ICEST 2025

3RD INTERNATIONAL CONFERENCE ON ENGINEERING, SCIENCE AND TECHNOLOGY

THEME:

CONVERGENCE OF AI, DIGITAL ECONOMY, AND DECARBONIZATION: ENGINEERING, SCIENCE AND TECHNOLOGY FOR A SUSTAINABLE FUTURE

DATE: 30th July to 1st of August, 2025
VENUE: UNIVERSITY OF CROSS RIVER STATE, NIGERIA

CONFERENCE PROGRAMME OF EVENTS &
BOOK OF ABSTRACTS

PROF. FRANCISCA BASSEY
Vice Chancellor
University of Cross River State, Nigeria
CHIEF HOST

ENGR. PROF. SIMON OGBECHE ODEY
Dean, Faculty of Engineering
University of Cross River State, Nigeria
HOST

ENGR. DR. SAMUEL OLIVER EFFIOM
Sub Dean, Faculty of Engineering
University of Cross River State, Nigeria
CHAIRMAN ICEST CPC

ICEST ORGANIZING COMMITTEE

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Engr. John Itakwu-Secretary
Engr. Dr. Joseph Onah Ukpata-Facilitator
Engr. Prof. Eko James Akpama-Facilitator
Engr. Prof. Fidelis Ibiang Abam-Facilitator
Engr. Prof. Simon Ogbeche Odey-IPC

Technical Committee:
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2. Engr. Asibong Icha-Secretary
3. Engr. Joseph Ekunke Obu-Member
4. Dr. Ofut Ogar-Member
5. Engr. Dr. I. Ibiang-Member
6. Engr. Dr. Patrick Ofem-Member
7. Engr. Dr. Maria Kaka Enoh-Member
8. Engr. Oliver Ita-Member
9. Engr. Robert Ekom-Member
10. Engr. Enyam Awuna-Member
11. Engr. Dickson Atowon-Member

Program/Book of Abstract:
1. Engr. Asibong Icha-Coordinator
2. Engr. Joseph Ekunke Obu-Member
3. Engr. Dr. Oliver Inah-Member
4. Engr. Enyam Awuna-Member
5. Engr. Dr. Patrick Ofem-Member
6. Engr. Dr. I. Ibiang -Member
7. Engr. Robert Ekom-Member
8. Engr. Odu Emmanuel-Member

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2. Engr. Odu Emmanuel-Member
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4. Engr. Dr. Gertrude Fische-Member
5. Engr. Dr. Paul Anyin-Member

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2. Engr. Oliver Ita-Member
3. Engr. Dr. I. Ibiang-Member
4. All departmental PG coordinators -Member

Registration, finance, and ticketing:
1. Engr. Odu Emmanuel-Coordinator
2. Engr. John Itakwu-Member
3. Engr. Asibong Icha -Member
4. Engr. Enyam Awuna -Member
5. Engr. Milliscent Ededet-Member
6. Engr. Robert Ekom-Member

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1. Engr. Dr. Maria Kaka Enoh-Coordinator
2. Engr. Dr. Patrick Ofem-Member
3. Engr. Dr. Oliver Inah-Member
4. Engr. Dr. Gertrude Fischer-Member
5. Engr. Oliver Ita-Member
6. Engr. John Itakwu-Member
7. Engr. Dickson Atowon-Member
8. Engr. Milliscent Ededet-Member
9. Engr. Goodnews Okon Umoh
10. Engr. Rose Ekor Ugor

Awards, exhibitions, and poster presentation:
1. Engr. Dr. Patrick Ofem-Coordinator
2. Engr. Dr. Maria Kaka Enoh-Member
3. Engr. Dickson Atowon-Member
4. Engr. Odu Emmanuel-Member
5. Engr. Gittu Bassey-Member
6. Engr. Asuquo Eke-Member

Faculty of Engineering Student Volunteers Team
1. Lawrence Sunday Emmanuel
2. Gilbert Ogar Agum
3. David David Isogon
4. Favour Eyo Egbai
5. Emmanuel Bassey Ekop
6. Donald Oliver Nsikhe
7. Emmanuel Odum Agbor
8. Ogabo Godwin Elekpa
9. Ofonmbuk Idio Udom
10. Paul Enang Abu
11. Benedict Ozibe Ofre
12. Kingsley Ugochukwu
13. John Utibe
14. Godfrey Nkanor Ita
15. Inemesit Aniefiok Charlie

OUR SPONSORS

CONFERENCE VENUE DESCRIPTION

To locate the Chapel of Grace Hall, University of Cross River State (UNICROSS) in Calabar from Margaret Ekpo International Airport, you can follow these general directions:

1. Taxi or Car Rental: Upon arriving at Margaret Ekpo International Airport, you can hire a taxi from the airport terminal. Most taxis are readily available at the airport and can take you to your destination.
2. Travel Route: From the airport, travel southwest towards Calabar city center. The University of Cross River State is situated in Calabar, the capital city of Cross River State.
3. Use Navigation Apps or Maps: Utilize navigation apps like Google Maps or Waze by entering the destination address or the name of the University of Cross River State (UNICROSS) in Calabar. These apps will provide you with real-time directions and the best route to reach the university from the airport.
4. Distance and Time: The distance and travel time from Margaret Ekpo International Airport to UNICROSS in Calabar may vary depending on traffic conditions, but it generally takes approximately 20-40 minutes by car, covering a distance of about 10-20 kilometers, depending on the specific location of the university within the city.
5. Local Assistance: If needed, you can ask for directions or assistance from airport staff, taxi drivers or locals to guide you towards the University of Cross River State in Calabar. They might provide helpful information about the best routes or landmarks to navigate to the university.

Always ensure to confirm the address and location of the University of Cross River State beforehand and use reliable transportation methods to reach your destination safely and efficiently.

MAP TO UNICROSS

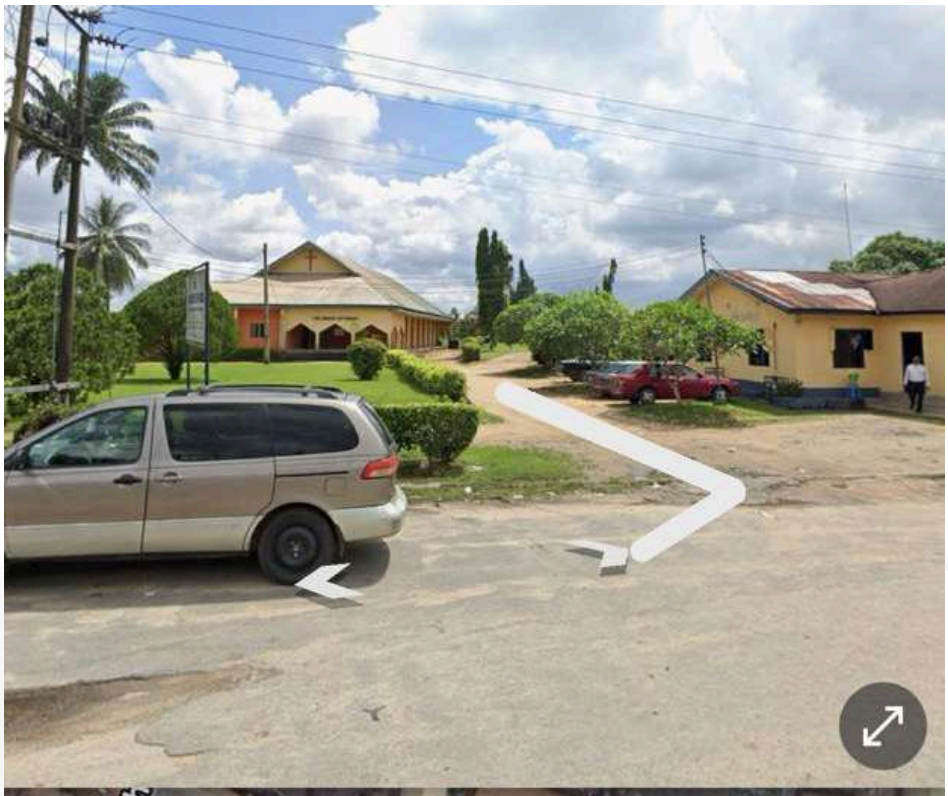
You can easily find the University of Cross River State (UNICROSS) in Calabar using online mapping services such as Google Maps, Apple Maps or other GPS navigation applications.

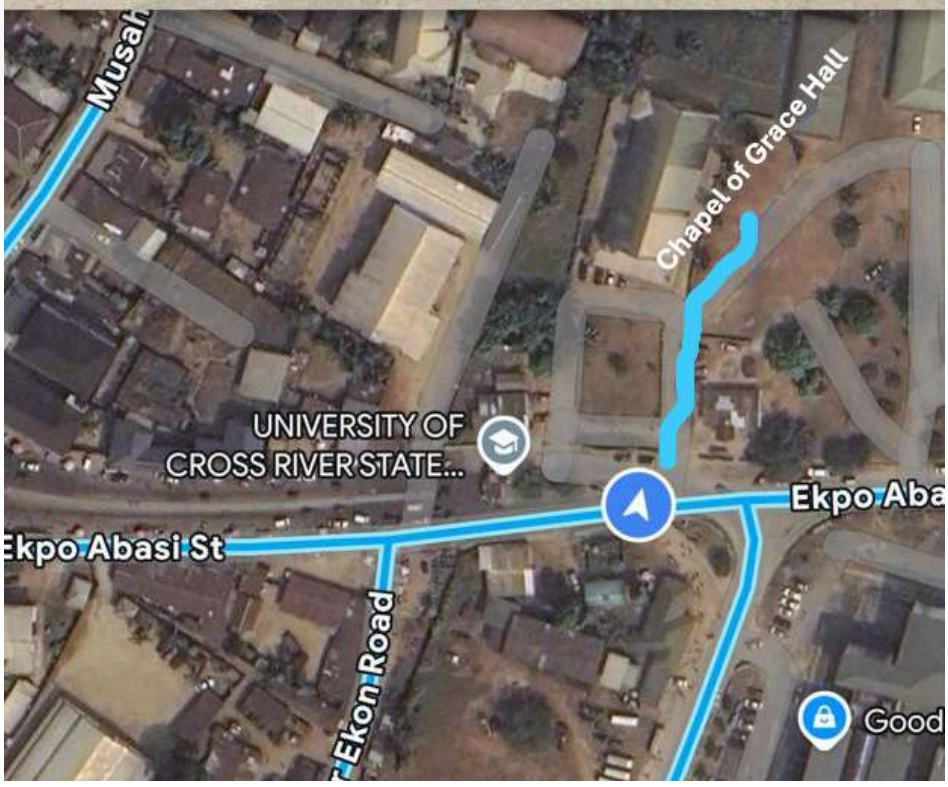
To locate UNICROSS on a map:

1. Open a mapping application on your smartphone, tablet or computer. Google Maps is a popular choice.
2. In the search bar, type "University of Cross River State, Calabar" or enter the specific address if available. The university might also be recognized under its former name, "Cross River State University of Technology (CRUTECH)." Or use the link: https://maps.app.goo.gl/YeQubrKTJYKgyhTs7
3. The map application will display the location of UNICROSS in Calabar, showing you the exact placement within the city and nearby landmarks or roads.

This method will provide you with a detailed map and directions to reach the University of Cross River State (UNICROSS) from your current location. You can use the map features to zoom in, explore nearby streets and plan your route accordingly.

MAP TO UNICROSS





INVITED KEYNOTE SPEAKER

BRIG. GEN. SIKIRU ADEPOJU MOHAMMED *PH.D, CENG, FIMECHE*

Brigadier General Sikiru Adepoju Mohammed is a serving Officer of the Nigerian Army Corps of Electrical & Mechanical Engineers. He holds a Ph.D in Mechanical Engineering from the University of Leeds, UK. Mohammed has attended several military courses and he is a daggered fellow of the Army War College Nigeria. Sikiru served as the Nigerian Army Plant representative in Ukraine and also represented Nigeria in Defence engagements in Egypt and Turkey. Brig. Gen. SA Mohammed has participated in several military operations within and outside Nigeria and he has held some command, staff and instruction appointments. Sikiru is a chartered engineer, a Fellow of the renowned IMechE and a registrant of the Engineering Council, UK. He has made physical presentations in academic engagements in Nigeria, Cameroon, Togo, Ethiopia, Mali, Ukraine, UK, USA, Czech Republic, Uzbekistan and India. Sikiru emerged Engineering Faculty Researcher of the Year 2017 at the University of Leeds, UK. He is a recipient of the Chief of Army Staff's (Nigeria) Commendation Award 2022 and also a recipient of the Year 2022 Study UK Alumni Award for Science and Sustainability in British Council organised event in Nigeria. Brig. Gen. SA Mohammed currently serves as a Directing Staff at the Naval War College Nigeria and also as a Senior Lecturer (Adjunct) at the Mechanical Engineering Department of the Nigerian Defence Academy.

Topic: Emerging Technologies and Digital Economy: Sustainable STEM Practices in Focus

LEAD PRESENTER

ENGR. PROF. HILLARY OWAMAH
DEPUTY VICE CHANCELLOR - ACADEMICS
DELTA STATE UNIVERSITY, NIGERIA

Professor Hilary Ijeoma Owamah is a distinguished scholar, accomplished administrator and renowned expert in Civil Engineering. He currently serves as the Deputy Vice-Chancellor (Academic) of Delta State University, Abraka, a position he was appointed to on March 11, 2025, at the age of 42, making him the youngest professor ever to hold this position in the University's 33-year history.

With a strong academic background, Professor Owamah holds a B.Eng. degree from the Federal University of Technology, Owerri, a Master's degree from the University of Port Harcourt and a Ph.D. in Civil Engineering from the University of Benin. His academic journey began at Landmark University, Omu-Aran, Kwara State, in 2013, before joining Delta State University, Abraka, in 2016 as a Senior Lecturer. He attained the rank of full Professor on October 1, 2022, at the age of 40, becoming the youngest professor ever produced by Delta State University and one of the youngest nationwide.

As a prolific scholar of international repute, Professor Owamah has authored over 60 peer-reviewed publications in Scopus- and Clarivate-indexed journals, earning him accolades and recognition within and beyond Delta State University. His research focuses on environmental sustainability, wastewater engineering and infrastructure systems. He has delivered over 70 keynote and public lectures across Nigeria and abroad, showcasing his expertise and thought leadership in his field.

Professor Hilary Ijeoma Owamah is a distinguished scholar, accomplished administrator and renowned expert in Civil Engineering. He currently serves as the Deputy Vice-Chancellor (Academic) of Delta State University, Abraka, a position he was appointed to on March 11, 2025, at the age of 42, making him the youngest professor ever to hold this position in the University's 33-year history.

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LEAD PRESENTER

MR. ISAAC MARTINS
PRODUCT & SALES MANAGER
HUAWEI TECHNOLOGIES LTD., CHINA

Isaac Martins is a seasoned technology professional with a proven track record in product management and sales. Currently serving as a Product and Sales Manager at Huawei Technologies, Isaac is at the forefront of driving innovation and growth in the Nigerian telecommunications sector.

Isaac holds a Master of Science degree in Computer Science with a focus on Artificial Intelligence and Data Science from Covenant University, where he honed his expertise in cutting-edge technologies. He also earned a Bachelor of Science degree in Computer Science from Babcock University, laying a strong foundation in computer science principles.

Isaac has an impressive research portfolio, with several publications in reputable journals and conferences. His research interests span cloud computing and recommendation systems, demonstrating his commitment to advancing knowledge and innovation in the field.

At Huawei, Isaac is instrumental in supporting the deployment of 5G products and leads several surveys and trials for 5G in Nigeria. His expertise in product management and sales has enabled him to drive business growth and deliver innovative solutions to customers.

Isaac will be speaking on "Digital Transformation in Nigerian Telecoms: Innovations, Challenges and the Road Ahead" at the ICEST 2025 conference. With his extensive experience in the telecommunications sector, Isaac will provide valuable insights into the latest trends, challenges, and opportunities in digital transformation.

Isaac is an Expertise in:
- Artificial Intelligence and Data Science
- Cloud Computing
- 5G Technology
- Product Management
- Sales and Business Development

With his expertise and experience, Isaac Martins is well-positioned to provide thought leadership and insights into the future of digital transformation in Nigerian telecoms.

LEAD PRESENTER

DR. BURHAN SAEED

ASSISTANT PROFESSOR OF AEROSPACE FLIGHT DYNAMICS & CONTROL

UNIVERSITY OF NOTTINGHAM, UNITED KINGDOM

Dr. Burhan Saeed is a seasoned Assistant Professor of Aerospace Flight Dynamics & Control currently teaching at University of Nottingham, United Kingdom. Before joining the University of Nottingham, he has worked as a Lecturer of Mechanical and Aerospace Engineering at Imperial College London (ICL), Lectured at the University of Portsmouth and has also been a panel tutor at Cambridge University. He has also been a Research Lead at the Centre for Alternative Technology – Mid Wales, University of Leeds, University of Bath and Brunel University London.

Dr. Saeed's education span across Brunel University London (PhD in Aeronautical Engineering), Cranfield University (Thermal Power MSc in Aerospace Propulsion), University of Bristol (MSc in Advanced Dynamics Engineering), University of Manchester (BEng in Aeronautical & Astronautical Engineering). He is also an accomplished researcher, with a significant research track record and research collaborations with Academics in the UK, Europe, USA, Nigeria and China.

A parallel to thriving engineering research, Dr. Saeed has tutored undergraduates and coordinated/supervised postgraduates in their group and individual projects.

As an Academic, he has delivered lectures, tutorials and led laboratory experiments in various aero-mechanical subjects including aerodynamics, thermos-fluids, solid mechanics, aircraft design, clean aviation fuels and renewable energies. For the past 18 years, he has been involved in supporting young engineers realize their potentials and career prospects. He is a fellow of the Higher Education Academy (FHEA).

LEAD PRESENTER

ENGR. PETER INAH
FIELD SERVICE LEAD
WARTSILA MARINE & POWER SERVICES NIG. LTD.

Peter Inah is a highly accomplished and results-driven professional with over 12 years of experience in the marine, energy and cement industries. With a strong technical foundation in mechanical engineering and a growing strategic business acumen, Peter is a versatile expert who excels in providing technical expertise, ensuring operational efficiency, and driving customer satisfaction.

As a Service Engineer at Wärtsilä Marine and Power, Peter leverages his deep specialization in 4-stroke marine and energy installations to deliver high-quality services across Africa and Europe. His expertise includes upgrades, overhauls, installations and commissioning of Wartsila product lines.

In his current role at Wartsila, Peter has been instrumental in driving decarbonization initiatives and has earned recognition as a Decarbonization Champion and a finalist representing Africa at the 2025 Wartsila Weknow global competition on decarbonization, future fuels and sustainable product development in Finland.

Peter is committed to excellence and has certifications as a:

- Project Management Professional (PMP)
- Certified Maintenance and Reliability Professional (CMRP)
- Certified Wartsila Four Stroke Marine and Energy Expert

He has a Bachelor of Engineering Degree in Mechanical Engineering, obtained from the Cross River University of Technology. He's currently concluding his Master of Business Administration.

With his multifaceted expertise and commitment to sustainability, Peter Inah is a valuable asset to any organization seeking technical proficiency, strategic thinking and a passion for excellence.

Topic: Innovative Pathways to Decarbonization and Energy Efficiency in the Marine, Energy, and Power Sectors: Achieving IMO and EU 2050 Targets

LEAD PRESENTER

PROF. NURENI ADEDAPO ADEWOLE
PROFESSOR, DEPARTMENT OF WOOD PRODUCTS AND BIOMATERIAL ENGINEERING
UNIVERSITY OF IBADAN, NIGERIA

N. A. Adewole is a Professor in the Department of Wood Products Engineering, University of Ibadan. He has puts in about twenty years of professional practice as Wood Products Engineer in Nigerian Wood Sector. In his capacities as lecturer and consultant, he has helped many graduates of his Department to develop small scale wood-based business models and these firms are among the top fliers in Nigeria's wood sector. Prof Adewole is an active member of Nigeria Society of Engineers and has the honour of being the first registered Wood Products Engineer in Nigeria. He is a member of many other professional bodies within and outside the country and Fellow of Forestry Association of Nigeria (FFAN) and Fellow of International Society for Development and Sustainability, Japan (FISDS). He led the Wood Products Engineering panel of the Council for Regulating Engineering Practice in Nigeria (COREN) that developed the Benchmark for Minimum Academic Standard (BMAS) for Nigerian Universities in 2015 and the document was adopted by six countries. He has served as a member of the COREN Visitation Team to assess engineering programmes across the country. Within the University of Ibadan, he has served and still serving the University of Ibadan in many capacities including the Faculty of Technology Sub-Dean (Undergraduate, 2011-2015); Head of Department (2021-2023); UI Admission Committee (2011-2015), Congregation Representative on UI Senate, UI Senate Representative on many committes, member of UI Housing Committee, member of UI Tree Campus Management Committee (now Biodiversity Committee) etc. He is currently statutory member of Senate. He has held different positions including the Vice-Chairman of the branch executive committee of the Academic Staff Union of University, University of Ibadan branch. He has supervised well above 100 students at both undergraduate and postgraduate levels and has well over 120 publications to his credit. He has special interest in Wood and Non-Timber Forest Products (NTFPs) Properties, Processing and Utilization; Furniture Design, Manufacturing and Ergonomics Studies, and, Biomass Energy Studies.

Topic: Maximizing Capacity for Adoption of Decarbonization Technologies and Utilization of Renewable Biomaterials: Nigeria's Path to a Sustainable Future

LEAD PRESENTER

DR. BLESSING GUEMBE

Dr Blessing is a Software Engineer and Researcher passionate about building trustworthy Artificial Intelligence (AI) systems through model explainability and responsible innovation. His work focuses on minimizing the privacy and security risks associated with existing and emerging knowledge-based and AI technologies, while preserving their utility.

He holds a Ph.D. in Computer Science with a research focus on AI, decentralized learning, privacy-preserving technologies and the development of secure, interpretable models. He is a recipient of the KUMARi project grant, funded by the Italian Ministry of University and Research and the EU NextGeneration initiative under the Research Projects of Relevant National Interest (PRIN) framework. His work under this initiative stems from observing recent dynamics in considering the protection of users' data and privacy and users' access to potential misinformation, through EU regulations and guidelines. A key aspect is the balance between the rights to confidentiality, autonomous decision-making, free access to information and freedom of expression.

Topic: AI-Driven Decarbonization: The Role of Machine Learning Algorithms in Achieving Net-Zero Emissions

LEAD PRESENTER

MR. TAYO OGUNDEJI
PRODUCT MANAGER, ARTIFICIAL INTELLIGENCE
HUAWEI TECHNOLOGIES LTD., CHINA

Tayo Ogundeji is an accomplished Product Manager at Huawei Technologies, driving innovation at the intersection of Artificial Intelligence and enterprise software solutions. With a deep-rooted understanding of software development and architectural design, Tayo brings technical precision and visionary leadership to the forefront of AI-driven product strategy.

In his current role, Tayo is focused on reshaping the enterprise sector by spearheading the development of intelligent digital solutions that streamline operations, enhance user experiences, and unlock new avenues for business growth. His expertise lies in integrating AI capabilities into complex systems, delivering transformative products that align with evolving industry needs.

Tayo's background in software engineering and system architecture equips him with the tools to bridge technical and business objectives, ensuring scalable and sustainable innovation across Huawei's enterprise portfolio.

Topic: Reshaping Customer Engagement in Digital Finance through Artificial Intelligence

LEAD PRESENTER

MR. FIDELIS ALU
AI PRODUCT MANAGER
W. W. GRAINGER, INC. CHICAGO, ILLINOIS, USA

Fidelis Alu is an AI Product Manager and applied researcher with a strong focus on leveraging artificial intelligence to optimize energy systems, digital infrastructure and enterprise operations. His work centers around applying deep reinforcement learning (DRL) and intelligent control systems to modernize power grids and support the global shift toward decarbonized energy.

With a Master's degree in Information Technology (University of Cincinnati) and a background in Mechanical Engineering (University of Cross River), Fidelis blends technical depth with product vision. His research explores how AI agents can support adaptive energy distribution, grid resilience and carbon footprint reduction—enabling smarter, more sustainable energy ecosystems.

Fidelis has experience working in key product leadership roles across industries, like W.W. Grainger, where he has supported digital transformation initiatives using AI and automation. At Grainger, he led programs focused on internal tooling, cloud infrastructure and intelligent workflows that improved operational efficiency across large-scale supply chains.

He is also the founder of VitalSearch, an AI-powered medical intelligence platform that delivers trusted clinical information using large language models (LLMs). Through this and other ventures, Fidelis continues to apply cross-domain insights to build scalable, human-centered AI solutions.

His broader interests include AI safety, sustainability and governance frameworks that support ethical innovation in critical sectors. He has presented academic research on AI bias and decision-making in space applications,

At ICEST 2025, under the theme "Convergence of AI, Digital Economy and Decarbonization," Fidelis will deliver a keynote presentation on "Deep Reinforcement Learning for Sustainable Energy Systems: Emerging Trends and Applications." His talk will explore how cutting-edge AI models can be deployed in real-world energy infrastructure to enhance performance, reduce emissions and accelerate the path toward a net-zero future.

LEAD PRESENTER

MR. SUNDAY OCHEDI
MECHANICAL CAD TECH/AUTONOMOUS SYSTEMS ENGINEER
ENGENIOUS DESIGN, CHICAGO, USA

Sunday Ochedi is a skilled Mechanical Design Engineer with a strong background in robotics and a passion for product innovation. As a SOLIDWORKS Champion, he excels in CAD modeling, Finite Element Analysis (FEA) and rapid prototyping, with a diverse experience spanning healthcare, consumer technology and automation. He is proficient in creating detailed and accurate CAD models using SOLIDWORKS and skilled in simulating and analyzing the behavior of complex systems and structures through FEA. Sunday is also experienced in creating functional prototypes to test and validate design concepts and adept at blending engineering precision with user-centered design principles to create innovative products.

With a background in working on various projects across multiple industries, including healthcare, consumer technology, and automation, Sunday has developed a unique ability to drive innovation and deliver high-quality products that meet the needs of users. In addition to his professional work, he is an avid freelancer, taking on projects that allow him to explore new ideas and apply his skills in creative ways. Sunday is committed to staying at the forefront of design innovation and technology, continually exploring new ideas and developing novel solutions that push the boundaries of product design and engineering through personal projects and research.

Sunday holds a BEng Degree in Mechanical Engineering from the Cross River University of Technology, where he graduated as the Best Graduating Student in Engineering. He furthered his education with a Master of Science Degree in Autonomous Systems and Robotics from the Illinois Institute of Technology, USA. Recognized for his expertise and proficiency in SOLIDWORKS, Sunday is well-equipped to drive innovation and deliver high-quality products that meet the needs of users.
Topic: Designing Medical Devices for a Sustainable Future: Integrating Innovation, Efficiency, and Care

LEAD PRESENTER

PROF. EZENDU ARIWA
DEPARTMENT OF COMPUTER SCIENCE & TECHNOLOGY,
UNIVERSITY OF BEDFORDSHIRE, UNITED KINGDOM

Professor Ezendu Ariwa holds the position of Professor in Computer Science at University of Bedfordshire, United Kingdom, Department of Computer Science & Technology, with speciality in Practice in Computing. He is also a Visiting Professor at Gulf University, Bahrain, Visiting Professor in Engineering Sustainability and ICT, Anadolu University, Turkey, Visiting Professor, University of Lagos, Nigeria, Visiting Professor and Co-Director of the Centre of Excellence in Cloud Computing, IAMTECH University, Sierra Leone and Visiting Professor, Kano State Polytechnics, Nigeria as well as Visiting Affiliate of the Green IT Observatory, RIMT University, Australia and Visiting Affiliate of ICT University, USA. He also holds the position of Director – Technical and Non-Executive Director and Research Professor for Enterprise Projects at Sun Bio IT Solutions Pvt. Ltd, India.
He is also the Chair for the IEEE Consumer Electronics Chapter, United Kingdom & Ireland (UK&I), Chair for the IEEE Broadcast Technology Chapter, UK&I and Chair for the IEEE Technology Management Council Chapter, UK&I. He is a Senior Member of Institute of Electrical & Electronic Engineers (SMIEE); Chartered FELLOW of the British Computer Society (CITP, FBCS), Fellow of the Institute of Information Technology Training (FIITT), Fellow of Institute of Leadership and Management (FInstLM), Fellow of the Higher Education Academy (FHEA) and Fellow of the Royal Society of Arts (FRSA). He is also a member of the Elite Group of The British Computer Society (BCS), member of British Institute of Facilities Management and Fellow of Global Strategic Management, Inc., Michigan, USA and Member of the UK Council for Health Informatics. He has experience of doctoral research supervision as well as doctoral external examiner for various Universities both in the UK and internationally.
He has a good research profile and the Founding Editor-in-Chief of the International Journal of Green Computing (IJGC), Editor-in-Chief of the International Journal of Computing and Digital Systems (IJCDS), Journal of E-Technology, and the Associate Editor of the International Journal of E-Politics and the Associate Editor of International Journal of Distributed Systems and Technologies (IJDST). He is a member of Policy Co-ordination Committee of the International Research Foundation for Development (A Corporation of NGO in special Consultative status with the Economic and Social Council of the United Nations). Professor Ezendu Ariwa is author of a number of books and more than 100 papers published in international journals and conference proceedings. He has also delivered keynote speeches at various international conferences.
He recently published three books: Green Technology Applications for Enterprise and Academic Innovation (ISBN13: 9781466651661, IGI publisher, USA); Africa Business, Sustainability and Technology Innovation Practices, (ISBN 978-605-86159-9-1), MacroWorld Publishers); Green Technology in E-Learning and Human Capital: Global Perspectives. MacroWorld Publisher, 2016 (ISBN : 978-605-86159-8-4)

LEAD PRESENTER

DR. OSITA CHUKWUMA
CEO & DIRECTOR
TUNGSTEN ENERGIES LTD., UNITED KINGDOM

Osi is a multifaceted professional, serving as CEO and Director of Tungsten Energy Ltd in the UK and Nigeria, a renewable energy company leading initiatives in hydrogen electrolysis and advocating for renewable energy adoption across industries in Nigeria. Simultaneously, as the Chief Executive of DGS Technologies (UK) since 2013, he's significantly improved operational performance, securing contracts with major companies like British Petroleum, BAT and Coca-Cola's Costa Coffee for IT and Big Data solutions.

With a PhD in Big Data Analytics and extensive experience in enterprise IT and infrastructure solutions in the UK and Nigeria, Osi is certified in various project management methodologies and a member of the Project Management Institute. Over 25 years, he's spearheaded portfolio management for FTSE 100 & 250 companies, engaging with C-Suite executives to formulate organizational strategies and operational models.

Beyond his professional commitments, Osi passionately engages in community service, mentoring young individuals in Nigeria and the UK. He organizes an annual IT conference aiding minorities in accessing professional employment and operates a charity funding education for disadvantaged students in Nigeria. Additionally, he shares his expertise as a guest lecturer at various UK universities.

Overall, Osi's career spans impactful leadership in energy, technology and academia, coupled with a strong commitment to philanthropy, shaping industries and positively influencing aspiring professionals and underprivileged communities in Nigeria and the UK.

Topic: Artificial Intelligence in Power Generation, Transmission and Distribution: Future directions for Nigeria

NATIONAL ANTHEM

Nigeria, we hail thee,
Our own dear native land,
Though tribe and tongue may differ,
In brotherhood we stand
Nigerians all,
And proud to serve our sovereign Motherland.

Our flag shall be a symbol
That truth and justice reign,
In peace or battle honoured,
And this we count as gain,
To hand on to our children
A banner without stain.

O God of all creation,
Grant this our one request:
Help us to build a nation
Where no man is oppressed,
And so with peace and plenty
Nigeria may be blessed.

STATE ANTHEM

Land of our Birth, we pledge to thee,
Our love and toil in the years to be,
When we are grown and take our place,
As men and women we are raise.
Cross River State our faith, our pride
Almighty God all thanks to thee
Our Motherland we pledge to thee
Heads, Hearts and hands in the years to be

WELCOME ADDRESS BY THE HOST

Welcome address presented by the Host, Engr. Prof. Simon Ogbeche Odey, Dean, faculty of Engineering, University of Cross River state, (UNICROSS), Nigeria, on the occasion of International Conference on Engineering, Science and Technology (ICEST, 2025).

The amiable Vice Chancellor, University of Cross River State,
Distinguished Keynote Speaker, Brig. Gen. Sikiru Adepoju Mohammed
Esteemed Plenary Speakers and Guest Lecturers
Distinguished Professors, Heads of Departments,
Members of the Academic and non-teaching staff,
Industry players
Sponsors and Partners & Participants from Nigeria and Beyond
Distinguished, Ladies and Gentlemen!

I'm highly honoured and privileged to welcome you all to the 3rd International Conference on Engineering, Science and Technology (ICEST), 2025. I particularly welcome our hard working, dedicated, passionately focused and amiable Vice Chancellor, Prof. Francisca Bassey. I also welcome the UNICROSS management team and other invited guests present here. I acknowledge the presence of all dignitaries and participants in this year's ICEST. It is my great pleasure to welcome you to this esteemed conference on the theme: "**Convergence of AI, Digital Economy and Decarbonization: Engineering Science and Technology for a Sustainable Future**".

Today, we gather to explore the transformative potential of artificial intelligence, digital economy, and decarbonization in shaping a sustainable future for all. The theme is uniquely chosen to express the current trend. As we converge on this critical topic, we recognize the pivotal role of engineering science and technology in addressing the world's most pressing challenges. Climate change, economic inequality and technological disruption require innovative solutions that harness the power of AI, digitalization and sustainable practices. Over the next 3 days, we will engage in thought-provoking discussions, share cutting-edge research and collaborate on solutions that can drive meaningful impact. I am confident that this conference will inspire new ideas, foster partnerships and accelerate progress toward a more sustainable future.

I extend my gratitude to our sponsors, organizers, speakers and participants for their dedication to this course. Special thanks to the Vice Chancellor of our great university, UNICROSS, for encouraging us with a release of funds to support our drive. Together, let us harness the power of convergence to create a better world. Thank you and I wish you a productive and enriching conference experience!

Dean, Faculty of Engineering
University of Cross River State, Nigeria

WELCOME ADDRESS BY THE ICEST COMMITTEE CHAIRMAN

- The Vice Chancellor, University of Cross River State
- Distinguished Keynote Speaker, Brig. Gen. Sikiru Adepoju Mohammed
- Esteemed Plenary Speakers and Guest Lecturers
- Deans and Heads of Departments
- Members of the Academic and Research Community
- Industry Leaders and Policymakers
- Sponsors and Partners
- Participants from Nigeria and Beyond
- Ladies and Gentlemen

Good morning, everyone!

On behalf of the Central Planning Committee of ICEST 2025, I extend a warm welcome to all distinguished guests, scholars, industry experts and participants gathered here today – both physically and virtually, for the 3rd International Conference on Engineering, Science and Technology (ICEST 2025). This is a biannual conference organized by the Faculty of Engineering, University of Cross River State (UNICROSS), Nigeria.

This year's theme, "Convergence of AI, Digital Economy and Decarbonization: Engineering, Science and Technology for a Sustainable Future," reflects our collective commitment to addressing global challenges through innovation, collaboration and sustainable solutions.

ICEST 2025 serves as a pivotal platform to:

- Foster interdisciplinary dialogue on cutting-edge advancements in AI, green energy and digital transformation.
- Showcase research across 12 sub-themes, from smart grids to biomedical innovations, aligning with global sustainability goals.
- Bridge the gap between academia, industry and policymakers to translate ideas into actionable strategies for Nigeria and beyond.

We are honored to host renowned speakers, especially the keynote speaker Brig. Gen. Sikiru Adepoju Mohammed and all the 11 Guest Speakers whose insights will illuminate pathways to a decarbonized and digitally empowered future.

We deeply appreciate:

- The Vice Chancellor for her unwavering institutional support and for graciously declaring this conference open.
- Our sponsors and partners, whose contributions have been instrumental in bringing this event to life.
- The organizing committee, reviewers and volunteers for their tireless efforts in ensuring a seamless experience for all participants.

To our attendees, your presence enriches this exchange of ideas. Whether you are presenting a paper, participating in technical sessions or networking, your engagement is the cornerstone of ICEST's success.

Over the next two days, let us:

- Collaborate across borders and disciplines.
- Innovate with a focus on sustainability and inclusivity.
- Inspire the next generation of engineers and scientists to lead the charge towards a greener tomorrow.

Once again, thank you for joining us. Let's make ICEST 2025 a milestone in the journey towards a sustainable future.

Welcome, and let the conference begin!

Engr. Dr. Samuel Oliver Effiom
Sub-Dean, Faculty of Engineering & Chairman, ICEST 2025
University of Cross River State, Nigeria

Day 1: Conference Opening Ceremony & Plenary Sessions

Venue: Chapel of Grace Hall, UNICROSS
Virtual Line/Zoom Link: Join Zoom Meeting - https://mit.zoom.us/j/97573440076
Meeting ID: 975 7344 0076

- Arrival, onsite registration, & accreditation of participants (8:00am – 9:00am)
- Introduction of dignitaries/Sponsors (9:00am – 9:15am)
- Opening Prayer (9:15am – 9:20am)
- National Anthem (9:20am – 9:25am)
- State Anthem (9:25am – 9:30am)
- Declaration of the Conference open by Chief Host, the Vice Chancellor (9:30am – 9:35am)
- Host's welcome address (Dean, Faculty of Engineering, UNICROSS) (9:35am – 9:40am)
- ICEST Committee Chairman's welcome address (9:40am – 9:45am)
- Group Photograph with invited dignitaries (9:45am – 9:55am)
- **Citation of keynote speaker: Brig. Gen. Sikiru Adepoju Mohammed** (9:55am – 10:00am)

- **Keynote Lecture:** Emerging Technologies and Digital Economy: Sustainable STEM Practices in Focus (10:00am – 10:45am)
- Remarks on the keynote lecture (10:45am – 10:50am)
- Vote of thanks by the ICEST committee chairman (10:50am – 10:55am)

Plenary Papers by Guest Speakers

- **Plenary Paper 1:** Eco-Integrated Infrastructure Planning and Delivery Strategies; by **Professor Hilary Ijeoma Owamah** (11:00am – 11:30am).
- **Plenary Paper 2**: Maximizing Capacity for Adoption of Decarbonization Technologies and Utilization of Renewable Biomaterials: Nigeria's Path to a Sustainable Future; by **Prof. Nureni Adedapo Adewole** (11:30am – 12:00pm).
- **Plenary Paper 3**: Artificial Intelligence in Power Generation, Transmission and Distribution: Future directions for Nigeria; by **Dr. Osita Chukwuma** (12:00pm – 12:30pm).
- Recognition of ICEST 2025 Sponsors. (12:30pm – 12:40pm)
- **Plenary Paper 4**: Innovative Pathways to Decarbonization and Energy Efficiency in the Marine, Energy, and Power Sectors: Achieving IMO and EU 2050 Targets; by **Engr. Peter Inah** (12:40pm – 1:10pm)
- **Plenary Paper 5**: Deep Reinforcement Learning for Sustainable Energy Systems: Emerging Trends and Applications; by **Mr. Fidelis Alu** (1:10pm – 1:40pm)
- **Plenary Paper 6**: Designing Medical Devices for a Sustainable Future: Integrating Innovation, Efficiency, and Care; by **Mr. Sunday Ochedi** (1:40pm – 2:20pm)

LUNCH BREAK (2:20pm – 2:30pm)

- **Plenary Paper 7**: AI-Driven Decarbonization: The Role of Machine Learning Algorithms in Achieving Net-Zero Emissions; by **Dr. Blessing Guembe** (2:30pm – 3:00pm)
- **Plenary Paper 8**: Digital Transformation in Nigerian Telecoms: Innovations, Challenges and the Road Ahead; by **Mr. Isaac Martins** (3:00pm – 3:30pm)
- **Plenary Paper 9**: Reshaping Customer Engagement in Digital Finance through Artificial Intelligence; by **Mr. Tayo Ogundeji** (3:30pm – 4:00pm)
- **Plenary Paper 10**: Neurodiversity and Artificial Intelligence Applications for Green Technology Decarbonization Sustainability; by **Prof. Ezendu Ariwa** (4:00pm – 4:30pm)
- **Plenary Paper 11**: Current and on the horizon eVTOL technologies for sustainable urban transportation; by **Dr. Burhan Saeed** (4:30pm – 5:00pm)
- Remarks on Plenary Papers (5:00pm – 5:30pm)
- Closing

Day 2: Technical Sessions

Track A: Innovative Materials and Digital Technologies for Sustainable and Low-Carbon Construction			
S/N	AUTHoR(S)	PAGE TITLES	PIDN
1	Apeh, S. E.*, Subair, O. W., Achema, F., Ekpe, E. E., Ochei, E. S., Fabiyi, M. O., Ogedoh, I. T., Fajugbagbe, A.	Circular Economy, Materials Reuse and Waste Management for Sustainability in Nigeria	**A1**
2	Daodu A. E*, Agbonko E.B, Ovat, F. A, Ofem, M. I, Fakorede, O.D.	Experimental and Taguchi Optimisation Technique to Determine the Tensile Strength of Cow Bone and Cassava Cortex Hybrid Composite for Automotive Application	**A2**
3	Itakwu, John Unimke*, Tolulope E. Kolajo, Obu, Joseph Ekunke, Temidayo E. Omoniyi	Modification of Lignocellulosic Polymer via Chemical Treatments to Improved Bamboo Plastic Composites	**A3**
4	J.E. Obu*, O.O. Adefisan, J.U. Itakwu, A.D. Atowon	Production and Testing of Blockboard made from Tectona grandis Wood	**A4**
5	Atowon, A. D. Jimmy, U. A. Enang, O. P. and Obu, J.E.	Mechanical evaluation of hybrid paper from selected lignocellulose materials	**A5**
6	O. Q. Hassan-Ajao*, P. A. Okanlawon, T. E. Omoniyi	Development And Performance Evaluation of a Locally Fabricated Multi-Mould Wood Cement Composite Vibrating Table Machine	**A6**
7	Wofai O. Ewa*, Wofai O. Usang	Artificial Project Management Intelligence (APMI): PM-AI Automation for Sustainable Engineering and Digital Futures	**A7**
8	Enang, Patrick Ofem* Ekeng, Emmanuel Ewa	The Role of Stakeholders Management and Managerial Stakeholder Theories in Ensuring on-Time Construction Project Completion	**A8**
9	O. E. Eteng*, D. E. Aju and R. U. Ekor	Preliminary Analysis on The Suitability of Crushed Palm Kernel Shells (CPKS) As Partial Replacement for Fine Aggregate in Concrete	**A9**
10	Daniel E. AJU*, Kennedy C. ONYELOWE, Lawrence O. ODUM, Ofem E. ETENG	Constrained Vertex Optimization and Simulation of the California Bearing Ratio Properties of Geotextile Reinforced Soil for Flexible Foundation Construction	**A10**
11	Asibong A. Icha	Developing Sustainable Forest Practices for Bio-material Production to Serve as Alternative for Industrial Growth	**A11**

Track B: AI and Scientific Innovations for Environmental Sustainability in a Digital Economy			
S/N	AUTHoR(S)	PAGE TITLES	PIDN
12	Effiom, Reuben Otu	Intelligent Water and Environmental Management for a Sustainable Future	**B1**
13	Bello R. S.*, Saidu M. J., Sampson N. M., Bello M. B., Odey S. O.	Waste management and Public Health in Nigeria: A Study of Ebonyi State Environmental Protection (EBSEPA) Activities in Selected Towns	**B2**
14	Milliscent Ededet*, Dickson Atowon, Emmanuel Ugbong	Sustainable Energy Generation from Agricultural waste: A Review	**B3**
15	Bello R. S.*, Odey S. O. Bello M. B. Sampson N. M.	A critical review of women exclusion in agricultural development revolution: contributions, constraints, and strategic solutions	**B4**
16	Bassey, Iniko Ekeng*, J. O. Babatola, O. M. Ojo, E. O. Onagbola.	Development of Bioreactor System for Green Energy Production from Termite-Digested Agro Solid Wastes.	**B5**
17	Ekeng, Emmanuel Ewa*, Enang, Patrick Ofemb	Comparing Flood Frequency Analysis of Calabar Municipal Council Using Annual Peak Rainfall Data of Calabar Metropolis	**B6**
18	Ibiang Ebri Ibiang, Ofem Patrick* Enang Emmanuel Ewa Ekeng	Artificial Project Management Intelligence (APMI): PM-AI Automation for Sustainable Engineering and Digital Futures	**B7**
19	OBIO, E. A	Effects of Environmental Factors Influencing Evapotranspiration in Nigeria	**B8**
20	Robert Ibingha Ekom, R. U. Ekor	Advancement of Water Resources and Irrigation Practices: A Case Study of a Farmstead in Calabar, Southern Nigeria.	**B9**
21	Tawo Godwin A*., Osahon O., Gertrude Fischer A.	Enhancing and Adaptation of E-commerce Network for Micro/Cooperative Farmers in Developing Nations (A Case Study of Nigeria's Agricultural Sector	**B10**

Track C: Next-Gen Energy Systems and AI Solutions for a Decarbonized Future			
S/N	AUTHoR(S)	PAGE TITLES	PIDN
22	Bariledum Dumkhana*, Dodeye Igbong	Compressed Air Energy Storage (CAES) Plant: A Technical, Economic, and Exergoenvironmental Review for a Sustainable Low-Carbon Future	**C1**
23	Thankgod Sylvanus Ntem*, Nwafor Christiana O., Olumide Omojola, Eko James Akpama	Impact Assessment of Seasonal Turbidity Variation and Distributed Generation on The Energy Demand of Water Treatment Infrastructure in Cross River State, Nigeria	**C2**
24	Cordelia Ochuole Omoyi*, Edward Asu Obi, David Ogar Ushie Gideon, A.O.G Fidelis Abam	Evaluating Renewable Energy Technologies for Low-Carbon Transition: A Multi-Criteria Decision Technique	**C3**
25	Cordelia Ochuole Omoyi*, Dane Osim-Asu, Samuel Oliver Effiom, Fidelis Abam	Extended Thermoeconomic Metrics and Sustainability Potential of Small Wind Energy Systems: A Case-Based Analysis	**C4**
26	Isaac John*, Samuel Effiom, Igiri Uket, Cordelia Ochuole Omoyi, Fidelis Abam	Optimizing Biodiesel Production from Underutilized Non-Edible Oils Based on Metaheuristic Grey Wolf Technique	**C5**
27	Ibiang Kapona Igwe*, Eko James Akpama, Ekum, Awuna Eyam	Optimization Of a Hybrid Solar-Wind Energy System for Rural Electrification: A Case Study of Ugep, Mkpani Community, Yakurr LGA.	**C6**
28	Achunikang, Fidelis Ayourim*, Ubi, Inah Ibor	Hybrid Energy Storage System In Future Micro Grid	**C7**
29	Omini Okon Jimmy*, Samuel Oliver Effiom, Maria-Kaka Etete Enoh, Oliver Ibor Inah	Optimizing Vertical Axis Hydro Turbines for In-Pipe Power Generation: A Comparative Analysis of Lift-Type and Drag-Type Design	**C8**
30	Ntunde, Dilibe Ifeanyi* and Igbo, Joseph Chidiebere	Carbon and Particulate Matter Capturing Potential of Zeolite in Gasoline Generators	**C9**
31	Jehoshaphat John Egbai	Evaluating the Impact of Energy Access on Health Outcomes in Nigeria	**C10**
32	Florence Peter Edet*, Gertrude Austin Fischer, Evarest Bassey Oyom, Ekum, A. Eyam and Asuquo Eke	Comparative Analysis of Renewable Energy Technologies and its Application in Ikot Oson, Akwa Ibom State, Nigeria	**C11**
33	Oluremi Joshua Ibitoye	Performance Analysis of a Multigeneration Ammonia Powered Plant Operating with Gas Turbine and Solid Oxide Fuel	**C12**

Track D: Smart Grids, AI, and Intelligent Communication Systems for Sustainable Development			
S/N	AUTHoR(S)	PAGE TITLES	PIDN
34	ThankGod Sylvanus Ntem*, Iwueze Ifeanyi M., Iwuamadi Obioma C.	Comparative Analysis of Distributed Generation Penetration for Enhanced Energy Efficiency in Power Network Operation: A Case Study of Cross River State Waterboard Distribution Network	**D1**
35	Omini, Ofem Uket* and Fischer, Gertrude Austine	Design Of Isosceles Triangle for Antenna Terrestrial Broadcasting and Satellite Communication Using Method of Moment (Mom)	**D2**
36	Ake David*, Asuquo Eke, Abdulahi M.M., Eneji Joseph Ewhe., Akpama E.J,	Modeling of a Synchronous Generator for Performance Enhancement and Stability Assessment (Simulink Approach)	**D3**
37	Peter O. Ohiero	Advanced Forecasting of Solar Irradiance in Calabar for Effective Electric Energy Management Using Machine Learning	**D4**
38	Patrick O. Odu*, Obasi-sam O. Ojobe, Peter Daffin Onwe, Lehi-Owor Obojor Ogar	PSAT Simulation-Based Study of Voltage Performance of Nigeria 330kv Power System Network	**D5**
39	Ekpenyong Nsa Oku*, Eko James Akpamab, Emmanuel E. Effiongc, Effiong E. Cobhamd, Victor Inyang	Optimized MPPT Algorithm Integration for Smart Photovoltaic (PV) Systems in Modern Power Applications	**D6**
40	M. I. Elemi*, E. E. Akisot, C. J. Edeubaka, S. E. Okachi, E. I. Ene	Mitigation of Power Quality Disturbances in Nigerian Power Systems Using a Series of Active Filters and Dynamic Voltage Restorers Controlled by Space Vector Pulse Width Modulation (SVPWM	**D7**
41	Julius Omonafe Ezra*, Godwin Ogoh Ogbu	Assessment of the Impact of Distributed Generation in a Distribution Network	**D8**
42	Godwin Ogoh Ogbu*, Julius Omonafe Ezra	Evaluating The Impact of Shunt Capacitors and Harmonic Filters On Power Flow Optimization	**D9**
43	Johnpaul Oliver Effiom*, Deborah Emmanuel Abel, Gertrude A. Fischer	Implementing the use of AI-Driven Biomedical Signal Processing (AI-BSP) in Nigeria: Opportunities, Challenges and Strategic Pathways	**D10**
44	Gertrude A. Fischer*, Nseobot Akpan, Ebenezer N. Agbor	Advancing Precision Medicine with Smart Sensors for Real-Time Health Monitoring and Diagnostics	**D11**

Track D: Smart Grids, AI, and Intelligent Communication Systems for Sustainable Development			
S/N	AUTHoR(S)	PAGE TITLES	PIDN
45	Noah Aniah*, Nsa Ewa Ekeng, Gertrude A. Fischer	Powering the Future with Smart Sensors for Intelligent Grids and Zero-Waste Energy Systems	**D12**
46	Okokon Okon Ekpenyong*, Gertrude A. Fischer	MATLAB-Based Simulation of Simultaneous Wireless Information and Power Transfer (SWIPT) In Wireless Sensor Networks (WSNs) With Rf Energy Harvesting.	**D13**
47	Ochicha G. Egbung*, Gertrude A. Fischer	Comparative Performance Analysis of a Rectangular Micro Strip Patch Antenna For C- Band Application	**D14**
48	Osungbohun, Olumide Cornelius* Tim, Peter Oritsetimeyin and Okpon, Walter Okorn	Investigating the Effect of Distance, Temperature and Time on Signal Strength of HIT 95.9 FM Station Calabar Cross River State Nigeria.	**D15**
49	Ibiang Kapona Igwe*, Ubi, Inah Iborb Gertrude Fischer	The Future of Innovative Smart Grid and Microgrid Cybersecurity in Nigeria Technologies.	**D16**
50	Ekum, A. Eyam*, Iyaji, S. Ogbaji, Peter O. Ohiero, Archibong, A. Etim and Eko J. Akpama	Real-Time Fault Classification in Smart Grids Using Wavelet Transform and Machine Learning in Simulink	**D17**
51	Asuquo Eke, Etim Archibong, David Ake, E.J Akpama, O. I. Okoro,	Effect of Swing Bus Placement Location on the Distance Buses in an Electric Grid Network (Case Study: Nigeria Transmission 330kv Lines Network)	**D18**
52	Gertrude Fischer, Friday C., Prince Chinedu*, Ayi A. Bassey, Isaac A. Victor, Udoekpo I. Akpan	Artificial Intelligence (AI)-Enhanced Signal Interference Mitigation in Wireless Communication	**D19**
53	Peter Eguhe Egbenta	Optimization Of Reactive Power Compensation in a 132kv Transmission Network Using Fact Device	**D20**
54	Gregory Gregory Udofa	Enhancing Protection of Transmission Lines Using Wavelet Transform-Based Fault Detection	**D21**
55	Olasunmade, Rilwan Alaoa, Itam, Promise Thomasb	Design And Construction of Autophase Selector with Android Interface	**D22**
56	Esangebianga Victor Oboho*, Brown Udoma Brownson, Ignatius Ugar Atsu	Genetic Algorithm-based Optimizing Network Layer Protocols for High Bit Rate Applications in Wireless Communication Systems	**D23**

Track D: Smart Grids, AI, and Intelligent Communication Systems for Sustainable Development			
S/N	AUTHoR(S)	PAGE TITLES	PIDN
57	Udeh Maryrose Ify*, Ojile Precious, Mgbe Ferdinand Bassey, Okafor Chidera Onyebuchi	Investigating the Feasibility and Impact of Localized Edge Computing in Nigerian Cities for Smart Applications.	**D24**
58	Udeh, Maryrose*, Odu Patrick, Asuquo Eke, Etim Archibong, Israel Osamudiamen	The Economic Impact of Solar Energy Embedded to Calabar Distribution Network for Effective Energy Delivery and Reliability	**D25**
59	Gertrude A. Fischer*, Loveth Ebong Angiating, Edwards Emmanuel	Artificial Intelligence in Robotics: A Comprehensive Review of Algorithms, Architectures, and Application	**D26**
60	Akpa Pius Wonaha*, Anyin Paul Betianga, Idang, Ushie Idang, Angiating, Edwards Emmanuel	A Review on an Adaptive Neuro-Fuzzy Reinforcement Learning Controller for Real-Time Personalized Insulin Delivery in Type 1 Diabetes Mellitus Patients	**D27**
61	Akpama, E. J.*, and Arong, V. A.	Sensorless Control of Induction Machines.	**D28**
62	Anyin Paul Betiang*, Anyin Peter Betianabeshe, Unde Sornen Ralph	Pontryagin-Based Optimal Load Shedding Strategy for Renewable-Integrated Microgrids under Uncertain Demand	**D29**

Paper Presentation Schedule

Venue: Engineering Conference Room, UNICROSS	
Time: 9:00am - 5:00pm	
Chairman: Engr. Prof. Fedilis Abam	
Rapporteur: Engr. Dr. Obio Ekpe	
Zoom: https://mit.zoom.us/j/99669331015	
Meeting ID: 996 6933 1015	
Time	**TIDN**
9:00 – 9:15	A2
9:15 – 9:30	A3
9:30 – 9:45	A4
9:45 – 10:00	A5
10:00 – 10:15	A7
10:15 – 10:30	A8
10:30 – 10:45	A9
10:45 – 11:00	A10
11:00 – 11:15	A11
11:15 – 11:30	B1
11:30 – 11:45	B3
11:45 – 12:00	B5
11:45 – 12:00	B6
12:00 – 12:15	B7
12:15 – 12:30	B8
12:45 – 1:00	B9
1:00 – 1:15	B10
1:15 – 1:30	C1
1:30 – 1:45	C2
1:45 – 2:00	C3
2:00 – 2:30	**LUNCH**
2:30 – 2:45	C4
2:45 – 3:00	C5
3:00 – 3:15	C6
3:15 – 3:30	C7
3:30– 3:45	C9
3:45– 4:00	C10
4:00 – 4:15	C11
4:15 – 4:30	C12
Collection of Certificates	

Venue: Civil Engineering PG Room, UNICROSS	
Time: 9:00am - 5:00pm	
Chairman: Engr. Dr. Nkpa Ogarekpe	
Rapporteur: Engr. Sunday Iyaji	
Zoom:	
Meeting ID:	
Time	**TIDN**
9:00 – 9:15	D1
9:15 – 9:30	D2
9:30 – 9:45	D4
9:45 – 10:00	D5
10:00 – 10:15	D6
10:15 – 10:30	D7
10:30 – 10:45	D8
10:45 – 11:00	D9
11:00 – 11:15	D10
11:15 – 11:30	D11
11:30 – 11:45	D12
11:45 – 12:00	D13
11:45 – 12:00	D14
12:00 – 12:15	D15
12:15 – 12:30	D16
12:45 – 1:00	D17
1:00 – 1:15	D18
1:15 – 1:30	D19
1:30 – 1:45	D20
1:45 – 2:00	D21
2:00 – 2:30	**LUNCH**
2:30 – 2:45	D22
2:45 – 3:00	D23
3:00 – 3:15	D24
3:15 – 3:30	D25
3:30– 3:45	D26
3:45– 4:00	D27
4:00 – 4:15	D28
4:15 – 4:30	D29
Collection of Certificates	

Venue: Virtual Presentation	
Time: 11: 00am - 2:00pm	
Chairman: Engr. Dr. Joseph Ukpata	
Rapporteur: Engr. John Itakuw	
Virtual Presentation Link: https://us06web.zoom.us/j/85639258965?pwd=XrYq347JyhdbwLF0C5ROWKbVilo3oL.1	
Meeting ID: 856 3925 8965 **Passcode:** 915097	
Time	**TIDN**
11:00 – 11:20	A1
11:20 – 11:40	A6
11:40 – 12:00	B2
12:00 – 12:20	B4
12:20 – 12:40	C8
12:40 – 1:00	D3
1:00 – 1:20	
1:20 – 1:40	
1:40 – 2:00	
1:40 – 2:00	LUNCH

BOOK OF

ABSTRACT

1. Circular Economy, Materials Reuse and Waste Management for Sustainability in Nigeria

Apeh, S. E.[a,*], Subair, O. W.[a], Achema, F.[a], Ekpe, E. E.[a], Ochei, E. S.[a], Fabiyi, M. O.[a], Ogedoh, I. T.[a] and Fajugbagbe, A.[a]

[a] Engineering Materials Research Department, Nigerian Building and Road Research Institute, Ota. Nigeria.
* corresponding author email: solomonapeh@gmail.com

Abstract: Nigeria's rising industrialisation, urbanisation, and lack of proper waste management infrastructure are causing the country to face increasing environmental concerns. Making the shift to a circular economy (CE), which encourages resource efficiency, material reuse, and efficient waste management, offers a feasible route to sustainability. With a focus on the possibilities for material reuse in industries including electronics, construction, and agriculture, this article addresses the applicability of CE principles in Nigeria. It also looks at how waste is currently managed, pointing out areas where infrastructure, policies, and public awareness are lacking. Based on international best practices and local case studies, the paper explores ways to incorporate CE into Nigeria's development plans. Nigeria may use circular economy methods to mitigate environmental degradation, improve economic resilience, and advance sustainable development, according to the findings, provided that the appropriate legislative frameworks, technological investments, and stakeholder participation are in place.

Keywords: Sustainability, Waste Management, Circular Economy, Environmental Challenges

2. Experimental and Taguchi Optimization Technique to Determine the Tensile Strength of Cow Bone and Cassava Cortex Hybrid Composite for Automotive Application

Daodu A. E [a,*], Agbonko E[a], Ovat F. A [a], Ofem M. I [a]

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Abstract: The increasing demand for sustainable, lightweight, and high-performance materials in the automotive industry has led to extensive research into the development of bio-based composites. Natural fibre composites, though environmentally friendly, often lack the mechanical strength required for structural applications. This study investigates the development and optimisation of a hybrid composite material reinforced with cow bone and cassava cortex particles, aimed at improving tensile strength for potential automotive applications. The composite samples were fabricated using the hand lay-up method and reinforced with varied proportions of cow bone and cassava cortex particles. An L18 orthogonal array based on the Taguchi method was employed to systematically design the experiments and optimise three key factors: reinforcement composition, NaOH chemical treatment, and particle size. Tensile strength tests were conducted in accordance with ASTM D3039 standards using a Universal Testing Machine. The results showed that the optimal configuration—20% cow bone, 20% cassava cortex, 4% NaOH treatment, and 100 µm particle size—yielded the highest tensile strength of 91.80 MPa. Statistical analysis using signal-to-noise (S/N) ratios and ANOVA confirmed reinforcement composition as the most significant factor influencing strength, followed by chemical treatment and particle size. The study demonstrates that agricultural waste materials can be effectively converted into high-performance reinforcements in polymer composites through appropriate optimisation techniques. The findings support the feasibility of developing cost-effective, environmentally sustainable composite materials with improved mechanical performance for specific automotive structural applications.

Keywords: Optimisation, automotive application, hybrid composites, tensile strength, biomaterials.

3. Modification of Lignocellulosic Polymer via Chemical Treatments to Improve Bamboo Plastic Composites

Itakwu, John Unimke [a,*], Tolulope Eunice Kolajo[b], Obu, Joseph Ekunke[a], Temidayo E. Omoniyi[b]

[a] University of Cross River State, Calabar, Nigeria
[b] University of Ibadan, Ibadan, Ibadan, Nigeria
*Corresponding author email: johnitakwu@gmail.com

Abstract: Wood plastic composites (WPC) have replaced traditional materials in numerous applications due to their favourable properties, such as lightweight, durability and cost-effectiveness. Bamboo is a construction material that is often discarded as waste after used. This can be reused in wpc production, but there is need for pretreatment to enhance durability and compatibility with plastics. WPC made from bamboo and plastic waste are pre-treated with 5% sodium hydroxide (NaOH) to determine their physical and mechanical properties. Waste plastic water bottles and bamboo wastes were collected and used in the proportions 100/0, 95/5, 90/10, 85/15 and 80/20 respectively. The samples were produced through injection moulding method. Water absorption (WA), Density, thickness swelling (TS) and flexural strength were the properties determines according to ASTM standards. For untreated and treated bamboo plastic composites (BPC), the density decreases as the bamboo content increases from 5% to 20%. WA for untreated ranges 0.07% to 1.08% for 24hrs soaking in water while the treated WA ranges from 0.05% to 0.42% for 24hrs soaking in water. Similarly, TS for untreated ranges from 0.09% to 0.61% for 24hrs soaking in water while treated ranges from 0.07% to

1.08% for 24hrs soaking in water while the treated WA ranges from 0.05% to 0.42% for 24hrs soaking in water. Similarly, TS for untreated ranges from 0.09% to 0.61% for 24hrs soaking in water while treated ranges from 0.07% to 0.53% for 24hrs soaking in water. Mechanical analysis indicated that flexural strength ranges from 1.77Mpa to 2.83Mpa for Untreated and 1.77Mpa to 3.21Mpa for treated BPC. Optimum flexural properties were obtained at 15% bamboo content for both treated and untreated. The composites' moderate strength and dimensional stability suggested that they may be used in a variety of settings such as, floor and wall tiles, wall panels and indoor insulting components.
Keywords: bamboo plastic composites, NaOH Pre-treatment, sustainability

4. Production and Testing of Blockboard made from *Tectona grandis* Wood

J.E. Obu[a,*], O.O. Adefisan[b], J.U. Itakwu[c], A.D. Atowon[c]
a*,c University of Cross River State, Calabar Nigeria
b University of Ibadan, Ibadan, Nigeria
* corresponding author email: josephekunkeobu72@gmail.com

Abstract: The scarcity of renowned economic wood species has given rise to the imminent search for suitable alternatives such as Engineered Wood Products (EWP). Blockboard is an EWP made from strips of wood bonded with adhesive and veneered to form timber like products which can be deployed for internal and external applications. Blockboard was made from Tectona grandis wood species, using top bond adhesive and tested for selected physical, mechanical and water sorption properties. The results obtained indicated that the composites had adequate moisture content (17.2%), moderate density (605.1 kg/m3), low mechanical property (Moduli of Rupture- 40.1 MPa and Elasticity- 4,500.2 MPa, compressive strength parallel to grain- 36.3 MPa). The fabricated board was not suitable for structural applications but may be adapted for non- structural purposes such as interior decoration, wall cladding and novel furniture items.
Keywords: Blockboard, *Tectona grandis*, Engineered Wood Products (EWP), Wood Scarcity, Furniture

5. Mechanical evaluation of hybrid paper from selected lignocellulose materials

Atowon, A. D.[a,*], Jimmy, U. A. [b], Enang, O. P.[b] and Obu, J.E.[b]
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Abstract: The exponential population growth, industrialization and urbanization has risen the need for pulp and paper products, avert effect on shortage fibrous wood based pulp resource and increased deforestation are link with over tapping of wood based pulp and paper production. The study presents the mechanical evaluation of hybrid paper from blends of *Raphia farinifare* and *Gmelina arborea* fibres, aimed at exploiting alternative fibre source. *Raphia farinifare,* an underutilized agro –based material with coarse and long fibres displayed excellent reinforcing characteristic and G. arborea fibre contributed to improved fibre bonding and surface properties. Key paper properties were investigated such, paper grammage, tensile strength, tear resistance, bursting strength and fold endurance, depicted mechanical integrity with valued aligned with TAPPI standards of three blends of paper. However, the evaluation underscored the potential of locally sourced agro –waste/ non- conventional raw materials in promoting sustainable and cost-effectiveness further enhanced the shift toward circular economy practices by utilizing agricultural residues and rapidly renewable fibre sources.
Keywords: Renewable fibres, Kraft pulping, Hybrid paper and mechanical properties

6. Development and performance evaluation of a locally fabricated Multi-mould Wood Cement Composite Vibrating Table Machine

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Abstract: The properties and functionality of wood-cement boards are affected by air bubbles, void spaces, weak spots, and component segregation. Improving the vibrating table's functionality was the focus of this study. The top plate of the multi-mould vibrating table was developed with full uniform unidirectional vibration and dua-driven electrically and manually. The primary parts are the electric motor, springs, top plate as a platform, stand frame, and unbalanced eccentric assembly. The vibrating table with an eccentricity assembly of mass 1.64 kg produced ten (10) composite tiles at the same time, with an operating frequency of 1500 rpm and an amplitude of 0.4 mm, an average production rate of 1020 Roman tiles per hour. Non-porous, homogenous, and well-consolidated boards were produced and had superior attributes compared to conventional boards, as the performance test revealed.
Keywords: Cola nitida sawdust, Fiber-cement Tiles, Multi-mould vibrating-table, Machine design

7. Artificial Project Management Intelligence (APMI): PM-AI Automation for Sustainable Engineering and Digital Futures

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Abstract: The convergence of artificial intelligence (AI) and project management (PM) is rapidly transforming the landscape of infrastructure and engineering delivery in the digital era. Traditional project management frameworks, while structured and systematic, are increasingly limited in addressing the complexity, scale, and sustainability demands of modern engineering projects. This study introduces the concept of Artificial Project Management Intelligence (APMI)—a systems-based, AI-driven framework designed to augment project delivery across the full lifecycle, from initiation to closing. APMI integrates tools such as machine learning (ML), natural language processing (NLP), robotic process automation (RPA), and intelligent dashboards to enable data-driven decisions, proactive risk management, and sustainability-aligned operations. The research employs a qualitative exploratory approach involving expert interviews with 14 professionals from diverse sectors, supported by simulation-based analysis and AI tool modelling. Two case studies—a retrospective application to the Lagos Blue/Red Line urban rail project and a futuristic deployment in Saudi Arabia's NEOM smart city—demonstrate APMI's potential for improving delivery efficiency, stakeholder coordination, and sustainability performance. Key findings show that APMI can significantly enhance project accuracy, responsiveness, and transparency while addressing ethical concerns such as algorithmic bias and human oversight. The paper concludes that APMI represents a pivotal advancement for sustainable engineering in the digital economy and recommends sector-wide adoption, supported by policy frameworks, adaptive toolkits, and AI readiness training. Future directions include plug-and-play AI agents, reinforcement learning, and cross-domain collaboration for scalable implementation.
Keywords: Artificial PM Intelligence, AI in Engineering, Sustainable Delivery, Lifecycle Automation, Digital PM Transformation

8. The Role of Stakeholders Management and Managerial Stakeholder Theories in Ensuring on-Time Construction Project Completion

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Abstract: Timely delivery of construction projects remains a significant challenge in Nigeria, often due to inadequate stakeholder coordination and ineffective management practices. The study aims to define the role of stakeholder's management and managerial stakeholder's theories in ensuring on-time construction project completion. This study explores the role of stakeholder management and managerial stakeholder theories in enhancing the on-time completion of construction projects. It examines how stakeholder engagement, conflict resolution, communication practices, contract conditions, and ethical managerial theories influence project success. Data was collected through structured surveys and interviews with construction professionals across Nigeria. Analysis was conducted using qualitative methods that guides stakeholder engagement across the project life cycle. Findings indicate that conflict among stakeholders, lack of stakeholder knowledge, and insufficient professional training are major barriers to timely project delivery. The findings reveal that by applying Freeman's stakeholder's theory about 20% of project are more likely to finish on time. Also, it shows that high stakeholders' engagement reduces change orders by 15% and lastly, conflicting stakeholder's interests cause 30% of delays in large-scale project. The study proposes a validated stakeholder management framework to improve project outcomes and recommends institutional training, early stakeholder mapping, and ethical governance as strategies for improvement. This research provides a comprehensive guide for construction industry practitioners and policy makers seeking to improve stakeholder collaboration and ensure timely project completion in Nigeria.
Keywords: Stakeholder, Stakeholder management, Stakeholder engagement, Stakeholder Interference, Managerial Stakeholders' theories.

9. Preliminary Analysis on the Suitability of Crushed Palm Kernel Shells (CPKS) as Partial Replacement for Fine Aggregate in Concrete

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Abstract: This research investigates the use of Crushed Palm Kernel Shells (CPKS) as a partial replacement for fine aggregate in concrete. The specific objective was to evaluate the effects of CPKS on selected concrete properties, using replacement levels of 0%, 10%, 20%, 30%, 40%, and 50%. Concrete mix ratios of 1:2:4, 1:3:6, and 1:1½:3 were tested for compressive strength at 7, 14, 21, and 28 days. Concrete samples without CPKS (0% replacement) served as the control group. The batching was done by weight. Crushed CPKS, with particle size less than 4.75 mm, was incorporated into the concrete. A total of 96 concrete cubes, for each mix ratio, compressive strengths (in N/mm²) of 20.88, 20.21, 19.35, 18.36, 17.32, and 16.49 for the 1:3:6 mix; 25.08, 24.41, 23.47, 22.65, 21.28, and 20.25 for the 1:2:4 mix; and 26.93, 26.42, 25.51, 24.42, 23.76, and 22.69 for the 1:1½:3 mix.
Keywords: compressive, strengths, Crushed, Palm-kernel, Shells.

10. Constrained Vertex Optimization and Simulation of the California Bearing Ratio Properties of Geotextile Reinforced Soil for Flexible Foundation Construction

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Abstract: In this study, extreme vertex design (EVD) was adapted for the mixture experiment involving the problematic soil strength properties modification for civil engineering construction use through the utilization of geotextile materials for soil reinforcement. This soil stabilization approach's aim is to reduce the overall road cross-section layer thickness, enhancing road performance by improving the bearing capacity and durability of the road pavement. EVD method provides a flexible design of experiment approach in soil stabilization, where the components are imposed with constraints at the lower and upper limits and the experimental points are got from the vertex, edges, center and interior portions of the constrained region. Using design experts and Minitab 18 software, the design of experiments, statistical diagnostics and influences, and graphical and numerical optimization were carried out. I-optimal design with quadratic model design was utilized to explore the constrained experimental region to formulate the mixture ingredient proportions at 10 experimental runs. I-optimality and D-optimality of 0.39093 and 1747.474, respectively, was obtained with G-efficiency of 64.8%. The test soil's general engineering properties and classification were carried out before the mechanical properties tests with respect to varying ratios of mixture components. Responses were obtained through a laboratory process and the generated data utilized for model development and statistical analysis.The desirability function was utilized to achieve numerical and statistical optimization to arrive at the optimal solution for the mixture components combination at 0.002:0.098:0.9 for geogrid, water and soil respectively. A desirability score of 1.0 was obtained with an optimal response of 19.546%.
Keywords: Soil, geotextile, reinforcement, ratio, Optimization.

11. Developing Sustainable Forest Practices for Bio-material Production to Serve as Alternative for Industrial Growth

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Abstract: The rapid depletion of wood resources due to continuous harvesting and deforestation has necessitated the exploration of alternative materials to support industrial growth. This paper examines the potential of bio-materials, particularly bamboo, as viable substitutes for wood in industrial applications, highlighting the role of sustainable forest practices in their development and utilization. Bamboo, with its fast-growing rate, high strength properties and versatility, offers an eco-friendly and cost-effective alternative to wood products. However, its industrial adoption in Nigeria faces challenges such as inadequate processing equipment, limited local innovation and low awareness of its economic potential. Reflected in this paper is the importance of sustainable forest practices to ensuring the availability of bio-materials while preserving biodiversity. It also emphasizes the need for localized equipment development and skills training to overcome barriers to efficient bio-material production. By integrating sustainable forest practices with innovative equipment and policy support, The State can unlock the industrial potential of bio-materials, reduce deforestation and drive economic growth. This paper can serve as a framework for stakeholders to advance sustainable forestry and bio-material development as key pillars of a resilient and green industrial future.
Keywords: Sustainable Development, Forest Practices, Bio-materials, Bamboo Utilisation, Wood Alternative, Industrial growth.

12. Intelligent Water And Environmental Management For a Sustainable Future

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Abstract: The water sector is grappling with escalating challenges in achieving sustainable urban water management, driven by climate change, rapid urbanization, and population growth. Key issues include cost recovery, non-revenue water (NRW) management, equitable revenue generation, and addressing increasing water demand. Traditional management practices have proven inadequate, necessitating the adoption of advanced technologies and resilient frameworks. This work explores the integration of artificial intelligence (AI), machine learning, and information and communication technologies (ICT) to enhance water management efficiency, reduce losses, and ensure sustainable resource utilization. Case studies from regions like Portugal and Korea demonstrate the transformative potential of smart water management (SWM) systems, which leverage IoT, GIS, and real-time data to optimize distribution, monitor quality, and detect leaks. The implementation of SWM strategies has significantly reduced NRW, improved system efficiency, and lowered operational costs, positioning regions among the most efficient globally. Furthermore, the integration of micro-hydropower projects has enhanced energy efficiency and reduced CO2 emissions, highlighting the water-energy nexus. The findings emphasize the need for strategic investments, policy alignment, and the adoption of advanced technologies to ensure long-term water sustainability in the face of emerging challenges.
Keywords: Environmental Management, Sustainable Water, Smart Water Management

13. Waste management and Public Health in Nigeria: A Study of Ebonyi State Environmental Protection (EBSEPA) Activities in Selected Towns

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Abstract: This study evaluates the impact of public administration on the operational effectiveness of the Ebonyi State Environmental Protection Agency (EBSEPA) in managing solid waste across five major towns in Ebonyi State. Increasing urbanization, population growth, and escalating waste generation, prompted the research in identifying major gaps in infrastructure, policy implementation, and public engagement in the agency's waste management activities. The study adopts a human capital theoretical framework and utilizes a stratified survey method to assess types of waste generated, level of community awareness, availability of waste infrastructure, and health implications of poor waste disposal. The findings reveal that although EBSEPA is moderately effective in urban centers like Abakaliki, faces significant operational deficiencies in rural and semi-urban areas due to inadequate infrastructure, poor enforcement, and low public awareness. Indiscriminate dumping and limited health surveillance contribute to respiratory, waterborne, and vector-borne diseases across the state. The study concludes that strengthening public administration through decentralization, funding, public education, and community inclusion is critical to enhancing EBSEPA's performance and achieving sustainable environmental governance in Ebonyi State.
Keywords: Public administration, waste management, environmental protection, EBSEPA, health implications

14. Sustainable Energy Generation from Agricultural Waste: A Review

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Abstract: The increase in agricultural production has resulted in increased quantities of livestock waste, agricultural crop residues, and agro-industrial by-products. A review of agricultural wastes, such as palm oil and other wastes, is valuable because of their contribution to environmental degradation and the need to convert them to value-added products, such as renewable energy, to reduce their impacts. This paper reviews the available renewable biomass resources that can enable developing countries, including Nigeria, to overcome their current energy challenges. The palm oil industry generates a large quantity of waste, making its disposal a challenging task. Apart from a few isolated cases where palm kernel shells (PKS) and palm fruit fiber serve as sources of fuel for cooking, they are usually dumped in open fields and water ponds, which negatively impacts the environment. Renewable energy produced from agricultural waste will add to the national system in view of the exhausting nature of fossil fuel resources coupled with the challenges of environmental degradation.
Keywords: Sustainable energy, Agricultural wastes, palm oil wastes, palm kernel shell, Biomass

15. A critical review of women exclusion in agricultural development revolution: contributions, constraints, and strategic solutions

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Abstract: Women's roles in agricultural production system have been relegated as traditionally domestic contributors to reproductive tasks, despite their pivotal roles in agricultural systems across the globe; they remain systematically marginalized in decision-making, access to productive resources, technology adoption, and leadership. This paper investigates the multi-dimensional discrimination of women in agriculture, highlighting both structural and socio-cultural barriers that hinder their empowerment. Drawing on global and regional evidences, the study explores the historical and contemporary contributions of women to sustainable agricultural practices, emphasizing the exclusivity of women from male-centric agricultural tool and machine development, extension services, and agrarian governance. It concluded that women are regarded as passive recipients in the agricultural development trajectory despite their contributions to the development of the sector. The paper proposed gender-responsive reforms and implementation in the area of tool redesign and female-centric ergonomic considerations as agricultural technology advances. It further suggests an inclusive policy frameworks, capacity-building strategies, and public sector reforms to enhance women's recognition in agriculture. The study advocates for the mainstreaming of gender equity as a fundamental pillar for achieving sustainable productive agri-food systems.
Keywords: Gender inclusivity, empowerment, passive farmer, public sector reform, gender-responsive policy

16. Development of Bioreactor System for Green Energy Production from Termite-Digested Agro Solid Wastes

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Abstract: The enormous and increasing waste generation due to distressing population pressure on land space and its attendant problems of air, water and land pollution necessitates innovative, sustainable and cost-effective approach to solid waste management. The energy from such biomass is projected to make possible Nigeria's ability to contribute to balancing future bioenergy demands. This work demonstrates the feasibility of using termite-digested biomass for optimal solid waste degradation, global warming control and generation of green/clean gas for energy, which can efficiently replace the more expensive fossil fuel. Three lignin-containing solid waste types were chosen based on their availability/abundance and evaluated by designed experimental run over a 30-day period. In-situ termireactors were created using polycarbonate material (plexiglass) and inserted into existing active termites' colony to mimic its natural habitat. Maize cob/shaft, sugarcane bagasse and coconut husks were the selected cellulose sources and feed characterization was carried out in accordance with ASTM D 5142-04. The termites in their termitaries were fed with the selected feedstocks and the emitted gas flow rate and volumes were obtained using glass float micro rotameter flow meter. The thermo-hygrometer probe devices were deployed to directly measure and monitor the micro-climatic conditions of the termitaries over time. This research investigates the relationship between key operational parameters and retention time within this novel bioreactor system developed for green energy production using termite-digested agro solid waste. Results reveal that temperature and relative humidity profiles of sugarcane bagasse, maize cob, and coconut husk within the bioreactor displayed a characteristic zigzag pattern over a 30-day retention period, reflecting dynamic microbial activity and substrate-specific decomposition behaviors. Temperature fluctuations ranged between 27.17°C and 31.19°C, with peaks corresponding to active microbial phases such as acidogenesis and methanogenesis. Relative humidity increased progressively, reaching up to 98.15%, with intermittent dips highlighting termite metabolism and variable moisture release from feedstocks. Feed consumption increased steadily for all substrates, with sugarcane bagasse showing the highest consumption (0.63 kg) due to its favorable lignocellulosic structure. Daily and cumulative biogas production followed an upward trajectory with retention time, further emphasizing the impact of feedstock composition. Sugarcane bagasse yielded the highest biogas volume (59,775 cm^3/day by day 30), while maize cob, with higher lignin content, produced the least. These findings affirm that retention time, temperature, relative humidity and feedstock biodegradability significantly influence biogas yield. Among the feedstocks tested, sugarcane bagasse emerged as the most efficient substrate.

17. Comparing Flood Frequency Analysis of Calabar Municipal Council Using Annual Peak Rainfall Data of Calabar Metropolis

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Abstract: This manuscript explores the flood frequency dynamics within the Calabar Municipal Council, employing annual peak rainfall data sourced from the Calabar metropolis. The study aims to compare flood frequency analysis results based on annual peak rainfall data within the Calabar Municipal Council, providing insights into the council's hydrological vulnerabilities. Utilizing statistical methods and hydrological analysis techniques, the research examines historical rainfall records to construct flood frequency curves and estimate return periods for different areas within the municipal council. The methodology involves the compilation and analysis of long-term rainfall datasets that were collected from meteorological stations across Calabar metropolis. Flood frequency analysis methodologies, including the Log-Pearson Type III and Gumbel distributions, were applied to discern patterns and trends in flood occurrences. Comparative assessments were conducted for Gumbel distribution values, Log-Pearson III distribution and Simulation-based method values to identify spatial disparities and temporal variations in flood frequency distributions across different zones within Calabar Municipal Council. Considering the prediction for 10, 20, 50, 100 years, empirical method shown the range, 150, 200, 240, and 270mm while Gumbel method gave 160, 210, 280, and 300mm. Also, Log-Pearson III method shown a range of 165, 220, 290, and 310mm and finally, the Simulation- Based method shown ranges of 170, 225, 290, and 310mm. Municipal Council, employing annual peak rainfall data sourced from the Calabar metropolis. The study aims to compare flood frequency analysis results based on annual peak rainfall data within the Calabar Municipal Council, providing insights into the council's hydrological vulnerabilities. Utilizing statistical methods and hydrological analysis techniques, the research examines historical rainfall records to construct flood frequency curves and estimate return periods for different areas within the municipal council. The methodology involves the compilation and analysis of long-term rainfall datasets that were collected from meteorological stations across Calabar metropolis. Flood frequency analysis methodologies, including the Log-Pearson Type III and Gumbel distributions, were applied to discern patterns and trends in flood occurrences. Comparative assessments were conducted for Gumbel distribution values, Log-Pearson III distribution and Simulation-based method values to identify spatial disparities and temporal variations in flood frequency distributions across different zones within Calabar Municipal Council. Considering the prediction for 10, 20, 50, 100 years, empirical method shown the range, 150, 200, 240, and 270mm while Gumbel method gave 160, 210, 280, and 300mm. Also, Log-Pearson III method shown a range of 165, 220, 290, and 310mm and finally, the Simulation- Based method shown ranges of 170, 225, 290, and 310mm.
Keywords: Flood frequency, Calabar Municipal, Peak rainfall, Flooding, Gumbel distributions

18. Optimizing Concrete Strength With Rice Husk Ash and Palm Kernel Shell: : An Environmental Waste Minimization Approach

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Abstract: This study investigates the potential of rice husk ash (RHA) and palm kernel shell (PKS) as partial replacements for cement and coarse aggregate, respectively, in sustainable concrete design. Amidst increasing global emphasis on environmental sustainability and the need to mitigate the ecological footprint of cement production. Agricultural waste by-products present a promising alternative. A total of 25 concrete cubes were prepared with varied mix ratios and subjected to compressive strength and workability tests. Regression modeling was employed to predict compressive strength based on cement, sand, RHA, PKS, and gravel proportions. The optimal mix (1:2:0: 0:4) yielded a compressive strength of 24.375 N/mm², while the regression model demonstrated moderate predictive capability with an R^2 of 0.435. The findings affirm the viability of integrating agro-waste into concrete design to enhance strength and promote eco-efficient construction.
Keywords: Rice Husk Ash (RHA), Palm Kernel Shell (PKS), Sustainable Concrete, Compressive Strength, Waste Valorization, Regression Modeling, Cement Alternatives

19. Effects Of Environmental Factors Influencing Evapotranspiration in Nigeria

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Abstract: Evapotranspiration is the loss of water to the atmosphere by two processes – evaporation and transpiration. Evaporation is the loss of water from open bodies of water such as lake, reservoirs, bare soil and snow cover, while transpiration is the loss of water from living plant surface to the atmosphere. Humility and temperature works in concert with each other to determine the dryness or drying power of the atmosphere. The Vapour Pressure Deficit (VPD) is the meteorological variable used to quantify the drying power of the atmosphere. The most important environmental factors influencing evapotranspiration include net solar radiation, surface areas of open bodies of water, wind speed density and type of vegetation cover, availability of soil moisture, root depth, reflective land surface characteristics stomata resistance ecosystem, crop management practices, temperature, humidity. There is need to minimize or control the negative effects of these factors through mulching, planting of trees to serves as wind break, a well-designed drip or trickle irrigation, intercropping practices should be encouraged in Nigeria to protect our environment for the best to mankind
Keywords: Evapotranspiration, Evaporation, Transpiration, Vaporization

20. Studies of Water Resources Advancement in Relation to Irrigational Requirements in a Selected Farmstead in Calabar, Southern Nigeria

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Abstract: This study investigates water resources advancement for irrigation in a selected farmstead, Royal International Farm, in Calabar, Southern Nigeria. The objectives were to determine the available moisture content of arable land, measure rainfall and infiltration data, parcel the land into measurable irrigated plots, and develop an irrigational requirement model using statistical analysis. Soil samples from 16 locations were analyzed for moisture content, and infiltration rates were measured using a double ring infiltrometer. Rainfall data were collected via non-recording rain gauges. Statistical analysis using SPSS yielded a model with an adjusted R^2 of 0.171, explaining 17.1% of the variance in irrigational processes. The derived model is $Y = -0.0179 + 0.0000006X_1 + 0.015X_2 - 0.000012X_3$, where Y represents infiltrated water, X_1 is irrigated land area, X_2 is soil moisture content, and X_3 is rainfall. The study highlights the need for comprehensive water resource management to address challenges such as surface water availability, pollution, and ecosystem health, recommending enhanced hydrological data collection and sustainable practices like rainwater harvesting and groundwater management.
Keywords: Water resources, irrigation, infiltration, soil moisture, Calabar, statistical modeling

21. Enhancing E-Commerce for Micro/Cooperative Farmers in Nigeria: A Scalable Digital Solution

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Abstract: Agricultural trade in Nigeria faces persistent challenges due to poor infrastructure, limited digital literacy, and fragmented market access. This paper proposes a scalable e-commerce platform tailored for micro/cooperative farmers to address these issues. The platform is built using a three-tier architecture with Python/Django and MySQL, offering secure user authentication, product management, and escrow-based transactions. Offline order placement and simplified interfaces enhance accessibility for low-literacy users. Data flow diagrams and a normalized database schema support system integrity and scalability. A case study involving cassava farmers in Benue State demonstrates a 30% increase in revenue through direct market access. This solution presents a viable model for digital agricultural transformation in developing economies
Keywords: E-commerce, micro/cooperative farmers, digital agriculture, Nigeria, scalable platform

22. Compressed Air Energy Storage (CAES) Plant: A Technical, Economic, and Exergoenvironmental Review for a Sustainable Low-Carbon Future

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Abstract: Nigeria's energy sector faces critical challenges with unreliable grid failure, causing the people to depend solely on fossil fuels, while abundant yet underutilized solar and wind potential, presents a compelling case for adopting Compressed Air Energy Storage (CAES). This study examines CAES as a sustainable solution for grid reliability and decarbonization, capable of replacing fossil fuel-based Peaker plants while reducing greenhouse gas (GHG) emissions. Four CAES variants: conventional diabatic (D-CAES), adiabatic (A-CAES), isothermal (I-CAES), and underwater (UW-CAES) systems were revealed based on the technical feasibility, economic viability, and environmental benefits of CAES deployment. Results indicate that A-CAES is most suitable for Nigeria, offering 60-70% round-trip efficiency without fossil fuel dependence, though requiring thermal energy storage investment. Technical assessments demonstrate CAES's superiority for long-duration storage (6-24 hours) with 20,000 + cycle lifespan, outperforming battery alternatives. Economic modeling reveals favorable levelized costs ($0.10-0.20/kWh) compared to diesel generation ($0.30-0.50/kWh), with potential for ₦150-300/kWh savings through peak shaving. The study highlights Nigeria's exceptional CAES potential, with northern solar resources (4-6 kWh/m²/day) and coastal wind patterns (5 -7 m/s) ideally complementing storage requirements. Environmental assessments through exergy analysis and lifecycle evaluation show A-CAES can reduce grid emissions by 25-40% compared to current diesel reliance. The findings provide a roadmap for sustainable energy storage implementation for Nigeria's energy security and decarbonization.
Keywords: Compressed air energy storage, renewable integration, grid stability, energy transition

23. Impact Assessment of Seasonal Turbidity Variation and Distributed Generation on The Energy Demand of Water Treatment Infrastructure in Cross River State, Nigeria

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Abstract: Seasonal variations significantly influence the energy demand of water treatment infrastructures, particularly in regions with pronounced climatic shifts. This study evaluates the impact of seasonal turbidity fluctuations on the energy consumption in Cross River State Waterboard treatment plant, calabar, where dry-season turbidity peaks at 194 NTU, compared to 17 NTU in the rainy season. Using historical water quality and energy consumption data from the Cross River State Waterboard, the analysis quantifies correlations between turbidity and energy demand, alongside assessing the efficacy of Distributed Generation integration for grid stability. Results reveal a 23.5% higher daily energy demand during the dry season, driven by frequent backwashing of water filters. Load variability (measured by standard deviation) was 45% higher in dry periods, indicating operational instability. Distributed Generation implementation during peak hours reduced daily energy consumption by 9.1%, lowered peak demand by 30%, and decreased load variability by 37%, demonstrating its potential to enhance grid resilience. Statistical tests ($p<0.001$) confirmed the significance of seasonal energy differences and Distributed Generation effectiveness. The study underscores the critical role of adaptive strategies, such as renewable energy adoption and process optimization, in mitigating turbidity-driven energy spikes and contribute to sustainable water management practices in regions facing similar climatic challenges.
Keywords: Energy demand, water treatment plants, turbidity, Cross River State, operational optimization, Distributed generation integration.

24. Evaluating Renewable Energy Technologies for Low-Carbon Transition: A Multi-Criteria Decision Technique

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Abstract: This study utilizes the Analytic Hierarchy Process (AHP) to evaluate and prioritize renewable energy technologies for decarbonization in Nigeria, considering five key criteria: cost, CO_2 emission reduction, availability, maintenance, and social acceptance. Expert judgment was used to construct pairwise comparison matrices for these criteria and five renewable energy alternatives: solar photovoltaic (PV), wind, biomass, hydropower, and geothermal. The results reveal CO_2 emission reduction as the most critical factor, receiving a weight of 0.416, followed by availability (0.262) and cost (0.161). Geothermal energy emerged as the highest-ranked option with a priority score of 0.241, indicating its superior potential for decarbonization. Wind and solar PV ranked second and third, with priority scores of 0.226 and 0.203, respectively. Biomass and hydropower scored lower, with priority values of 0.172 and 0.158, respectively. Sensitivity analysis showed that even with a 10% increase in CO_2 reduction weight, geothermal remained the top choice, with a slight increase in score (0.241 to 0.255). These findings offer evidence-based insights for Nigeria's renewable energy policy, emphasizing the need for targeted investments and further exploration of geothermal resources
Keywords: Analytic Hierarchy Process (AHP), Decarbonization, Renewable Energy Technologies

25. Extended Thermoeconomic Metrics and Sustainability Potential of Small Wind Energy Systems: A Case-Based Analysis

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Abstract: This study assesses wind energy potential across six locations in Cross River State, Nigeria, for small-scale Wind Energy Conversion Systems (WECS). Annual mean wind speeds ranged from 3.38 m/s at OGP1 to 5.3 m/s at OBUP5, with no site recording speeds below 3 m/s indicating suitability for wind applications. Power and energy densities spanned 6.8-102.9 W/m² and 4.49-85.58 kWh/m², respectively, with the highest values at OBUP5 and AKP4. Exergy-based indicators were analyzed; Bergey XL.1 showed a 70.37% increase in the Exergetic Sustainability Index (ESI), a 9.09% rise in Waste Exergy Ratio (WER), and a 33% gain in Useful Speed Volume (USV), demonstrating efficient airflow utilization. Proven-2.5 kW and Skystream-3.7 kW exhibited ESI increases of 46% and 52%, respectively. Exergetic equivalents of labor (*eel*) ranged from 43.36 MJ (OGP1) to 65.04 MJ (BKP3), while capital equivalents (*eec*) varied from 64.88 MJ/$ to 80.11 MJ/$. Cost of energy (COE) values ranged from $0.063/kWh (BKP3, Proven-2.5 kW) to $0.181/kWh (OBRP6, Skystream-3.7 kW), confirming both technical and economic viability.
Keywords: Exergetic Sustainability Index, Cost of Energy, Small-scale wind power

26. Optimizing Biodiesel Production from Underutilized Non-Edible Oils Based on Metaheuristic Grey Wolf Technique

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Abstract: Biodiesel from non-edible feedstocks has gained significant attention due to its reliability, cost-effectiveness, and environmental benefits compared to conventional fossil fuels. Mucuna bean seed and Gmelina seed are abundant non-edible resources in Nigeria and other regions, making them promising feedstocks for biodiesel production because of their favorable oil content and composition. In this study, the Grey Wolf Optimization (GWO) algorithm was employed to optimize biodiesel production from Mucuna bean seed and Gmelina seed oils and to analyze the interactive effects of key process parameters. The parameters investigated included reaction time, stirring speed, methanol-to-oil molar ratio, catalyst concentration, and temperature. The GWO results revealed that the combination of catalyst concentration and reaction time yielded the highest biodiesel output at 93.5%, while catalyst concentration with temperature achieved 80%. Interactions between stirring speed and methanol/oil ratio resulted in 65% yield, whereas temperature combined with speed produced the lowest yield of 38.7%. These findings demonstrate that the GWO algorithm effectively optimized the biodiesel production process from these feedstocks, providing valuable insights into parameter interactions and highlighting opportunities to enhance the efficiency and sustainability of biodiesel production.
Keywords: Greywolf (GWO), Biodiesel, Optimization, Mucuna bean seed, Gmelina seed.

27. Optimization of a Hybrid Solar-Wind Energy System for Rural Electrification: A Case Study of Ugep, Mkpani Community, Yakurr LGA

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Abstract: Rural electrification remains a pressing challenge in many parts of Nigeria, including Ugep and Mkpani communities in Yakurr LGA. This paper investigates the human-centered design and technical optimization of a hybrid solar-wind energy system tailored to the unique socio-economic and environmental needs of the communities. The research employs HOMER Pro for technical simulation and optimization, incorporating local resource availability, energy demand, and economic feasibility. Results reveal that a properly sized hybrid configuration significantly improves reliability and affordability, while human-centric planning ensures long-term community engagement and sustainability.
Keywords: Hybrid Energy System, Solar-Wind Optimization, Energy Access, HOMER Simulation, Off-grid Power System.

28. Hybrid Energy Storage System In Future Micro Grid

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Abstract: This study explores the development and simulation of an innovative Hybrid Energy Storage System (HESS) designed for future micro grids, integrating Lithium-ion batteries and super capacitors. The HESS combines a 12V, 200Ah Lithium-ion battery with a 16V super capacitor bank made up of six series-connected capacitors and one parallel capacitor, totaling 500F. This combination leverages the high energy density of batteries and the rapid power delivery capability of super capacitors, aiming to enhance grid stability and efficiency despite the intermittent nature of renewable energy sources. Using MATLAB, the research formulates a comprehensive mathematical model to evaluate the dynamic performance, efficiency, and feasibility of the hybrid system in micro grid scenarios.

Results indicate that the HESS effectively manages both steady-state and transient power demands: the battery handles high-demand surges, while the super capacitors provide quick responses during rapid load changes. The simulation demonstrates a harmonious operation where the hybrid system improves power delivery stability and renewable energy utilization. The findings suggest that this HESS configuration can optimize energy storage, contributing to the resilience and sustainability of micro grids, ultimately supporting the transition toward cleaner energy sources and more reliable power networks.
Keywords: Hybrids Energy Storage System**,** Micro grid, System dynamics and Micro Grid Stability

29. Optimizing Vertical Axis Hydro Turbines for In-Pipe Power Generation: A Comparative Analysis of Lift-Type and Drag-Type Designs

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Abstract: This paper presents a comparative analysis of lift-type and drag-type vertical axis hydro turbines for small-scale power generation in water pipelines, drawing on recent advancements in turbine design and computational fluid dynamics (CFD). Building on the work of Yang et al. (2019), the study evaluates the performance of these turbines in terms of power output, efficiency, and pressure loss under varying flow conditions. Lift-type turbines are found to be more efficient and suitable for larger pipelines (>200 mm diameter) with flow velocities above 1 m/s, while drag-type turbines are better suited for smaller pipelines (e.g., 100 mm diameter) due to their simpler design. A proposed optimization framework integrates blade number, chord length, and dynamic stall mitigation strategies to enhance turbine performance. The findings provide actionable insights for deploying in-pipe turbines in municipal water systems, contributing to sustainable energy harvesting.
Keywords: K Vertical axis hydro turbine, lift-type turbine, drag-type turbine, water pipelines, computational fluid dynamics, sustainable energy

30. Carbon and Particulate Matter Capturing Potential of Zeolite in Gasoline Generators

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Abstract: The increasing levels of carbon emissions from anthropogenic activities are a major contributor to climate change, air pollution and environmental degradation. This study evaluates the particulate matter and carbon capturing efficiency of Zeolite with the respect to the quantity in mitigating emissions from small-scale gasoline generators. Using a 2 KVA Senwei gasoline generator and a multi-stage gas analyzer, the concentrations of carbon dioxide (CO_2), carbon monoxide (CO), and particulate matter (PM2.5) were measured before and after introducing zeolite as an adsorbent. It was observed that the zeolite exhibited proportional significant adsorption capacity with removal efficiencies of 43.42% for CO_2, 87.28% for CO, and 73.12% for PM2.5 at a mass of 100 g over a 20-minute interval. Thus with pollutant reductions which correlates positively with increased zeolite mass and exposure time. The study also highlights zeolite's potential as a cost-effective, eco-friendly material for emission reduction. These findings provide insights into integrating zeolite-based carbon capture systems into industrial and domestic generators, contributing to global efforts to mitigate environmental pollution and achieve climate goals.

31. Evaluating the Impact of Energy Access on Health Outcomes in Nigeria

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Abstract: Energy access is a critical determinant of health outcomes, particularly in low- and middle-income countries like Nigeria. This paper evaluates the impact of energy access on health outcomes in Nigeria with a focus on maternal and child health. We found that energy access is associated with improved healthcare delivery, reduced morbidity and mortality rates, and enhanced healthcare services, including vaccine refrigeration, medical equipment use, and emergency care. Through qualitative analysis, policy review and feedbacks, the study proposes a strategy to investigate Healthcare facilities functionality with respect to access to electricity allowing healthcare facilities to provide services using medical equipment, lighting, and communication systems, access to electricity for water treatment, pumping, and purification which can improve access to clean water and sanitation facilities and access to clean cooking fuels and electricity which can reduce indoor air pollution from polluting fuels. Communities with access to energy experience improved health outcomes. Also vulnerable populations, including mothers, children, and the elderly, benefit the most from access to energy and energy access can reduce healthcare costs and improve economic productivity if properly harnessed. This research supports SDG 3 (Good Health and Wellbeing) and SDG 7 (Affordable and Clean Energy) by demonstrating empirical relationships between energy and health. Improved diagnostics such as the cold chain for vaccines and the functioning of ultrasounds and laboratories strengthens primary care synthesized through reliable power. It motivates longitudinal analyses aimed at estimating the impact of enhanced energy access on significant health outcomes over time along with evidence-based financing and costing for energy-health initiatives at both federal and state levels. It also strengthens policy and regulatory frameworks that facilitate the growth of renewable energy.
Keywords: Energy Access, Health outcomes, renewable energy

32. Comparative Analysis of Renewable Energy Technologies and Its Application in Ikot Oson, Akwa Ibom State, Nigeria

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Abstract: This paper conducts a comparative analysis of the application of solar, wind, and biomass energy technologies to assess their viability, efficiency, and potential contribution to Nigeria's energy mix. This paper analysis compares the technological, economic, and environmental implications of deploying these renewable energy sources across the diverse geographical regions. Key factors such as resource availability, cost of deployment, energy efficiency, scalability, and environmental impact were explored. Results show that solar energy is favored for due to high solar insolation but faces challenges related to initial costs and energy storage. Wind energy is suitable for specific regions but encounters limitations in terms of predictability and infrastructure requirements. Biomass energy, leveraging agricultural and organic waste, presents a dual opportunity for waste management and energy production but raises concerns about land use and sustainability. Further findings shows that incoming solar energy was 2,702kWh/yr, energy stored was 2,165kWh/yr, storage depletion was 4.31kWh/yr, losses were 541kWh/yr and the total output was 2,421kWh/yr. The capital cost was $14,400, and the annualized cost was $1,114. This showed a salvage value of $13,286 in operational year. In 24 hours, the maximum solar output power was 12kWh/day. This is enough to operate the required load. The maximum wind encountered here was 2.5m/s. The maximum output power was 1kWh/day. The biomass maximum power generated was 2kWh/yr. In 24 hours, 100% of the energy was generated and in 24 hours, 4kW/h of that power was consumed. This showed that renewable technology is a good way to follow if properly harnessed will be a better source of energy.
KeyWords: Biomass energy, Renewable energy, Wind energy, Solar energy, Organic waste.

33. Performance Analysis of a Multigeneration Ammonia Powered Plant Operating with Gas Turbine and Solid Oxide Fuel

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Abstract: The performance analysis of Ammonia powered multigenerational system using a solid oxide fuel cell is presented in this research. This study examines the performance of a high-temperature solid oxide fuel cell combined with a conventional recuperative gas turbine (GT–SOFC) plant, as well as the irreversibility within the system. Individual models are developed for each component, through applications of the first and second laws of thermodynamics. The overall system performance is then analyzed by employing individual models and further applying thermodynamic laws for the entire cycle, to evaluate the thermal efficiency and entropy production of the plant. The results of an assessment of the cycle for certain operating conditions are compared against those available in the literature. The comparisons provide useful verification of the thermodynamic simulations in the present work. The comparisons provide useful verification of the thermal simulations in the present work. Further outcomes indicate that increasing the turbine inlet temperature results in decreasing the thermal efficiency of the cycle, whereas it improves the net specific power output. Moreover, an increase in either the turbine inlet temperature or compression ratio leads to a higher rate of entropy generation within the plant. It was found that the combustor and SOFC contribute predominantly to the total irreversibility of the system. About 60% of the irreversibility takes place in the following components at typical operating conditions: 31.4% in the combustor and 27.9% in the SOFC. A comparison between the GT–SOFC plant and a traditional GT cycle, based on identical operating conditions, is also made. Although the irreversibility of a modern plant is higher than that of a conventional cycle, the superior performance of a GT–SOFC, in terms of thermal efficiency and environmental impact (zero CO2 emissions), over a traditional GT cycle is evident. It has about 27.8% higher efficiency than a traditional GT plant. In this case, the thermal efficiency of the integrated cycle becomes as high as 60.6% at the optimum compression ratio.

34. Comparative Analysis of Distributed Generation Penetration for Enhanced Energy Efficiency in Power Network Operation: A Case Study of Cross River State Waterboard Distribution Network

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Abstract: The integration of distributed generation (DG) into power distribution networks has emerged as a critical strategy for enhancing energy efficiency and grid reliability, particularly in regions with unstable grid infrastructure like Nigeria. This study evaluates how distributed generation penetration levels (10%, 33%, and 70%) affect energy efficiency, voltage stability, and operational feasibility in the Cross River State Waterboard Power Distribution Network. Using a combination of MATLAB-based power flow simulations, statistical analysis (paired t-tests, ANOVA), and sensitivity modeling, the study compared each distributed generation scenario against a base case (0% DG) to quantify performance trade-offs. Key findings reveal that 33% DG penetration delivers optimal benefits, reducing grid power dependency by 28.5% and line losses by 27.3%, while improving voltage stability. Higher penetration (70%) introduces voltage rise risks (>1.05 p.u.), necessitating advanced control strategies. The study also identifies load-specific responses, with pump stations showing greater sensitivity to DG variability than administrative buildings. These results provide actionable insights for Nigerian utilities, recommending phased DG deployment (30–40% penetration) for water infrastructure and highlighting the need for smart inverters in high-DG scenarios. By bridging the gap between theoretical Renewable Energy Integration potential and real-world implementation, this work contributes to sustainable energy planning in developing economies.
Keywords: Distributed Generation Penetration, Energy Efficiency, Voltage Stability, Water Infrastructure, Renewable Energy Integration, Developing Economies.

35. Design of Isosceles Triangle for Antenna Terrestrial Broadcasting and Satellite Communication Using Method of Moment (Mom)

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Abstract: The aim of this research is to design a triangular antenna using the isosceles triangle shape. It is a simple and compact design. The antenna was design to resonate at the frequency of 9.328MHz and 32.16cm wavelength. This antenna is noted for its high directive characteristics, the choice for its application as antennas mostly used for line of sight microwave signal transmission in communication systems. For the simulation and design calculations, MatLab and CST studio suite simulation tools were used. In this research, various parameters such as return loss, radiation resistance, radiated power, E –field intensity were evaluated. Method of moment was used to determine the current distribution on the antenna. The results obtained showed the loss resistance is zero, therefore, the efficiency of the antenna became 100% and radiated power as 116.1watt. With 1.875dBi gain, it directivity was 0.9375, confirming the antenna's high directivity characteristics. Because of it compactness flexibility, and it directionality, it can be used as a directional antennas, especially in satellite communications. This antenna has good performance in terms return loss, radiation resistance, and gain.
Keywords: Isosceles Triangle, antenna, loop, method of moment

36. Modeling of a Synchronous Generator for Performance Enhancement and Stability Assessment (Simulink Approach)

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Abstract: Maintaining synchronism between multiple generators within the network is growing tougher with time. Since the expansion of an interconnected system is an ongoing process, new generators are often added to the network. This paper analyzes the transient stability of a synchronous machine coupled to loads at various points on the system. It also solves a number of differential equations using MATLAB/SIMULINK and analyzes the Swing equation. The equations that explain the performance of a three-phase salient-pole synchronous machine under various situations (at no fault, three-phase fault, and single-phase fault at A, B, and C) may be used to forecast the electrical and electromechanical behavior of the majority of synchronous machines. With the use of simulation models, this study aims to clarify stability studies of synchronous machines by examining the performance of the proposed linearized model of synchronous machines under normal and disturbance conditions using the Swing equation, small signal performance, and application to 3-phase fault. Although there are a number of ways to establish transient stability in synchronous machines, the proposed system behaviors are tested in this study utilizing the Swing equation and numerical solutions using MATLAB/SIMULINK. The anticipated outcome of this effort is to demonstrate when temporary system impacts may be eliminated by lessening their impact on the machines.
Keywords: Matlab/Simnlink, Transient Stability, Synchronous Machines, Swing Equation, 3-Phase fault.

37. Advanced Forecasting of Solar Irradiance in Calabar for Effective Electric Energy Management Using Machine Learning

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Abstract: : Integration of renewable energy sources, especially solar photovoltaics (PV), into national networks is a necessity due to the increasing demand for energy and the need for sustainable development. The intrinsic variability of solar radiation, however, presents serious problems particularly for energy management, grid stability, and energy dispatch optimisation. In order to successfully forecast solar irradiance in Calabar, Cross River State, Nigeria, over the short to medium term, this study develops and assesses sophisticated Machine Learning (ML) models. Both Long Short-Term Memory (LSTM) and xGBoost models, two well-known machine learning methods, were trained and validated using Python utilising historical meteorological data, such as global horizontal irradiance (GHI), temperature, humidity, and cloud cover. The model performance were evaluated using metrics such as Mean Absolute Error (MAE), Root Mean Squared Error, Mean Absolute Percentage Error (MAPE), and R-squared (R2). For the 24-hour ahead forecast for the month of March demonstrating forecast scenario in dry season, the results consistently show that the developed ML models, in particular the LSTM model, performed better than xGBoost and the persistence baseline. Its lower MAE of 11.65 W/m2, RMSE of 21.23 W/m2, MAPE of 3.78%, and higher R2 of 0.998 showed impressive performance. The models show a similar pattern when trained to predict July's rainy season solar irradiance. With precise forecasts, Calabar's grid managers and policymakers can better manage energy, reduce the need for expensive conventional generation reserves, increase the dependability of renewable energy dispatch, and eventually make it easier and more efficient to integrate solar PV systems.
Keywords: Solar Irradiance Forecasting, Machine Learning (ML), Energy Management, Calabar, Photovoltaic (PV) Systems, Long Short-Term Memory (LSTM), xGBoost, Tropical Climate.

38. PSAT Simulation-Based Study of Voltage Performance of Nigeria 330kv Power System Network

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Abstract: This study presents a detailed simulation-based analysis of the voltage performance of Nigeria's 330kV power system network using the Power System Analysis Toolbox (PSAT). The research models the entire transmission grid, incorporating key infrastructure elements to accurately reflect operational realities. Newton-Raphson power flow simulation was carried out to assess voltage profiles under steady state operations, revealing significant deviations from optimal voltage levels across the network. The results indicate that only 27.45% of operational voltages fall within the optimal range of 0.95–1.05 per unit (pu), while 47.06% are within a tolerable but less ideal range, and 25.49% are at critical levels corresponding to temporary or emergency conditions. These findings highlight persistent voltage stability challenges, particularly in regions with high load concentrations and insufficient reactive power support. The study further explores the impact of reactive power compensation strategies demonstrating their effectiveness in improving voltage profiles and enhancing grid reliability. The PSAT-based approach offers valuable insights for system operators and planners, supporting targeted interventions to maintain voltage within acceptable limits and ensuring the stable, efficient operation of Nigeria's high-voltage transmission network. The research underscores the importance of continuous monitoring, proactive planning, and investment in voltage control technologies to address ongoing challenges in Nigeria's power sector.

Keywords: PSAT, Voltage stability, Nigeria 330kV transmission network, Power system, Voltage profile

39. Optimized MPPT Algorithm Integration for Smart Photovoltaic (PV) Systems in Modern Power Applications

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Abstract: The increasing demand for sustainable and efficient energy systems has intensified global interest in photovoltaic (PV) technologies due to their scalability, environmental benefits, and potential to address energy security. However, PV systems face performance limitations under dynamic environmental conditions such as fluctuating irradiance and temperature. This study focuses on the integration of an optimized Maximum Power Point Tracking (MPPT) algorithm to improve the responsiveness and efficiency of PV systems in modern power applications. The objective is to model and simulate a smart PV system using the Perturb and Observe (P&O) MPPT algorithm, integrated with a DC-DC boost converter to extract maximum power under varying conditions. MATLAB/Simulink was employed for system design and simulation, and energy demand data from a case study at the Cross River University of Technology (CRUTECH), Calabar, Nigeria, was used for validation. The proposed system achieved an average efficiency of 90.5% under variable irradiance, with output power peaking at 5.4 kW during full sunlight (1000 W/m²). Comparative analysis revealed substantial improvement in power stability and load responsiveness over conventional PV setups. Results demonstrate that optimized MPPT algorithms significantly enhance PV system performance, making them suitable for grid-tied systems, microgrids, and institutional energy solutions. The study concludes that intelligent MPPT integration is a viable approach for maximizing energy yield and ensuring reliable operation in modern smart energy infrastructures.

Keywords: Photovoltaic Systems, MPPT, Boost Converter, Smart Grid, Renewable Energy

40. Mitigation of Power Quality Disturbances in Nigerian Power Systems Using a Series of Active Filters and Dynamic Voltage Restorers Controlled by Space Vector Pulse Width Modulation (SVPWM)

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Abstract: This paper introduces a simulation-based method for reducing power quality disturbances in Nigerian power distribution systems using an integrated solution of Series Active Filters (SAFs) and Dynamic Voltage Restorers (DVRs) managed by Space Vector Pulse Width Modulation (SVPWM). Power quality problems such as voltage sags, swells, and harmonic distortions are common in developing countries like Nigeria, where grid instability and nonlinear loads frequently affect sensitive equipment and industrial processes. Conventional solutions, including passive filters and uninterruptible power supplies (UPS), lack real-time responsiveness and scalability. In this research, SAFs and DVRs are modeled and simulated in MATLAB/Simulink to provide dynamic voltage compensation during dips and eliminate harmonics caused by nonlinear loads. SVPWM is selected for its higher switching efficiency, lower harmonic content, and better DC link utilization compared to standard PWM methods. The simulation setup includes a three-phase distorted power source, nonlinear load banks, and the combined SAF–DVR system. Results show that before compensation, the system experiences a 20–25% voltage sag and a total harmonic distortion (THD) exceeding 22.4%. After activating the SVPWM-controlled devices, the THD drops below 5%, and the load voltage returns to normal levels within one to two cycles. These results demonstrate that the proposed method provides quick response, IEEE 519-compliant harmonic reduction, and stable voltage regulation under changing conditions. The study offers a technically solid and cost-effective foundation for enhancing power reliability and operational stability in Nigerian grid systems. Additionally, it supports the wider adoption of intelligent power conditioning in smart grid initiatives, aiding ongoing global efforts toward energy efficiency and grid modernization.

Keywords: Power Quality Disturbances, Dynamic Voltage Restorer (DVR), Series Active Filter (SAF), Space Vector Pulse Width Modulation (SVPWM), Total Harmonic Distortion (THD)

41. Assessment of the Impact of Distributed Generation in a Distribution Network

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Abstract: The integration of Distributed Generation (DG) into distribution networks has become a key strategy for improving power system performance, especially in developing regions. This study investigates the impact of integrating a synchronous generator (hydro-based DG) into an existing 11 kV distribution network using ETAP simulation software. The system was first analyzed without DG to assess its baseline performance in terms of voltage profile, power losses, and power factor. A synchronous generator was then introduced at a strategic location, and the resulting changes in system parameters were recorded and analyzed. The results revealed a significant improvement in system power factor, a stable voltage profile across all buses, and minimal line losses, proving that hydro-based DG can effectively enhance the performance of distribution networks when properly integrated. The study highlights the technical benefits of synchronous generation in modern power systems and serves as a foundation for more extensive deployment of DG in Nigeria's electricity sector.
Keywords: Distributed Generation, Voltage Profile, Power Factor, Hydro Generator, ETAP

42. Evaluating the Impact of Shunt Capacitors and Harmonic Filters on Power Flow Optimization

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Abstract: This research investigates the optimization of power flow in an 11 kV distribution network through the application of shunt capacitors and harmonic filters. Using Electrical Transient Analyzer Program (ETAP) software, the study models and simulates four different operational scenarios: the Base Case (without compensation), Case A (with shunt capacitors), Case B (with harmonic filters), and Case C (with both shunt capacitors and harmonic filters). The primary performance indicators evaluated include voltage profile improvement, reduction of reactive power losses, and total harmonic distortion (THD) mitigation. Simulation results show that the application of shunt capacitors in Case A significantly improved voltage levels and reduced reactive power losses across the network. However, several buses exhibited overvoltage conditions, indicating the need for precise capacitor tuning. In Case B, harmonic filters alone had major impact on the network's harmonic distortion, with THD values of some buses still above the IEEE 519 recommended threshold of 5%. Case C, which combined both compensation techniques, further enhanced voltage profiles and minimized reactive losses but harmonic distortion remines the same as Case B. The findings suggest that while shunt capacitors are effective for reactive power compensation and voltage support, harmonic filters must be carefully designed and strategically placed to address harmonic issues effectively. The study concludes with recommendations for improved filter design, the use of active harmonic filters, and the integration of real-time power quality monitoring for optimal system performance
Keywords: Power flow optimization, harmonic distortion, shunt capacitors, harmonic filters, ETAP, 11 kV distribution network, voltage profile, reactive power compensation.

43. Implementing the use of AI-Driven Biomedical Signal Processing (AI-BSP) in Nigeria: Opportunities, Challenges and Strategic Pathways

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Abstract: The integration of AI-Driven Biomedical Signal Processing (AI-BSP) into Nigeria's healthcare system presents significant opportunities for improving diagnostics, patient outcomes, and cost efficiency. However, the country faces substantial challenges, including inadequate infrastructure, limited local datasets, and a shortage of skilled professionals. This paper explores the current state of AI-BSP adoption in Nigeria through benchmarking case studies, stakeholder engagement, and SWOT analysis, comparing it with leading nations like the USA, China, and the UK. A strategic roadmap is proposed, focusing on infrastructure development, education, policy frameworks, and public-private partnerships to bridge the gap. The findings highlight the transformative potential of AI-BSP in Nigeria's healthcare sector, provided these challenges are addressed through coordinated efforts and investments.
Keywords: AI-Driven Biomedical Signal Processing, Healthcare Transformation, Nigeria, Strategic Roadmap, Infrastructure Development

44. Advancing Precision Medicine with Smart Sensors for Real-Time Health Monitoring and Diagnostics

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Abstract: Precision medicine aims to customize healthcare based on individual genetic, environmental, and lifestyle factors. Traditional episodic healthcare models present limitations in providing continuous, personalized insights. This paper addresses these challenges by exploring the transformative potential of multimodal wearable biosensor patches for real-time health monitoring and diagnostics. The discussion encompasses the design principles, including flexible electronics and integrated energy harvesting, and the diverse operational mechanisms such as electrochemical and capacitive sensing. These patches are capable of continuously monitoring a comprehensive array of physiological signals, including electrocardiography, blood pressure, and body temperature, alongside biochemical biomarkers like glucose and lactate from sweat and saliva. The integration of artificial intelligence further

enhances their utility for predictive diagnostics and personalized health management. While significant advancements have been made, challenges related to data accuracy, privacy, interoperability, and clinical translation persist. Overcoming these hurdles through continued innovation and multi-stakeholder collaboration is crucial to fully realize the promise of smart sensors in advancing precision medicine.
Keywords: Precision Medicine, Wearable Biosensors, Real-time Monitoring, Multimodal Sensing, Diagnostics

45. Powering the Future with Smart Sensors for Intelligent Grids and Zero-Waste Energy Systems

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Abstract The modernization of global energy infrastructure is critical for addressing escalating energy demands and environmental imperatives. This paper explores the transformative potential of smart sensors in enabling intelligent grids and fostering zero-waste energy systems. Traditional grids face limitations in managing distributed energy resources and ensuring reliability, necessitating a shift towards more resilient and efficient paradigms. Smart sensors provide real-time, granular data, forming the bedrock for proactive grid management. The paper details the functionalities and synergistic operation of key sensor technologies: Itron Open Way smart energy meters for load monitoring, SEL-351A Phasor Measurement Units and ACS712 voltage/current sensors for advanced fault detection, Apogee SP-215 solar irradiance sensors for renewable monitoring, SHT85 temperature/humidity sensors for energy efficiency, and LoRa Node/ESP32 IoT Gateways for robust communication. These technologies collectively enhance grid resilience, optimize energy utilization, and significantly contribute to minimizing energy waste across generation, transmission, and consumption, thereby accelerating the transition to a sustainable energy future.
Keywords: Smart Sensors, Intelligent Grids, Zero-Waste Energy, Fault Detection, Renewable Integration.

46. MATLAB-Based Simulation of Simultaneous Wireless Information and Power Transfer (SWIPT) In Wireless Sensor Networks (WSNs) With Rf Energy Harvesting

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Abstract: This research presents the modeling and simulation of a Simultaneous Wireless Information and Power Transfer (SWIPT) system for Wireless Sensor Networks (WSNs) using the power splitting protocol. The increasing demand for energy-efficient and self-sustaining communication systems, especially in low-power sensor networks, has prompted the integration of radio frequency (RF) energy harvesting with data transmission. A MATLAB/Simulink model was developed featuring an 8-PSK modulation scheme, Rayleigh fading channel with Jakes Doppler spectrum (0.01 Hz), Additive White Gaussian Noise (AWGN) channel with an Eb/No of 10 dB, and a custom 8-symbol constellation for signal mapping. The simulation was designed to assess system performance in terms of energy harvested and Bit Error Rate (BER). The results demonstrated the feasibility of SWIPT in WSNs under stationary conditions. The energy harvesting waveform showed high variability but sufficient average power levels suitable for storage and reuse. Meanwhile, the BER results indicated minimal transmission errors, confirming reliable data communication even with concurrent energy harvesting. The study confirms that the power splitting protocol provides an efficient trade-off between information decoding and energy extraction in RF-based WSNs. The outcomes suggest that SWIPT is a promising technique for extending the operational lifespan of wireless sensor nodes in energy-constrained environments.
Keywords: SWIPT (Simultaneous Wireless Information and Power Transfer), Wireless Sensor Networks (WSNs), Energy Harvesting, Bit Error Rate (BER), Power Splitting Protocol

47. Comparative Performance Analysis Of A Rectangular Micro Strip Patch Antenna For C- Band Application

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Abstract: This study presents a performance analysis of a rectangular microstrip patch antenna (RMPA) designed for C-band applications (4–8 GHz), using MATLAB's Antenna Toolbox for simulation and evaluation. The microstrip patch antenna is lightweight, compact, and flexible, making it ideal for applications such as radar, satellite communication, broadcasting, and military systems. The research focuses on how substrate materials and antenna dimensions affect key performance parameters, including return loss, VSWR, bandwidth, gain, and radiation patterns. Results show that the choice of substrate material significantly influences performance. For example, using FR4 epoxy achieved a return loss of -28.26 dB at 6.5 GHz, indicating excellent impedance matching and low signal reflection. Variations in patch length and width also affected the antenna's resonant frequency and bandwidth. One configuration achieved a bandwidth of 318.5 MHz and a VSWR of 1.0, which reflects efficient power transfer and minimal signal loss. Radiation pattern analysis confirmed a directional radiation profile, beneficial for focused communication, and gain values reached up to 5.934 dB. The study concludes that careful selection of materials and dimensions is essential for optimizing RMPA performance. The use of MATLAB's Antenna Toolbox enabled accurate modeling, making it a valuable tool for antenna design and development.
Keywords: Microstrip Patch Antenna, C-Band, Substrate Material, Return Loss, Antenna

48. Investigating the Effect of Distance, Temperature and Time on Signal Strength of HIT 95.9 FM Station Calabar Cross River State Nigeria.

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Abstract: This paper examines the variation of signal strength over temperature and time for Hit 95.9 FM along selected routes in Calabar, Cross River State, Nigeria. The study aims to identify factors contributing to signal fluctuations and proposes strategies for improving broadcast stability. Empirical data were collected using a cable television signal strength meter at 0.5 km intervals. Signal strength measurements were used to calculate path loss, which was then plotted against distance. Results indicate that path loss increases with distance across all routes. A predictive model was developed and validated using statistical tools such as RMSE, ME, and SDE. The model demonstrated high accuracy, with RMSE values close to zero. Comparisons with existing empirical models revealed that those models tended to overestimate path loss for the studied station. Additionally, the study assessed the influence of temperature and time on signal strength at a 3 km distance from the base station. Findings show that signal strength slightly decreases with rising temperature and varies throughout the day—stronger signals are typically recorded at night and in the early morning, while weaker signals occur in the afternoon. Overall, the research highlights the impact of environmental conditions, terrain, and interference on FM signal propagation. These insights can support the optimization of Hit 95.9 FM's broadcasting system in Calabar and similar environments.

Keywords: Path loss, Distance, Temperature, Time, Signal Strength.

49. The Future of Innovative Smart Grid and Microgrid Cybersecurity in Nigeria Technologies

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Abstract: The increasing implementation of smart grids and microgrids in Nigeria signifies a dramatic change in the country's energy framework, providing improved efficiency, dependability, and sustainability. Nigeria's energy sector faces profound challenges, including pervasive inefficiencies, unreliable national grid, and significant energy poverty, which collectively undermine economic development and national security. In response, the nation is actively pursuing modernization through the widespread adoption of smart grids and microgrids, aiming to integrate renewable energy sources and enhance overall grid resilience. This research explores the evolving cybersecurity landscape within this transformative context, analyzing the energy infrastructures. It delves into the current state of cyber threats, the existing regulatory environment, and critical implementation challenges in Nigeria. Furthermore, the research examines the transformative potential of innovative cybersecurity technologies, including smart security solutions using Artificial Intelligence/Machine Learning for advanced threat detection, Blockchain for secure energy transactions and decentralized techniques such management, and advanced encryption as homomorphic and post-quantum cryptography for data privacy and long-term resilience. The analysis underscores that while these technologies offer robust defense mechanisms, their effective deployment in Nigeria necessitates overcoming significant hurdles related to infrastructure, financial capacity, technical expertise, and regulatory enforcement. Ultimately, the report concludes that a strategic, multi-faceted approach, prioritizing integrated security by design, robust policy implementation, and sustained capacity building, is paramount to safeguarding. Nigeria's energy future against increasingly sophisticated.

Keywords: Smart-grid, Microgrid, Cybersecurity, AI-based threat detection, Distributed energy resource

50. Real-Time Fault Classification in Smart Grids Using Wavelet Transform And Machine Learning in Simulink.

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Abstract: The increasing integration of distributed energy resources and the complexity of modern smart grids demand advanced fault detection and classification techniques to ensure reliable and secure power delivery. This paper presents a real-time fault classification framework for smart grids that combines wavelet transform-based feature extraction with machine learning algorithms, implemented and validated in MATLAB/Simulink. The discrete wavelet transform (DWT) is employed to analyze the three-phase current and voltage signals, capturing transient characteristics of faults with high time-frequency resolution. Extracted wavelet coefficients are processed using statistical feature extraction techniques, including mean, energy, skewness, and kurtosis, which serve as inputs to machine learning classifiers such as artificial neural networks (ANN), multilayer perceptron (MLP), and support vector machines (SVM). The proposed system effectively identifies fault types including single line-to-ground, line-to-line, double line-to-ground, and three-phase faults and accurately classifies faulty phases in real time. Simulation results in Simulink demonstrate high classification accuracy and rapid response times, essential for minimizing fault impact and expediting grid restoration. The approach is robust against variations in load conditions and fault resistances, making it suitable for practical deployment in complex smart grid environments. This integration of wavelet-based signal processing and machine learning within a Simulink framework provides a scalable and efficient solution for enhancing smart grid fault management, contributing to improved grid resilience and operational stability.

Keywords: Wavelet transform, Distributed Energy, Faults Classification, SVM and Simulink

51. Effect of Swing Bus Placement Location on the Distance Buses in an Electric Grid Network (Case Study: Nigeria Transmission 330kv Lines Network)

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Abstract: : Using Nigeria's 330kV transmission lines network as a case study, this paper examines how swing bus placement site affects the spacing between buses in an electric grid network. In power system analysis, especially load flow studies, the swing bus is essential. The accuracy and convergence of load flow solutions can be strongly impacted by the swing bus's location. The impact of various swing bus placements on the spacing between buses in the Nigerian 330kV transmission network is examined in this research using ETAP. The findings indicate that the swing bus's location has an impact on the network's power flow, line losses, and voltage profile. Decisions on power system design and operation can be influenced by the study's insights regarding the swing bus's ideal location inside the Nigerian grid network. The results show that, toward the northern part of the network, due to the long distance, the system violate the voltage limits in almost all the busses. The system frequency limit also affected. Since the swing bus sets a reference voltage angle, its location affects system-wide voltage phase angles. A choice distorts the voltage profile, especially in radial, weakly meshed sections area of the network. Swing bus position affects how losses are circulated and distributed across the lines.

Keywords; Swing Bus Placement, Electric Grid Network, Load Flow Analysis, Transmission Line Stability, Nigeria 330kV Network

52. Artificial Intelligence (AI)-Enhanced Signal Interference Mitigation in Wireless Communication

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Abstract: This paper comprehensively examines AI-enhanced signal interference mitigation in wireless communication, focusing on deep research, practical code implementation, and academic publication guidance. It details the foundational role of deep learning architectures, specifically Convolutional Neural Networks (CNNs) and Long Short-Term Memory (LSTMs), in processing complex wireless signals. The study outlines essential data preprocessing techniques, discusses model training and evaluation methodologies using key performance metrics, and addresses critical challenges related to real-time inference and hardware integration. Practical guidance is provided through recommended Python frameworks and illustrative code structures. The paper concludes with detailed information on crafting high-impact research papers and navigating the academic publication landscape, emphasizing reproducibility

Keywords: Wireless communication, Signal interference mitigation, Artificial intelligence, Deep learning, Convolutional Neural Networks (CNNs).

53. Optimization of Reactive Power Compensation in A 132kv Transmission Network Using Fact Device

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Abstract: In power transmission systems, poor voltage regulation and excessive reactive power burden on generators are common challenges that affect system efficiency and stability. This study focuses on the optimization of reactive power compensation in a 132kV transmission network using Flexible AC Transmission System (FACTS) devices. The network was modeled and simulated using ETAP software, utilizing real-world data for generators, loads, and bus systems. A comprehensive pre-compensation analysis was carried out to identify voltage violations, reactive power imbalances, and overloaded load buses. Static VAR Compensators (SVCs) and shunt capacitor banks were strategically implemented at selected buses to provide localized voltage support and reactive power balancing. Post-compensation simulation results revealed significant improvements in voltage profiles across the network, a substantial reduction in generator reactive power output from 74.061 MVAR to 9.234 MVAR, and enhanced load bus performance with reduced loading percentages. The power factor at the generator improved from 89.6% to 99.82%, indicating more efficient active power generation. This study confirms that optimized reactive power compensation using FACTS devices can greatly enhance the operational performance, voltage stability, and reliability of high-voltage transmission networks.

Keywords: Reactive Power Compensation, Power Quality, Voltage Stability, 132kV Transmission System, Power System Optimization

54. Enhancing Protection of Transmission Lines Using Wavelet Transform-Based Fault Detection

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Abstract: Traditional fault detection methods in high-voltage transmission lines often struggle with speed and accuracy, especially in the presence of noise, high impedance faults, or evolving grid complexities. This paper explores the use of Wavelet Transform (WT) techniques to enhance protection schemes by enabling faster and more reliable detection and classification of transmission line faults. A simulation model is developed in MATLAB/Simulink to analyze various fault types using the Discrete Wavelet Transform (DWT) for transient signal decomposition. Results show significant improvement in fault recognition time, sensitivity to high-impedance faults, and discrimination between fault types compared to conventional methods. The study recommends implementing WT-based algorithms in digital relays to optimize Nigeria's transmission line protection systems.
Keywords: Wavelet Transform, Fault Detection, Transmission Line Protection, MATLAB, High-Impedance Faults

55. Design And Construction Of Autophase Selector With Android Interface

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Abstract: The rate of damage on electrical/electronic appliances in most developing countries Nigeria in particular is on daily basis and alarming. The power lines are frequently overloaded resulting to a trip by the action of switch gears or the load shading processes undertaken by the distribution authorities known as Electricity Distribution Company. The importance and advancement of electronic control system in engineering have created different ways in which automatic switching systems can solve domestic and industrial problems especially in the developing countries. Hence, all control devices are all built upon the 'zeros' and the 'ones'. Digital Electronics is all a concept of 'zeros' and 'ones'. It is just manipulating these two parameters to read and give desired results. This project seeks to design an android based automatic phase selector which observes the three phases available to any building and select the most suitable phase (i.e. between the range of 170V and 240V). In this design as in every other control design, there is (are) actuator(s) and sensor(s). The aim of this project work is to design and construct a microcontroller based automatic power phase selector with android interface using wireless communication. An Arduino microcontroller (ATMega328P) is used to develop power management systems to do the thinking and logical analysis within the system. The microcontroller detects the best voltage amongst the three phases and establishes this phase as the currently active phase which will in turn supply power to the building.
Keywords: Electrical/Electronic Appliances, Power management, Arduino Microcontroller and Wireless communication

56. Genetic Algorithm-based Optimizing Network Layer Protocols for High Bit Rate Applications in Wireless Communication Systems

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Abstract: This paper presents a sophisticated optimization approach to enhance network layer protocols for high-bit-rate applications in wireless communication systems by employing a **Genetic Algorithm (GA).** The primary objective is to improve the efficiency and reliability of routing protocols under diverse network conditions, particularly in multi-path fading channels. The proposed method systematically optimizes routing paths by integrating node positions and network topology, aiming to minimize latency and maximize data throughput. In our methodology, we initialize a population of potential routing solutions and iteratively refine these solutions through selection, crossover, and mutation processes typical of genetic algorithms. Fitness functions are meticulously designed to evaluate the viability of each route based on connectivity, path length, and adherence to source-destination requirements. Our implementation leverages **MATLAB** to simulate the wireless network environment, allowing for a comprehensive evaluation of the optimized routing protocols. Extensive simulations demonstrate that the GA-optimized routing protocol significantly outperforms conventional routing algorithms. Metrics such as throughput, latency, and network stability are markedly improved, showcasing the potential of GA in adapting to dynamic network conditions and mitigating the challenges posed by multi-path fading. This research not only underscores the efficacy of genetic algorithms in network optimization but also lays the groundwork for future advancements in adaptive and intelligent network layer protocols, crucial for next-generation wireless communication systems. The detailed **MATLAB** implementation provided serves as a robust framework for replicating and extending this optimization strategy in practical scenarios.
Keywords: Analysis, Investigation, research, Genetic Algorithm, effieciency, reliability, routing protocols, multi-path fading channels

57. Investigating the Feasibility and Impact of Localized Edge Computing in Nigerian Cities for Smart Applications

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Abstract: Edge computing is a distributed computing paradigm where client data is processed as close as feasible to the source at the network's edge in the twenty first century, Due to the rapid growth in the amount of data exchanged globally especially in smart city applications like autonomous vehicles. This research investigates the feasibility and impact of localized edge computing within Nigerian cities to enhance smart city applications. The study explores how edge computing, which brings computation and data storage closer to the data source, which addresses challenges associated with traditional cloud-based systems in the context of Nigerian urban environments, such as latency, bandwidth limitations, and data security concerns. The research analyzes the potential benefits of edge computing in various smart city domains, including traffic management, environmental monitoring, and public safety, and assess the practical implications of its implementation in Nigerian cities. The core of this research lies in understanding how edge computing can optimize data processing and decision-making for smart city applications in Nigeria. By distributing computing resources closer to data sources (e.g., sensors, cameras, and other IoT devices), edge computing can significantly reduce latency and bandwidth requirements, leading to faster response times and improved system performance. This is particularly crucial in a Nigerian context, where bandwidth constraints and network instability are prevalent. In this case, this review article is focused on highlighting the study of edge computing and the key attributes of Edge computing that can be used to address emerging markets use cases, the impact, the crises of network service on businesses in Nigeria, and most recent trends on edge computing in the research field.
Key words: Edge computing, Cloud computing, Mobile edge computing, Industrial Internet of Thin, Latency.

58. The Economic Impact Of Solar Energy Embedded To Calabar Distribution Network For Effective Energy Delivery And Reliability

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Abstract Analysis of Solar Energy Embedded to Distribution Grid for Active and Reactive Power Supply to Grid presented in this study. Integration of solar energy into the distribution grid for both active and reactive power supply. With the increasing demand for renewable energy sources, the utilization of solar power has gained significant attention. However, the fluctuating nature of solar energy generation poses a challenge to its integration into the grid. This study focuses on the use of solar inverters for grid-tied systems, which enable the management of active and reactive power supply. The analysis includes simulations of solar power integration under various scenarios, considering factors such as weather conditions and grid topology. The results demonstrate the feasibility of solar energy integration into the distribution grid and provide insights into the potential benefits and challenges associated with this technology. This study serves as a valuable reference for researchers and engineers in the field of sustainable energy and grid integration. The work was tested with HOMER software. The optimization results reveals that with solar embedded in the network, the will be increases in energy generations, reliable power supply and economic improvement. The higher the renewable penetrations the lower the cost pay by the consumers.
Key words: Economic Impact, Distribution Network, Energy, Delivery, Reliability and Optimization

59. Artificial Intelligence in Robotics: A Comprehensive Review of Algorithms, Architectures, and Applications

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Abstract: Robotic systems have progressively transitioned from rigid, pre-programmed machines to adaptable, autonomous entities capable of operating in dynamic environments. This transformation has been driven by the integration of advanced computational techniques that enable perception, learning, reasoning, and real-time decision-making. This systematic review presents research conducted between 2015 and 2024, comprising 450 peer-reviewed articles across domains such as machine learning, control systems, architectural design, and real-world robotic deployment. It categorizes prevailing algorithmic approaches, examines control and reasoning frameworks, and analyzes application-specific implementations in sectors including manufacturing, healthcare, domestic services, and autonomous mobility. The study approach follows the PRISMA guidelines, with rigorous screening, coding, and classification of reviewed studies. Quantitative data are summarized in figures and tables, including the distribution of learning techniques, application domains, and architectural patterns. Results indicate a significant shift toward hybrid and distributed architectures, with reinforcement learning and sensor fusion emerging as central elements in autonomous behaviour. While progress is notable, challenges persist in real-time adaptability, hardware-software integration, interpretability and safety assurance. The review identified gaps and future directions, emphasizing the need for standard performance benchmarks, transparent system behaviour, and ethical operational frameworks. The outcome of this review support both academic researchers and industry practitioners in advancing the development, deployment, and governance of intelligent robotic systems.
Keywords: Intelligent robotics; Autonomous systems; Learning techniques; Robotic architectures

60. A Review on an Adaptive Neuro-Fuzzy Reinforcement Learning Controller for Real-Time Personalized Insulin Delivery in Type 1 Diabetes Mellitus Patients

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Abstract: Type 1 Diabetes Mellitus (T1DM) is a chronic metabolic disorder requiring lifelong insulin therapy and precise glycemic control. Recent advancements in Artificial Pancreas Systems (APS) have enabled semi-automated insulin delivery, yet challenges such as personalization, uncertainty management, and system explainability persist. This review explores the development and application of an **Adaptive Neuro-Fuzzy Reinforcement Learning Controller (ANFRLC)** for real-time, personalized insulin delivery in T1DM patients. We provide a comprehensive survey of existing control algorithms used in APS, including Proportional-Integral-Derivative (PID), Model Predictive Control (MPC), Fuzzy Logic, and various machine learning models. Particular focus is given to the fusion of fuzzy inference systems and reinforcement learning techniques, which offers the combined advantages of human-like reasoning and adaptive decision-making. Neuro-fuzzy systems can model nonlinear patient behavior, while reinforcement learning enables the controller to improve over time through interaction with a simulated environment. The methodology of this review involved a systematic exploration of literature from 2019 to 2025, critically examining key publications based on algorithmic approach, performance metrics, real-time feasibility, and clinical relevance. Comparative insights reveal that ANFRLC-based systems outperform traditional controllers in handling dynamic physiological variations, managing unannounced events, and maintaining glucose levels within the normoglycemic range (70–120 mg/dL). We conclude that ANFRLC presents a promising paradigm for next-generation artificial pancreas systems. However, challenges related to computational complexity, explainability, and clinical validation must be addressed. Future research should aim to optimize controller architectures for edge deployment and enhance interpretability for real-world use.
Keywords: Type 1 Diabetes Mellitus (T1DM), Artificial Pancreas System (APS), Adaptive Neuro-Fuzzy Inference System (ANFIS), Reinforcement Learning (RL), Personalized Insulin Delivery

61. Sensorless Control of Induction Machines.

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Abstract: Induction motors is used because of it high performance applications and cheaper in terms of cost and maintenance applications, robust and have low moment of inertia and light weight. The entry of vector control strategies the control of an induction motor is changed, that of vector control torque and flux can be controlled independently. The aim of this project work is to build up a vector controlled induction motor drive working without a speed sensor. The methodology is to detect the motor speed by using rotor Model reference adaptive systems MRAS. Sensorless indirect vector control have a disadvantage that motor parameters variation with temperature causes an estimation speed error in steady state and transient state. This increases the losses of the motor and reduces efficiency of the motor. When comparing the result of the simulation response of actual motor speed, estimated motor speed and error between actual speed and estimated speed for a constant speed reference of 80 rad/sec. The reference flux is kept at 0.98 web and the load torque is kept at zero N-m the actual speed converged to the reference speed. Starting motor currents are four to five times the steady state current. At steady state the current value is 28A. Under steady state actual and estimated currents match with each other. At the beginning rotor fluxes are increasing and then reaches to reference value. The estimated rotor flux and actual rotor flux settle to the reference value within 0.98 web. At constant speed reference of 100 rad/sec reference flux is kept at 0.98 web and the load torque at 25 N-m. At starting motor is accelerating and finally reaches to steady state. It is also observed that after a small time the estimated speed always followed the reference speed, because the speed controller knows the estimated speed one only. The actual speed converged to the reference speed. Actual and estimated α-axis stator currents and the errors between actual and estimated α-axis rotor flux and the error between them. The estimated rotor flux and actual rotor flux settle to the reference value within 0.98 web. The reference speed is kept at 100 rad/sec and load torque is kept at 25 N-m. And the system stabilizes at the time 1.2 seconds which was maintain throughout the simulation time. In conclusion, the Model reference adaptive system MRAS, would enable us put a system in place were a physical speed/torque sensor will be eliminated from all Conveying transport lines.

62. Pontryagin-Based Optimal Load Shedding Strategy for Renewable-Integrated Microgrids under Uncertain Demand

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Abstract: The integration of renewable energy sources into microgrids introduces generation uncertainties that complicate real-time load management, particularly during peak demand or contingency scenarios. Traditional load shedding strategies often heuristic or rule-based lack optimality and adaptability, leading to excessive energy not supplied (ENS) and inefficient battery utilization. This paper presents a Pontryagin-Based Optimal Load Shedding Strategy (PMP-OLSS) for renewable-integrated microgrids operating under uncertain demand and intermittent supply. The microgrid is modeled as a nonlinear dynamic system incorporating photovoltaic and wind generation, battery energy storage systems (BESS), and critical/non-critical loads. A continuous-time optimal control problem is formulated to minimize the combined cost of unserved energy, battery degradation, and system imbalance, subject to physical constraints. Using Pontryagin's Maximum Principle, we derive necessary conditions for optimal control and apply them to determine the optimal shedding actions. Simulations on a modified IEEE 33-bus microgrid reveal that the proposed PMP approach reduces ENS by 48.2% compared to rule-based methods, achieves smoother shedding profiles, and maintains better battery state-of-charge (SOC) stability. Scenario-based analyses further demonstrate its robustness (90% scenario coverage) and lowest control effort among benchmarked methods. Additionally, the derived costate variables provide insights into the temporal criticality of load sectors, enabling economically informed shedding decisions. Overall, PMP-OLSS offers a mathematically grounded, real-time control solution for enhancing resilience, efficiency, and explainability in smart microgrid operations.
Keywords: Pontryagin's Maximum Principle, Optimal Load Shedding, Microgrid Energy Management, Renewable Energy Uncertainty, Nonlinear Optimal Control