate raw materials available. Moreover, considering the hybrid system, the efficiencies of the solar PV, wind and biomass are 32%, 41.6% and 42% respectively. The estimated total capital cost of the whole system is satisfactory and greatly economical. Conclusively, the results obtained showed that Delta State, Nigeria has adequate resources in terms of required renewable energy to produce power that can be used to supplement the conventional systems. The findings also reveal that encouraging the hybrid alternative energy system will be useful for off-grid power in Delta State of Nigeria. This will help create job for young people, reduce the rate of crime and also improve education system in the country.

Keywords: Hybrid Alternative Energy; Techno Economic Analysis; Renewable Energy

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EP-007

Investigation of Microbial Fuel Cell Power Potential from Abattoirs in Effurun, Delta State, Nigeria

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ABSTRACT

In order to reduce the effect of the extensive consumption of fossil fuels energy on our planet, renewable energies exploitation and research need to be revived. Microbial fuel cells are indeed a renewable energy technology and a potential alternative that have a double function: to produce electricity while intensifying wastewater treatment processes by accelerating the degradation of organic matter. This research work therefore focuses on the investigation of microbial fuel cell power potential from abattoir in Effurun. Microbial Fuel Cell was built and assessed in terms of their performance. Different concentration of diluted abattoir wastewater was used as substrates. Important parameters including the maximum power density, average power and voltage were calculated and measured in order to compare the MFCs where different substrates concentration is used. The results were promising, as we could obtain a significant power of 92.16 mW, power density of 1.233 mW/mm^2, current of 168.1 mA, and voltage of 14.4 v. The results confirm the principle that controls electric generators, when put in series, the voltage adds up and the current increases.

Keywords: *Abattoir, Power, Voltage, Electrode, Effurun, Microbial Fuel Cell*

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ES-001

Seasonal Dynamics and Bedload Sediments: Towards the Sustainability of Eco-Geomorphologic Units in the Humid Tropical Rivers

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ABSTRACT

One of the most focal variables that induced geo-physical hazards (erosion and flood) across geographic space in the humid Tropics is the dynamics in climatic seasons. Changes in seasonal rainfall characteristics usually exert direct and indirect influence on the quantities and qualities of bedload sediments generated and disperse from one eco-geomorphologic unit to another within a given hydrological year. The application of multivariate analysis of variance (MANOVA) as a mathematical model often provide valid framework for testing and clarifying complex associations and variances among the sets of dependent and independent variables for sound ecosystem and engineering policy/ decision making that can enhance the protection of fragile and endangered hydrological and geomorphological units in the future. This study used the direct field survey and laboratory techniques. Using stratified and systematic sampling methods, eight eco-geomorphological sub-units comprising one first-order stream, six fourth order tributaries, and the estuary were selected. A total of 32 bedload samples were systematically collected during the four climatic seasons, digest properly to ensure standard compliances and analyzed in the laboratory. The MANOVA tests of variations, overlapping variances, and homogeneities among the groups of parameters give Pillai's Trace (2.027), Wilks' Lambda (24.745), Hotelling's Trace (6139.576), and Roy's Largest Root (40035.113) each significant at 0.00 confidence level. The results implied that variations in eco-geomorphologic units and climatic seasons have significant effect on the dispersal of bedload sediments within the study area. The study recommends for a sustain and deliberate promotions of community-driven afforestation programmes with strong supports from the governments and donor agencies to facilitate ecosystem services and mitigate the impacts of climate and River induced geomorphic (erosion and urban flood) hazards in the area. Also, periodic dredging of some silted small rivers and construction of drainages/roads will regulate surface runoff/ discharge from the cities/ towns to Rivers.

Keywords: *MANOVA Models, Climatic Seasons, Eco-Geomorphologic Units, Bedload Sediments, Humid Tropic, River Ecosystem.*

ES-002

Location, Distance and Utilization of Primary Health Care Centers: Implications on the Sustainable Development in Isiala-Mbano, Imo, Nigeria

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ABSTRACT

Primary Health Care is the first point of contact for most Nigerians with respect to health care system, but the level of clients utilization are mostly plagued with distinct problems across geographic locations, thereby impeding sustainable development of rural communities. The aim of this study is to evaluate the intriguing relationships existing among location, distance and the utilization of government owned primary health care facilities (PHCF) by residents in Isiala-Mbano area of Imo State. A stratified random sampling method was used to select a sample population of 475. Questionnaire and interviews were used to elicit information from the respondents, while geospatial tools were used for mapping the spatial distributions of three Health Posts and fourteen Health Centers. Analyses of data using descriptive statistics, geographic information system, nearest neighbour analysis, Pearson product moment correlation co-efficient and student's t-test revealed that: (i) PHCF's are randomly distributed within the study area as indicated by the Nearest Neighbour Index of R = 1.164. (ii) Estimated Euclidean distances from users' houses to nearest PHCFs showed that 66.5 percent of users live within 1 km and 33.5 percent live between 1 km to 2.3 km from nearest PHCFs. (iii) Average Nearest Neighbour Distance gave 1.3708 km with good topography. (iv) The ratio of population to health center gave 11,972:1, implying that Isiala-Mbano is adequately served by Primary Health Care Centers. A test of Hypothesis showed that there is no significant relationship between distance of primary health care facilities and level of utilization in the study area. Hence, this study concluded that distance and physical accessibility to the PHCCs was not a hindrance to utilization in the study area.

Keywords: Spatial location, distance, utilisation, health care facilities, sustainable development.

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ES-003

Climate Variability and Trend in Urban Flood Disaster Risk Awareness in Nigeria

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ABSTRACT

Prior to human civilization, floods have been identified as one of the most lethal environmental and geophysical disasters with destructive consequences. Yet, individual/ group awareness levels and impact mitigations vary across distinct geographic locations and times. This study explores trends in climate-induced flood disaster risk awareness in Nigeria. The discourse analyses using quasi-qualitative tools revealed that the causative factors and levels of flood disaster awareness in Nigerian communities varied across geographic location and timescale. Also, the flood disaster profiles in Nigeria reflect dominant control by variations in climatic seasons. Hence, devastating flood events in Northern Nigeria were mostly associated with dam failure and those in Southern Nigeria were influenced by the high frequency, density, and intensity of rainfall and poor land use planning. Finally, the vulnerable people were basically passive in their management approaches with emphasis on post-disaster rehabilitation. The perceived flaws led to very high risk, defined by limited capacity and locational effect. This paper therefore recommended adequate promotion of disaster risk mitigation options through environmental education programmes to boost community awareness, increase sense of responsibilities and peoples' safety.

Keywords: Climate Variability, Flood, Disaster, Risk Awareness

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ES-004

Suitability of Laterite Soil Reinforced with Periwinkle Shell and Palm Kernel Shell as Sub Base Materials in Road Construction in Edo State

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ABSTRACT

Pollution is a very predominant problem in Nigeria. As a developing nation, we face challenges of constant economic recession and this can have effect on so many facets of life including construction. Road construction is now so expensive. In other to combat pollution and bad roads, waste can be used with other construction materials to construct better roads. The study was to investigate the suitability of laterite soil reinforced with a mixture of palm kernel and periwinkle shells as material for subbase course in road construction. The soil samples were obtained from a borrow pit at Iguosa Housing Estate, Benin City, Edo state. The geotechnical properties of natural soil were determined, which included specific gravity, mechanical sieve analysis, consistency limit, compaction, and California Bearing Ratio (CBR) tests. The strength properties of the soil reinforced with periwinkle shell (PS) and palm kernel shell (PKS) in proportions of 6%, 9%, 12% and 15% by volume were carried out. For the control sample, the average result of the specific gravity obtained was 2.47 which was below the standard of 2.50 to 3.0 for lateritic soils. The plasticity index was 19.49% which indicates that the soil is of medium plasticity. The sieve analysis indicated that the soil is classified as an A-2-6 soil. The Maximum Dry Density and the Optimum Moisture Content were 1.78 g/cm^3 and 10.3% respectively. The average value for the soaked CBR was 15.11%. When the soil was reinforced with equal proportion of PS and PKS, the OMC ranged from 11.30% to 11.70%, the MDD ranged from 1.73g/cm^3 to 1.75g/cm^3 and from the CBR tests, the value for the soaked CBR ranged from 1.26% to 23.21%. The optimum mix proportion was obtained to be 12%. This did not meet the requirement of 30% for subbase stated by the Federal Ministry of Works and Housing. Therefore, these soil reinforcement techniques with PS and PKS can only be used for Trunk D roads or as subgrade materials which require a minimum soaked CBR of 5%. For Trunk A, B and C roads, the mixture would require a binder like cement before being considered as subbase materials.

Keywords: Laterite soil, Palm Kernel Shell, Periwinkle Shell, Sub base, reinforcement

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ES-005

Application of Analytic Hierarchy Process to Safety Policy in Oil and Gas Sector

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ABSTRACT

All attempts to reduce accident occurrence in the Oil and Gas sector have persistently been a discouraging task notwithstanding the enormous investments made by the industrial societies in general. The policy outlined towards plummeting the proportion of industrial accidents across preventive and predictive measures as well as to fashion sensitivity on the rights of victims of industrial accidents need be reinforced. Above all, there is the need to review the faulty operation and supervision of the licit framework governing matters of safety in workplaces. This paper seeks to review the Occupational Safety and Health Administration (OSHA) framework by selecting the most appropriate variable suitable for the overall safety of industrial workers in any developing nation. The purpose is for the re-contextualization of the OSHA Portable Concept. In line with the study design, a questionnaire was designed and distributed among the respondents in the six geo-political zones to collect their opinion to conduct pair comparison. The statistical computations were carried out with the aid of (AHP - OS) Online software. Nine criteria include national economy, pre-planning, training, etc. The result shows the contributing weights of individual criteria with a national economy ranking first exerting a weight of 25.14% from its Eigenvectors and consistency ratio (CR) 5% which is < 10% (is therefore acceptable). Conclusively, the safety policy outlook of the nation is limited to its prevalent economy, hence it should be reorganized to reduce its lost workdays as a result of minor injury and illness.

Keywords: Industrial accident, Analytical Hierarchy Process (AHP), OSHA, Re-contextualization, Portable Concept, Eigenvalue

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ES-006

Watershed Dynamics Using SWAT Model

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ABSTRACT

Land use/cover types and its change has an impact on changing watershed hydrology. Human activities exert more pressure in influencing the natural dynamism of the watersheds and hydrology through continues and steep slope cultivation. The objectives of this study was to assess the effects of land use/cover types on watershed dynamics and hydrology under varying slope gradient in terms of water balance of the two sub watersheds. Effects of land use/cover type on dynamism of the watersheds were estimated based on water component simulated by SWAT model. Cultivated land produced more surface runoff and water yield than others land followed by urban land, while Forest and grass land produced less surface runoff and water yield but higher in Evapo-transpiration, percolation, ground and lateral flow of water than cultivated and urban land. Area of cultivated land is more responsive to the value change of surface runoff and water yield than others land use/cover types. As land size of cultivated land increased both surface runoff and water yield decreased and had negative correlation, whereas, other hydrological variables were less responsive to change in land size. Slope gradient of land use/covers type also contribute for the water imbalance of the watersheds. As slope increased from 5% to15%, surface runoff and water yield decreased in cultivated, grass and forest land, whereas, increased in urban land as slope increased. The combined effects of land use/cover types with slope gradient on watershed dynamism was more observed where human action is high in terms of continuous and steep slope cultivation and urban built up expansion. Key Words: Land use/cover, Soil, Slope, watershed hydrology.

Keywords: **Watershed Dynamic, SWAT Model, land use, hydrology**

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ES-007

Assessment of Noise Pollution in Oba Market, New Benin Market & Oregbeni Market, Benin City, Edo State

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ABSTRACT

Increase in workplace stress, loss of sleep and anger may not be unconnected to the level of noise exposure an individual is subjected. Three major markets in Benin City namely Oba market, New Benin Market and Oregbeni market, being workplaces, were examined to determine their noise levels with a view to ensuring that shoppers and vendors carrying out their business in a healthy environment. The noise levels in these markets were measured between 8 – 11am, 12 – 3pm and 4 – 7pm daily spanning 7days at each market. Questionnaires were distributed to market stakeholders to get a glimpse of the sources of noise in the markets and the adverse health effects arising from prolonged exposure to the prevailing noise. Results showed that the average noise in the markets is between 77.00 to 89.20dB in the morning; 74.30 to 90.20dB in the afternoon and 83.30 to 90.90dB in the evening. Oba market has the highest mean noise (86.76dB), occurring predominantly in the evenings, followed by New Benin market which has the highest mean noise in the morning (84.73dB) and in the afternoon (85.55dB). Oregbeni market is the least noisy market in the pack even though it sometimes experiences sudden short and loud sound. Traffic activities, grinding machine and generator operations constitute the major sources of noise even as respondent acknowledged that they experience many of the adverse health effects associated with noise in the markets under review. Proper market administration, siting and layout structuring will be helpful towards reducing noise in the markets.

Keywords: Assessment, Noise, Pollution, Oba Market

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ES-008

Interpretation of Aeromagnetic Data of Oyo Area, Nigeria

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ABSTRACT

The study presents aeromagnetic data interpretation which involves the interpretation of aeromagnetic data features. Due to Magnetic properties of the earth crust, aeromagnetic anomalies over Oyo town are evaluated to map the magnetic lineaments and estimate the depth to the basement. The aeromagnetic data, from the study area sheet 241 Oyo, acquired were subjected to various filtering and processing technique which in turn properly displays the magnetic anomalies and magnetic intensities. Butterworth was applied to improve the signal to noise ratio, to reduce magnetic equator to properly position anomalies and to remove grappling effects. Gaussian filter was also applied to remove the regional effects thus leaving only the residual anomalies. Other processing techniques such as Upward continuation of 500m, 1000m, 1500m and 2000m, derivatives in x, y directions, analytic signal to delineate magnetically active zones, averaged power spectrum, Euler Deconvolution. The result shows that the depth to the top of the deepest magnetic source of about 2.3 km, depth to the shallow source ranges from 0.25 to 0.5km The obtained data shows that there is an abundance of positive anomalies that correspond to the migmatite-gneiss complex which is of moderate intensity. Derivatives in x, y and z directions revealed the parallel to sub-parallel lineaments which generally trends NE-SW direction except for major lineament that cuts through the migmatite-gneiss complex which trends in NW-SE direction. All these observations were made from qualitative and quantitative data interpretations, which in turn support magnetic information of the area.

Keyword: aeromagnetic data, magnetic intensity, Gaussian filter, Euler deconvolution, anomaly

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ES-009

The use of Irradiation for the Preservation of Food and a Means to Enhance Food Security in Nigeria

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Adequate preservation of food has been a major objective of man over time. In the course of storage, marketing, and transportation, food and food products have been significantly taunted by pests and microorganisms. This has resulted in a significant loss of foods (15% for cereals, 20% for fish and dairy products, 30% for root crops and up to 40% for fruits and vegetables). With the current global pandemic situation, there are possibilities that famine might be inevitable. Therefore, processes capable of long-term preservation of foods and food products should not only be practiced but readily available and acceptable. Irradiation of foods and food products is a measure that needs to be implemented all over the world, especially in the developing countries such as Nigeria. Food irradiation is scarcely practiced in Africa, mostly due to the economy and lack of knowledge on the part of the people, hindering its acceptance as a method of food preservation. Common methods of food preservation have been found to deter nutritional and sensorial qualities of foods; however, irradiation not only keeps foods safe for a longer time, but causes little or no effect on the sensorial qualities. Food irradiation is one of a set of processing strategies that via the application of ionization energy, has been used in the preservation of foods and food products, in addition, improves safety. Gamma rays, E-beams, and X-rays have been applied and studied extensively. As a 'cold' pasteurization process, the application of irradiation does not compromise flavor, aroma, and color of foods and food products. Since the irradiation source in no time comes in contact with the food material, irradiation does not make foods radioactive. Many parts of the world are considering food irradiation as a technological saviour in finding a suitable solution to the problems caused by pathogens in food. Irradiation can be regarded as a useful tool to attain food security in the 21st century. This study reviewed the basic principles, applications, benefit of irradiation technology, types of irradiation facilities and the associated potential health risk, if any, posed to consumers as a result of consumption of irradiated food. The Gamma Irradiation Facility (GIF), one of the components of the Nuclear Technology Centre (NTC) of the Nigeria Atomic Energy Commission (NAEC) is a multi-purpose facility for both industrial and research applications. Irradiation technology is easy to apply, clean, and environment-friendly. Over 50 countries have regulatory approvals in place for irradiation of one or more food products. 30 countries are practically applying this technology for a number of food items.

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Keywords: food irradiation, ionising radiation, radiological safety, shelf life.

ES-010

Characterization of Solid Waste Generation in Warri Metropolis

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ABSTRACT

Nigeria has poor waste management policy, and waste is improperly disposed on our environment. Waste from most towns in Nigeria is sometimes discharge into land, adjoining streams without treatment due to poor implementation of standards, thus causing environmental and public health hazards. The materials used include a weighing balance, hand gloves, black polyethylene bag. Stratified random sampling method was used adopted in this research work. The results obtained from solid waste characterization in Warri metropolis revealed that the components of solid waste generated include food left over, plastic and rubber, paper, wood, carbon, leather, textile material, glasses, ferrous metals, metal cans and ceramics. The results further shown that 0.55 kg of food waste was generated per person per day. More so, a total of 250.55 kg of household solid waste was generated per week by 100 households consisting of 405 persons. Besides, a 2.45 kg of solid waste was generated per household on a daily basis. By percentage composition, food waste has the highest percentage (70 %). Considering the high percentage composition of generated food waste recorded from this research work, there is a need for construction of AD plant for management of biodegradable portion of the solid waste in Warri metropolis.

Keywords: *Characterization, Solid Waste, Warri Metropolis, Percentage Composition, Dumpsite*

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ES-011

A Technical Review on the Hazard and Environmental Impact of Gas Flaring in Niger Delta

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ABSTRACT

Despite Nigeria is rated high in the list of crude oil producer in the world, yet oil exploration activities have resulted in a high rate of gas flaring due to weak enforcement of the anti-gas flaring laws by the regulatory authorities. Generated natural gas from oil production, is burnt in large volumes, thereby leading to the emission of greenhouse gases and waste of natural resources which could have generated billions of dollars for the Federal Government of Nigeria. There are concerns that if nothing is done to curtail this menace, humans and the environment will be imperiled due to its negative consequences. This present research work is therefore a technical review on the hazard and environmental impact of gas flaring on Niger Delta environment of Nigeria. A thorough review was carried out and the findings from the study showed that gas flaring is an is a major source of air pollution with deleterious effects on climate and human health of the populace of Niger Delta. Gas flaring by oil companies in the region has terribly devastated a substantial portion of farmlands leaving the streams polluted. These areas have been turned into ghettos and swamps with the indigenes becoming destitute in their fatherland. Their sources of livelihood, which is farming and fishing, have been closed as the streams have lost life, and the lands are no longer fertile. More so, weak enforcement of laws is a critical factor responsible for gas flaring in the region. Thus, there is a need to decrease gas flaring by imitating the strategies applied in other oil producing developed countries. Besides, to reduce greenhouse gas emissions in the oil industry for the sustainability of the energy sector and to generate more revenues for the government of Nigeria, gas flaring should be stop in the region.

Keywords: *Niger Delta, Gas Faring, Greenhouse Gases, Global Warming, Environment*

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ES-012

Environmental Impact of Potential Toxic Metals in Soil of Auto Mechanic Workshops in Northeastern, Nigeria

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ABSTRACT

Environmental pollution is one of the serious challenges facing humanity and other life system on recent time. This study was conducted to determine the environmental impact of trace metals (Fe, Cu, Mn, Cr, Ni, Cd, Pb and Co) in soils in the vicinity of auto mechanic workshops in Northeastern, Nigeria. Topsoil (0 - 15 cm) samples were collected from thirty different workshops and analyzed using Atomic Absorption Spectrophotometer (AAS). The concentration of trace metals were varied in the samples, the concentration ranged from (723.7 mg/kg - 1379.70 mg/kg) Fe, (147.34 mg/kg - 201.08 mg/kg) Cu, (18.35 mg/kg - 43.25 mg/kg) Mn, (3.52 mg/kg - 15.15 mg/kg) Cr, (134.50 mg/kg - 158.90 mg/kg) Ni, (9.89 mg/kg - 15.56 mg/kg) Cd, (111.54 mg/kg - 155.06 mg/kg) Pb and (12.53 mg/kg - 15.46 mg/kg) Co. The result showed that trace metals distributions were highly accumulated in the soil samples, Fe, Cu, Ni, and Pb were found to have highest concentration compared to other metals. The abundance of metals in the auto mechanic workshops was found in declining order: Fe > Cu > Ni > Pd > Mn > Cd > Cr > Co. Pollution indices studies showed that soil samples were high contaminated with the the majority of the metals. The ecological risk assessment classified under the high to serious ecological risk and cadmium contributing the 80-90% of the total potentially ecological risk.

Keywords: *Auto mechanic, Environmental impact, Pollution indices, Potential toxic metals*

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ES-013

Prospects of Green Fuels to Waste Management in Nigeria

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ABSTRACT

With the rising rate of greenhouse gas emissions observed due to the use of fossil fuels and the global demand of the world to reduce the level of dependency on the use of crude oil-based products, science, and industries across the globe are not significantly giving greater attention to the use of bio-based materials. Many advanced countries are already investing a lot in this aspect of science; many developing nations, including Nigeria, are yet to follow suit. In addition, waste management in Nigeria has long been receiving poor attention from both the government and its residents. Potentials that the wastes, which includes municipal, domestic, and industrial wastes, would continue to rise. The need to consider the engagement of the waste-to-wealth approach where the wastes, in this case, could be transformed into green fuels like bioethanol, biodiesel, biogas, and a lot more. As a way of unfolding details on the potentials that it has to offer for the development of the rising nations like ours, this report tends to provide highlights on the concept of green sciences, benefits it tends to offer, recent advances reported so far on the subject and possible recommendations on areas that required the attention of our academia. Efforts should be put in place to promote the development and commercialization of local technologies which are eco-friendly, sustainable, and renewable.

Keywords: *Green fuels, Wastes, Biomass, Biofuels, Biorefinery, Renewable Fuels*

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IT-001

Serverless Computing Technologies: Issues Towards its Adoption

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ABSTRACT

The challenges of existing cloud models birthed the need for the emerging serverless technologies as an extension of the cloud computing model to provide support for building cloud applications as a unit of Functions executed per running time. The transition however is somewhat slow as a result of inadequate exposure, the swift emergence of this technology, and how to deploy serverless applications by cloud developers and service consumers. To plug these challenges, the paper explores and exposes the foundations of serverless computing with intentions to combine and elucidate trending research to buttress with ample clarity, a vital point of view on the technologies, its impact, services, application, deployment, and challenges towards adoption by application developers and service consumers. For simplicity, it built a serverless application as a sample walkthrough to attract developers towards overcoming its drawbacks and embrace its adoption thereby boosting the services computing paradigm.

Keywords: services computing, cloud computing, serverless computing, FaaS, serverless architecture, serverless application.

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IT-002

Suitability Assessment for Genetic Algorithm Optimal Wireless Sensor Node Network Deployment in the University of Benin Using Geographic Information System

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ABSTRACT

The paper considers the suitability assessment of a genetically optimized node deployment scheme for a ZigBee wireless sensor network in a tropical environment. The development of a model for maximum connectivity and full area coverage with parameters such as isolated nodes and minimum islands were taken into consideration. Optimal positions of the sensor nodes were achieved using a heuristic tool Genetic Algorithm (GA) that operates on encoding of the decision variables with the Genetic Algorithm optimization tool set. Geographical Positioning System (GPS) coordinates of positions within the work area were taken and positions of the sensor nodes were achieved using graphical Information System (GIS) tool to determine possible influences of the University of Benin tropical environment to the node deployment scheme.

Keywords: Suitability, Assessment, Genetic Algorithm Optimal, Wireless Sensor

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IT-003

The Design and Development of a 3D Orientation Map System

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ABSTRACT

Map systems has been a form of finding different locations embraced by a larger percentage of the world population and with good content can be used to convey enough information faster than most means. This research was carried out to develop a 3D map system that is used to share some insight on the different locations of departments and classes in the faculty of engineering, University of Benin to the rest of the world through the map system. The project achieved this by employing scenery local to the faculty of engineering, University of Benin a Nigerian university in Benin City and an interactive play that revolves around the environment.

*Keywords: **3D Orientation, Map, System, Design***

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IT-004

Deployment of Machine Learning Models in Cybersecurity: A Review

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ABSTRACT

From ARPAnet to the Internet, computer networks have entered the lives of a huge number of people way beyond the scientific community. They have connected more than 3 billion Internet users in more than 160 countries and regions around the world, greatly enriching the way people work and live. However, the ensuing cyber security problem is fast becoming the biggest destabilizing factor affecting the ubiquity of the network. It is grossly highlighted by the increasing number of malicious programs on the Internet, the continuous development of cyberattacks, the normalization of advanced persistent threats, the expansion of intelligent devices amongst others. Therefore, the development of related network security technologies continues to be the focus of research in the field of Network Security and Digital Forensics. Recent advances in Machine Learning provide novel solutions to the security problems encountered in computer networks. By making use of mathematical techniques across huge datasets, machine learning algorithms essentially build models of behaviour and utilizes these models for making future predictions based on new input data. Machine learning and recently Deep Learning techniques have found widespread applications and implementations in cyber security related issues. Many techniques, approaches, algorithms, methods and tools provided by Machine Learning sphere are successfully implemented and used by cybersecurity experts, digital forensic scientists and researchers to improve the security level of systems and networks as well as solve electronic crimes. This discourse serves to describe some Machine Learning models being deployed for the above purposes today.
Keywords: **Machine Learning, Model, Cybersecurity, Network**

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IT-005

Development and Application of a Deep Learning Based SMS Spam Detection Model

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ABSTRACT

Antispam techniques have been developed for decades and many methods for mitigating spam emails have also been applied in the SMS domain. These include Artificial Intelligence techniques. This work is aimed at the development and subsequent deployment of a spam detection model using Deep Learning algorithms. Various Spam data repositories were scanned for usable data required to create the model. Packages such as Google Colab, Pandas, Seaborn, Matplotlib and Wordcloud were used for Expository data analysis to gain insight into the nature of the data. Packages such as Tensorflow, Python-dotenv, Scikit learn were used to create and evaluate the Deep Learning model. Finally, the model was deployed using Flask, a python library for web development. The web application was used to read SMS messages sent to a Twilio phone number which classified the messages into **spam or ham**. *The results showed an accuracy score of 98.3% which proves that the developed model is highly reliable for detecting SMS Spam messages.*

Keywords: **Development, Deep Learning, SMS, Spam Detection, Model**

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IT-006

Cyber-crime in Nigeria: Sociotechnical Implications, Preventive and Counter Measures

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ABSTRACT

The Internet platform has created unlimited opportunities for a vast array of human activities, more so in the areas of commerce and social interactions. However, correspondingly there has been an upward increase in security threats to such activities. Internet crimes are committed daily all over the world and in Nigeria as well. According to (Ibrahim, 2019) cybercrime was responsible for 43% of monetary loss in the country in the year 2016. Some reports (NIBSS, 2021) show that Fraud-related crimes cost Nigerian banks N3.5billion in losses from July to September 2020. This work focuses its analysis on crucial cybercrimes committed per sector the world over and compares with that of Nigeria including an investigation of key cybercrimes committed in Universities in Nigeria with a focus on Edo State. At the end of this paper reasons for as well as detection, prevention and counter techniques are presented in order to combat cybercrime for not just the crime fighting bodies and the government but all related stakeholders in the country.

Keywords: Cyber-crime, Nigeria, sociotechnical, preventive.

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IT-007

Smart Rack Protection Against Physical Insecurity and Privacy Intrusions of Mobile Phones in Examination Centres

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ABSTRACT

Mobile phones are resources used for learning in our educational system. Online classes are assessed via mobile devices just like study materials in texts, images, audio, video and other file formats are stored and read via mobile phones. Most times, examination candidates at various levels especially in higher institutions keep assessing these preparatory resources (on mobile phones) till the moments they are called into the examination halls. Meanwhile, these important study aids are not allowed into examination halls so as to avoid examination malpractices. So, candidates are compelled to keep them in open places where they are unsafe, exposed to illegal accesses, privacy intrusion and often stolen. This paper presents an electronic framework towards ensuring the privacy and security of candidates' mobile phones during examinations. A smart rack protection against physical insecurity and privacy intrusions of mobile phones in examination centres was developed. A physical structure suitable for keeping series of mobile phones is constructed with doors that automatically lock after enrollment to secure the mobile phone(s). The enrollment involves a fingerprint based security capturing that is interfaced through programmed microcontroller which locks the rack to protect the mobile phones until the owner gets back to unlock it through their saved fingerprint data. Fingerprint R305 is interfaced with ATMEGA 328 Arduino microcontroller to activate the locking and unlocking processes while the software was written in C programming language. Once a registered fingerprint is placed on the sensor, access is granted to the user, the rack door opens and closes. During this process, the 16X2 LCD displays the registered user and if the user is not registered, the response will be: "finger not found". The results of testing this work yielded an efficient performance that secures candidates' mobile phones during examinations.

Keywords: privacy, security, mobile phones, microcontroller, fingerprint, examinations

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MI-001

Corrosion Susceptibility of 0.32%C and 0.17%C Low Alloy Steels with Strain Induced Cavities

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ABSTRACT

The specimens from both steels were first austenized and thereafter spherodized. The microstructure was obtained using optical microscope. Some of the samples were machined into tensile specimens but not notched while others were notched. Some of the notched tensile specimens were then fractured to obtain three different strain levels. Based on these strain levels obtained, the notched specimens were prestrained. Some of the specimens were immersed in liquid nitrogen at -196ºC and then fractured by impact. The fracture surfaces were examined using scanning electron microscope. Some of the specimens were stress relieved to remove virtually all the residual stress present, leaving just cavities. The remaining specimens were not stress relieved, leaving both the residual stress and cavities. The specimens, were then immersed in seawater for 90 days and corrosion effect were measured using weight loss method. At the end of 90 days exposure, specimens with only cavity, had a corrosion rate of 17.69, 46.38 and 50.72 mg/cm²/yr for the low alloy steel, at three different prestrained levels respectively. For the 0.32%C steel, it was 15.66, 41.09 and 44.42 mg/cm²/yr. Though the specimens with cavities and residual stress were found to have higher corrosion rate, with a corrosion rate of 21.25, 48.05, 57.51mg/cm²/yr and 16.43, 42.86, 50.75 mg/cm²/yr for the 0.17%C low alloy and 0.32%C steel respectively, the cavities were found to contribute more to the high corrosion rate.

Keywords: Corrosion Susceptibility, Low Alloy Steels, Strain Induced Cavities

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MI-002

Evaluation of the Corrosion Performance of Epoxy-Agro Waste Nanoparticle Coating for Mild Steel

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ABSTRACT

Mild steels are increasingly being imported and locally produced in Nigeria as a result of industrialization of the economy and they are useful in various applications like railway, buildings, bridges, port construction e. t. c. where they may be subject to corrosion. Corrosion can be controlled or reduced through the use of suitable and locally available coatings. Nanoparticles due to their large surface areas have been shown to be excellent materials as they are good absorbents of coating pigments. Palm kernel shells and egg shells are readily available and easily accessible in Nigeria and they both contain silica and carbon which easily combine with epoxy to give compounds resistant to corrosion. The effect of the addition of eggshell ash nanoparticles (ESAnp) and palm kernel shell ash nanoparticle (PKSAnp) respectively in epoxy as a coating for mild steel was studied. In the experimentation, the palm kernel shell and egg shell were washed, dried and a carbolite furnace was used to ash them. They were characterized using XRD. Nanoparticles were produced using the sol gel method, particle size and morphology of produced nanoparticles were examined with transmission electron microscope as well as nanoparticle analyzer, specific surface area were measured, x-ray diffraction patterns were obtained, the surfaces of the samples were examined with scanning electron microscope, fourier transform infrared spectrometry was carried out, thermal decomposition was observed as well as x-ray fluorescence. The uncured epoxy (LY556) and its hardener (HY 951) were mixed in weight ratio of 2:1 then 1 to 5wt% of the nanoparticles were added followed by stirring at 1200 rpm for 15 minutes before the coating was applied to the mild steel test coupons and kept at room temperature for 7 days to allow for full curing. Corrosion protection efficiency of 95.42 and 98.62% were obtained for the mild steel when coated with epoxy-4wt%ESAnp and epoxy-5wt%PKSAnp respectively. The substrate showed more tendencies

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to pitting than the coated samples. This study has established that epoxy-4wt%ESAnp and epoxy-5wt%PKSAnp have good anti-corrosion applications.

Keywords: *Mild Steel, Nanoparticles, Epoxy, Palm kernel shell ash, Egg shell ash, Corrosion protection.*

MI-003

Nanostructures Design: The Role of Cocatalysts for Hydrogen and Oxygen Generation in Photocatalytic Water Splitting

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ABSTRACT

Due to the energy supply pressure caused by non-renewable fuels as well as the environment-related issues, the efficient conversion of solar-chemical energy via photo-induced water splitting is one of the promising strategies to address the existing problems. To strengthen the overall catalytic performance of photocatalytic hydrogen (H2) and oxygen (O2) evolution, the selection and construction of cocatalysts are crucial. Recently, semiconductor photocatalysts have been well modified with the loaded cocatalysts as the active sites by extending light harvest, promoting electron separation and transfer, and improving the photocatalytic activity. Combined with the principles of photocatalysis, the paper focuses on the mechanism and roles of cocatalysts for boosted photocatalytic water splitting in recent research. The categories with the corresponding research contents of the existing cocatalysts are also summarised, including cocatalysts for H2 evolution, cocatalysts for O2 evolution, dual cocatalysts for overall water splitting and artificial cocatalyst complexes. Finally, the future direction of the development is suggested for the rational design and large-scale application of highly efficient cocatalysts in the photo-induced water splitting system.

Key words: *photocatalysis; cocatalysts; semiconductor catalysts; charge separation and transport; activation; water splitting*

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MP-001

Comparing the Analytical and Matlab Solution to the Cauchy–Riemann Equations

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ABSTRACT

Cauchy – Riemann equations consider simplest equation in complex analysis. We solved Cauchy – Riemann equations analytically and using Matlab which is one of the most famous mathematical programs in solving mathematical problems. We followed the applied mathematical method using Matlab. We found that the solution of Matlab is more accuracy and speed than the analytical solution which proves the aptitude the usage of Matlab in mathematical solution.

Keywords: Comparative, Analytical Solution, Matlab Solution, Cauchy – Riemann Equations, Harmonic

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MP-002

Laplace-based Cryptography Using Shifted Legendre Polynomials
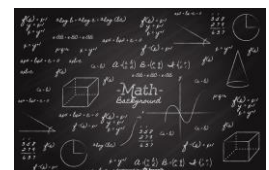
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ABSTRACT

The global threat posed by cybercrimes is of great concern to all as this menace is on the increase daily. The strength of a nation lies in the security of information. The continuous advancement in technology and the increase in the availability of data demands formidable security of information more than ever before. Therefore, development of new cryptographic scheme to improve on the existing ones is crucial to combating the rising challenges. This research introduces a new symmetric cryptographic scheme using shifted Legendre polynomials as an element for the encryption process and the Laplace transform as the transformational tool. The decryption process is considered and, an algorithm is presented to generalize the scheme.

Keywords: global threat, cybercrimes, cryptography, shifted legendre

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MP-003

Development of Calibration Combined Ratio Estimators of Finite Population Mean in Stratified Random Sampling

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ABSTRACT

This study deals with modification of combined ratio estimator in stratified random sampling using calibration estimation approaches. Calibration distance measures with their associate constraints were used to modify combined ratio estimator. New sets of optimum calibration weights are derived and used to obtained new calibration estimators of population mean in stratified random sampling. Empirical study through simulation was conducted to investigate the efficiency of the new estimators obtained. The results revealed that the proposed calibration estimators are more efficient than other existing estimators considered in the study.

Keywords: *Calibration weights, Combined Ratio, Estimators, Mean Squared Error, Stratified Sampling.*

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MP-004

Impact of Earthquake on Multi-Storey RC Structure

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ABSTRACT

Sequel to the rampant cases of structural failure due to earthquake across the world today, this study evaluates the Impact of Earthquake on Multi-Storey reinforced concrete (Rc) Structure using equivalent lateral force procedure to evaluate seismic forces. The analysis was carried out using different load combinations after which the effects from shear bending moment and axial forces was evaluated, in the stability analysis carried out shows that the factor of safety against overturning was 1.7 which is greater than the minimum value of 1.5 which indicate the proposed model was safety against overturning moments. The total dynamic shear at every storey when added together gives the same value as one earlier calculated as the total dynamic shear at the base of the structure. It was discovered form the analysis the internal columns experience high internal forces which results in to higher number of rebars compare to external ones but the seismic effect is higher at the external columns and beams. It was recommended that the effect of earthquake can be mitigated by adopting method of analysis, design, and detailing of structural element subjected to seismic loading.

Key Words: earthquake, overturning, rebars, dynamic shear, load combinations, and factor of safety

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MP-005

Ratio Estimators of Finite Population Mean Using Gini's Mean Difference

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ABSTRACT

A class of ratio-type estimators of finite population mean has been proposed. The proposed estimators were obtained by transforming Subzar et al. (2018) estimators. The properties of the proposed estimators i.e. Constant, Bias and Mean Square Error were obtained up to first order of approximation using Taylor's Series Expansion and the condition for their efficiency over some existing estimators was also established. The efficiency of proposed estimators shows significant improvement over the estimators considered in the study. The results of the empirical study show that the proposed estimators are more efficient than existing estimators based on the comparison criteria measures.

Keywords: Gini's Mean Difference, Mean Square Error, Auxiliary variable, Ratio estimator.

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MP-006

Application of Machine Learning Facies Classification from Well Logs

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ABSTRACT

Facies otherwise known as lithofacies are mappable subdivision of a stratigraphic unit that can be distinguished by its lithology (texture, mineralogy, grain size and depositional environment that produced it). The classification of lithofacies is crucial in seismic interpretation because different rocks have different permeability and fluid saturation for a given porosity. The usual sources for lithofacies classification are core samples of rocks extracted from wells. However, due to cost implications, it is usually difficult to obtain core samples at every location of the well. Thus, it is imperative to develop a method of classifying facies from indirect measurements such as from well logs. This will allow facies classification to be carried out by assigning a rock type or class to a specific sample on the basis of measured features. In this work, machine learning, a branch of artificial intelligence was employed to carry out this classification. Several machine learning algorithms were tested on well logs in order to determine how best to employ machine learning to classify lithofacies based on the measurement of wireline logs. Each algorithm was assessed based on the performance metrics and it was observed that the random forest algorithm performed best. Consequently, this algorithm was used to build the final model and tested on a blind well. The results obtained was very satisfactory. Hence, machine learning can be a veritable tool that can replace the costly core sample retrieval and measurement for mapping stratigraphic unit.

Keywords: Machine Learning, Lithofacies, Well logs.

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MP-007

Investigation of Kaolin - Granite Composite Bricks for Gamma Radiation Shielding

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ABSTRACT

Gamma radiation shielding properties of baked and unbaked kaolin bricks produced with 0%,10%, 20%, 30%, 40%, 50% of granite have been experimentally and theoretically investigated. A 3x3 inches NaI(Ti) detector was employed in the measurement of linear attenuation coefficients. The study concluded that all unbaked samples examined were valid for radiation shielding in terms of their linear attenuation coefficients when compared with the results of other materials. The optimum result for linear attenuation coefficient was obtained from unbaked sample of kaolin brick produced with 50% of micro scale granite.

***Keywords**: Kaolin; Granite; Radiation protection; Gamma radiation shielding.*

MP-008

Development of a Random-Forrest-Based Model via Machine Learning Technique for the Prediction of Liquid Holdup

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ABSTRACT

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In this work, analysis of experimental data obtained from air-silicone oil flow in a vertical pipe of 67mm internal diameter and 6m long was carried out to develop a random-forrest-based model for predicting liquid holdup and churn flow regime characteristics in vertical two-phase flow, using machine learning technique. The range of the liquid superficial velocity was (0.05-0.378m/s) while that of gas superficial velocity was (0.095-4.727m/s). The random-forest-based model predicted the liquid holdup, void fraction, and liquid film thickness accurately, but showed deviations in predicting structure velocity, churn frequency and length of churn unit based on the results. The deviations in predicting these flow characteristics could be attributed to data leakage in the course of processing the data for model development. The results of this work show that at constant liquid superficial velocity, the liquid holdup decreases with increase in gas superficial velocity, while void fraction increases as the gas superficial velocity increases. Cross plots of experimental and simulated liquid holdups, void fractions, structure velocities, churn frequencies, lengths of churn unit and liquid film thicknesses are presented in chapter four.

MSD-001

Design of a Remote Controlled Pneumatic Palm Climber and Harvester (PCAH)

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ABSTRACT

This project is on the design of a remote controlled palm climber and harvester to fill in the technological gap in palm harvesting. It is a synergy of engineering principles and relevant technologies like pneumatics and mechatronics to solve societal problem in the area of palm production. In this project, a Palm Climber and Harvester (PCAH) was designed. The movements of individual linkages in its mechanisms were determined, the pneumatic system which produces the motion and the electronic circuit which controls the pneumatic circuits were also designed. The dimensions of the individual linkages which will withstand the working stress were calculated. These dimensions, after being simulated under working condition using SolidWorks engineering application software were found to be within safety limits. PCAH as a machine can be readily manufactured for use in the palm oil industry.

Keywords: Design, Remote, Pneumatic Palm Climber, Harvester

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MSD-002

Development and Performance Indices of a Palm Kernel Cracking Machine

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ABSTRACT

Palm kernel oil has been utilized in very many facets of life, and the abundant of this palm fruit bunches in the southern part of Nigeria, if well maximized will nudge the economy of this country into a decent future. This study has been able to develop a palm kernel cracking machine with higher efficiency above what was obtainable in literature reviewed so far. The component for the development of the machine for cracking the palm fruit were sourced locally and Solid Works served as the design expert for the development of the machine as relating to the design working diagram. To boot the design process of the machine will eliminate loss of man hour time and reduce cost. The cracking machine was tested to determine its performance characteristics and it has shown an efficiency level of 96.6% with processing rate at 96 nuts per second with 2.5hp electric motor that is an improvement over existing palm kernel cracking machine that have 87.6% efficiency to cracking with processing rate of 89 nuts per second without re-cracking.

Keywords: Cracking Machine, Palm Kernel, Palm Kernel Oil, Performance efficiency

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MSD-003

Simulation of an Underwater Environment Via Unity 3D Software

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ABSTRACT

The ideal development platforms for underwater vehicle control systems are the physical vehicles themselves. However, limited availability of Underwater Vehicles (UVs) and the high costs associated with purchasing and maintaining them often call for the use of computer simulations as a more feasible and flexible development platform. The simulation must accurately emulate real world conditions and equipment to allow control software development in a virtual space. Unfortunately, simulations tend to be developed from the ground up for particular Underwater Vehicles and are thus idiosyncratic and difficult to reuse, and development time and cost can be substantial. It is therefore beneficial when developing simulation testbeds for intelligent control of UVs to utilize off-the-shelf, sophisticated simulation software namely, Game Engines. A game engine provides physics, modeling, and rendering capabilities that can significantly reduce simulator development time. The particular game engine utilized in this work is Unity 3D Game Engine. Various underwater scenarios were developed to prove the functionality of the underwater environment by creating C# scripts and utilizing the internal physics properties of Unity. A test object namely an autonomous underwater vehicle was deployed into the simulated environment to test the performance of the environment. Patrol scripts as well as obstacle avoidance scripts were written in C# to enable the underwater vehicle behave in the simulated environment. Results showed that the modelled underwater environment can serve the purpose of simulating various underwater scenarios such as navigation and patrol of Underwater Vehicles.

Keywords: Simulation, Underwater Environment, 3D Software

MSD-004

Modelling and Optimization of Material Removal Rate and Tool Wear Rate in a Straight Turning Operation

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ABSTRACT

This research work used RSM approach to addressed a multi- objective optimization problem in a straight turning operation of EN 8 mild steel bar, using HSS cutting tool. The study aimed at evaluating the best turning parameters setting which could simultaneously satisfy the requirements of both quality and productivity. The predicted optimal setting ensured maximization of material removal rate and minimization of tool wear rate, through a developed CCD using version 7.0 of Design Expert software. The ENC lathe machine was used to carry out the Turning operation, with work pieces, measuring 100 mm diameter and length 60 mm. A total of 20 experimental runs were done. The experimental results (data) were recorded and RSM was used to analyze the data. R^2 values of 0.9958 and 0.9887 for MRR and TWR respectively. From the analysis, it was found that all three input parameters of spindle speed, feed rate and depth of cut have significant influence on MRR. Only spindle speed and depth of cut were found to have significant influence on TWR. From the numerical optimization solution, it was observed that a spindle speed of 113.99 rpm, feed rate of 0.18 mm/rev and a depth of cut of 1.5 mm resulted in a turning process, with the

following properties: MRR of 9641.87 mm3/min. and TWR of 0.35293 mm3/min, with a composite desirability value of 96.4%.

Keywords: Response Surface Methodology (RSM), Material Removal Rate (MRR), Tool Wear Rate (TWR) Central Composite Design (CCD), Electronic Numeric Control (ENC)

MSD-005

Modelling and Optimization of Material Removal Rate and Tool Wear Rate in a Straight Turning Operation

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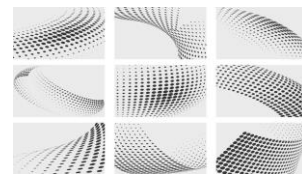*[1*]Corresponding author (+2348036711828)*

ABSTRACT
This research work used RSM approach to addressed a multi- objective optimization problem in a straight turning operation of EN 8 mild steel bar, using HSS cutting tool. The study aimed at evaluating the best turning parameters setting which could simultaneously satisfy the requirements of both quality and productivity. The predicted optimal setting ensured maximization of material removal rate and minimization of tool wear rate, through a developed CCD using version 7.0 of Design Expert software. The ENC lathe machine was used to carry out the Turning operation, with work pieces, measuring 100 mm diameter and length 60 mm. A total of 20 experimental runs were done. The experimental results (data) were recorded and RSM was used to analyze the data. R2 values of 0.9958 and 0.9887 for MRR and TWR respectively. From the analysis, it was found that all three input parameters of spindle speed, feed rate and depth of cut have significant influence on MRR. Only spindle speed and depth of cut were found to have significant influence on TWR. From the numerical optimization solution, it was observed that a spindle speed of 113.99 rpm, feed rate of 0.18 mm/rev and a depth of cut of 1.5 mm resulted in a

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turning process, with the following properties: MRR of 9641.87 mm3/min. and TWR of 0.35293 mm3/min, with a composite desirability value of 96.4%.

Keywords: *Response Surface Methodology (RSM), Material Removal Rate (MRR), Tool Wear Rate (TWR) Central Composite Design (CCD), Electronic Numeric Control (ENC)*

MSD-006

Design and Fabrication of a Shell and Tube Heat Exchanger for Laboratory Experiments

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ABSTRACT

Heat transfer instruction lessons has been a mainstay in the curriculum of undergraduate and postgraduate programs in mechanical and chemical engineering disciplines in higher institutions across the world. This paper presents the design and fabrication of a shell and tube heat exchanger (STHE) for laboratory experiments. A detailed thermal design using the Kern's approach was adopted for the thermal design of the heat exchanger. Thereafter, a mechanical design was carried out employing the TEMA standards and the ASME BPVC. It was then modeled before its fabrication. A water retention mechanism was designed using PVC pipes and 90˚ bend connectors to form a U-shaped apparatus to ensure efficient exchange of heat between both streams of fluid.

Keywords: *Heat, Heat Exchanger, Shell and Tube Heat Exchanger, Heat Transfer, Laboratory, Kern's Approach, Thermal Design, Fabrication.*

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MSD-007

Development and Evaluation of Improved Manual Dewatered Cassava Mash (DCM) Sieving Machine

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ABSTRACT

Traditional sieving of dewatered cassava mash (DCM) using plant, synthetic or metallic material as the sieving surface with the arbitrary aperture fixed by the local developers and to be used with the awkward posture of processors produces poor results as the sieving process exposes the users to musculoskeletal discomfort affecting their back, neck, shoulder and arm during the sieving process. Other factors that affect the sieving process besides the arbitrary fixing of the aperture, include lack of consideration of ergonomic and anthropometry of the user groups in the sieve development. To address this anomaly, this paper focuses on developing an improved dewatered cassava mash sieving machine incorporating ergonomic and anthropometric data of user groups as well as a modified sieve aperture. The machine was evaluated with respect to throughput capacity and exposure to musculoskeletal discomfort. The result showed an increase in throughput capacity from 35 to 59kg/h with a decrease in exposure to musculoskeletal discomfort from 66% to 47%. Adopting this improved machine will improve the livelihood of cassava farmers in this unit operation and add to a systematic change in sustainable development and ecologically smart future

MSD-008

Development of a UFAA-19 Series Hybrid Electric Vehicle

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ABSTRACT

Due to the ongoing control on emission levels and increase in fuel prices in many countries, it has become imperative for vehicle manufacturers to develop more fuel-efficient drivetrain technologies. Hybrid electric vehicles are viewed as short- or mid-term solutions for reducing emissions and fuel consumption while maintaining vehicle performance. ***This paper presents a design of a UFAA-19 Series Hybrid Electric Vehicle*** *to reduce the dependency on fossil fuels in Nigeria.A CAD model of the hybrid system was developed, afterwards, static and dynamic analysis were then carried out. The results from the static analysis showed that the model was stressed within permissible limits. The dynamic analysis showed that a* ***750W BLDC motor*** *was sufficient for providing the low-speed torque for the mini hybrid system. The vehicle reached up to speeds of* ***17km/hr***. *Results also showed that an IC engine rated at* ***3.5kW*** *would provide sufficient power for the system to reach up to speeds of* ***70km/hr***. *The hybridization factor for the system was found to be* ***17.6%***.

Keywords: Hybrid vehicles, statics, development, design, efficiency

MSD-009

Design, Fabrication and Performance Evaluation of a Foot Operated Water, Soap and Sanitizer Dispenser

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ABSTRACT

Hand washing and sanitizing has become a very essential part of our daily life especially in the era of COVID-19 pandemic. Most of the existing hand washing facilities on campuses is such that, the hands of the user are recontaminated after using the dispenser due to the use of hand for turning off the running tap after use. In this study, a pedal driven dispenser for hand washing and sanitizer is developed. The objective of this project is to reduce the risk of contracting or transmitting bacteria and virus during hand washing and to promote effective hand washing practice across university campuses in line with COVID-19 protocols. The machine was designed based on a simple working principle to accommodate a person at a time. All necessary engineering design specifications were considered. An average standard height was used to position the tap at a height of 1.25m. The mechanism is very easy to operate due to the simplicity

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of the foot pedal press. Hence, it can be conveniently used by almost everyone regardless of their height. The performance evaluation of the machine was analysed using computer aided design software called Autodesk Inventor software for simulation to outline the places that stress and strain would occur as regards to force application. This dispenser will replace the conventional veronica bucket (hand-operating tap) popularly used on campuses. It is also very effective and will help to stop the spread of the COVID-19 infections and promote good personal hygiene.

Keywords: *Dispenser, Fabrication, Water, Soap, Sanitizer, Simulation*

MSD 010

Development of a Smart Door

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ABSTRACT

An automatic suspended sliding door was designed and fabricated using materials sourced locally. Also, reliability analysis and availability analysis were carried out on the door. Most of the challenges associated with manually operated doors can be solve through the use of an automatic door. The automatic sliding door was tested after fabrication. The system was certified to have functioned properly as desired. The design values of the parameters were compared with the actual values measured from the system while in operation. The percentage deviation of the actual values from the design values of the parameters such as the door opening time, the door delay time, the door maximum velocity, the door minimum velocity, and the total time taken for the door to complete one operational cycle are 7.69%, 3.15%, 3.53%, 14.89%,

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and 6.51% respectively. The deviations of the actual values from the design values are negligible. Also, the analysis from reliability analysis shows that the system is reliable. Therefore, the design and fabrication, and the reliability analysis of a functional automatic suspended sliding door was successfully executed.

Keywords: Development of an Automatic Suspended Sliding Door

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A Comparative Analysis of Energy Storage Capacity of Selected Deep Cycle Batteries

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ABSTRACT

A battery data acquisition system, BDA specifically developed for this purpose was used to collect 76,326 experimental discharge data on seven (7) different deep cycle batteries over a period of Twelve (12) months under three (3) load conditions – 200W, 500W and 700W – and at varying operating temperatures. The resultant data was analyzed to know how they performed against each other in terms of discharge time, cyclic life and energy storing capacity. With respect to their discharge time, under a load of 200W, battery B was found to have the highest discharge time of 17,353.47sec while at the extreme battery F gave the least discharge time of

17,353.47sec. Battery B gave the overall better performance under all three sets of load while battery F gave the least performance. On the evaluation of the effect of ambient temperature on the batteries, battery B gave the better performance with a cumulative discharge of 888.80 while battery G gave the least performance of 938.40 cumulative discharge, battery B gave a better performance under the charge/ discharge cycle for each battery with a total of 1111 charge cycle while battery G gave the least performance of 1173 charge cycle.

Keywords: Battery performance, battery data acquisition, discharge time, ambient temperature.