IPS Journal of Engineering and Technology
ISSN: 3115-5669
IPS J. Engr. & Tech., 1(4): 189-194 (2025)
DOI: https://doi.org/10.54117/7bpcvq17

Load Optimization of a Single-Sided Electromagnetic Elevator

Nzeife, I. D.[1*], Okaroh, C. C.[1], Ilozionwu, T. S.[1], Nwamuo, C T.[1] and Ezechukwu, V. C.[2]

[1]Department of Electrical/Electronic Engineering, Faculty of Engineering, Chukwuemeka Odumegwu Ojukwu University (COOU), Uli, Anambra State, Nigeria.
[2]Department of Mechanical Engineering, Faculty of Engineering, Chukwuemeka Odumegwu Ojukwu University, Uli, Anambra State, Nigeria.
*Corresponding author email: nzeifeid@gmail.com

Abstract

This study investigates load optimisation in an existing elevator system to evaluate variations in thrust relative to defined performance objectives—thrust and efficiency. Using the elevator's actual design specifications, simulations were conducted to assess performance under varying load conditions. A user-driven iterative optimisation algorithm, termed the Wire Gauge Variation and Slot/Tooth Ratio (WGVSTR), was developed and implemented in MATLAB. The key advantage of the WGVSTR algorithm lies in its flexibility, allowing users to achieve desired optimisation goals by adjusting relevant design parameters. The analysis focuses on identifying the load condition that produces a thrust output closest to the target value while maintaining efficiency. The total weight of the elevator system without passengers is 1680 kg. Passenger loads, with each passenger assumed to weigh 75 kg, were incrementally added in eight steps up to 600 kg, exceeding the allowable limit of 375 kg (five passengers) for the existing model. Simulation results show that thrust and efficiency remained stable from Steps 1 to 5, corresponding to total loads of 1755 kg, 1830 kg, 1905 kg, 2055 kg, and 2130 kg. The 2055 kg load (Step 4), representing five passengers, was identified as the optimal load, yielding a full machine thrust of 26,560 N with minimal drop in output thrust. Beyond this point, thrust reduction became evident: 26,555 N, 26,530 N, and 24,500 N for Steps 6, 7, and 8, respectively. At Step 7 (2205 kg), equivalent to seven passengers, the thrust decrease was minimal (20 N below nominal), designating it as the maximum safe load. Efficiency remained constant up to Step 6 but dropped slightly to 87.28% and 87.25% at Steps 6 and 7, respectively, before declining sharply to 60.22% at Step 8 (2280 kg). The thrust and efficiency values at the maximum load were compared with those at no-load conditions to determine the elevator's optimal and maximum allowable loading limits for safety and performance assurance.

***Keywords**: Load optimization, SLIM, Thrust and Efficiency, Optimal and Maximum load and Effects.*

Article History
Received: 15 Oct 2025
Accepted: 03 Nov 2025
Published: 07 Nov 2025

Scan the QR code to view•

How to cite this paper: Nzeife, I. D., Okaroh, C. C., Ilozionwu, T. S., Nwamuo, C. T., & Ezechukwu, V. C. (2025). Load optimization of a single-sided electromagnetic elevator. *IPS Journal of Engineering and Technology, 1*(4), 189–194. https://doi.org/10.54117/7bpcvq17

1. Introduction

Elevator failure must be avoided as much as possible because of its negative consequences on lives and property at various dimensions [1, 2]. Elevator overload occurs mostly when the motor is under excessive load. The primary symptoms that accompany a motor overload are excessive current flow, insufficient torque and overheating due to overloading of the elevator with passengers and goods. Excessive motor heat which causes stiffness in the moving system is a major cause of motor failure. It has been recorded that excessive motor heat is a major cause of motor failure that leads to permanent failure [4 5]. In the case of an overloaded motor, individual motor components including bearings, motor windings, and other components may be working fine, but the motor will continue to run hot and eventually fails. For this reason, it makes sense to begin troubleshooting by checking for motor overload. Because motor failures are caused by overloading attention is then focused on the permissible weight of passengers and goods. In the case of induction motor elevators, premature wear on motor electrical and mechanical components leads to permanent failure [5]. 55 % of motor failures are caused by overheating due to overloading, and it is important to understand how to measure for and identify elevator overloading. Similarly, load failures in the Single Sided Linear Induction Motor (SLIM) elevators are the same but a little more complex.

1.1 The Linear Induction Motor (LIM): The linear induction motor (LIM) produces linear motion as compared to its traditional rotary counterpart. Because of its applications and endless merits, the linear induction motor has gained popularity and attention in modern research. LIM can be obtained from its rotary counterpart by cutting through the rotary motor and flattening it, as shown in Figure 1.

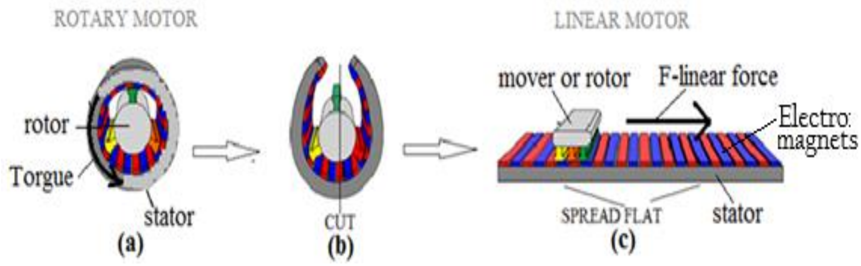

Figure 1: Modified analogy of an unrolled DC motor to form a LIM [1, 12]

Figure 1 shows an illustration of a rotary motor cut along its enclosure diameter and stretched flat. The concept is simple: when a rotary motor is radially cut and laid flat, it becomes nothing but the same rotary machine cut and flattened [13]. It is in this flattened geometry that it becomes linear and hence a linear machine. Its principle of operation does not differ much from that of the rotary machine. The dimensions of the rotary motor are then replaced with linear ones in the formed linear motor. For example, the parameter "torque" in rotary motors is replaced with "force"; the commutation cycle between two consecutive pole pairs that is 360 degrees in rotary motors now becomes a distance between two consecutive pole pairs in metres along the stretched stator. So as it were, the magnetic flux from the rotor (mover) is locked or synchronized with that of a stationary track (stator), converting electromagnetic energy into translation motion [14]. However, there are certain differences that exist between the rotary and linear motors (LM), e.g. the air gap is usually wider in LMs than in a rotary motor and a mover is shorter with respect to the track (stator) [2].

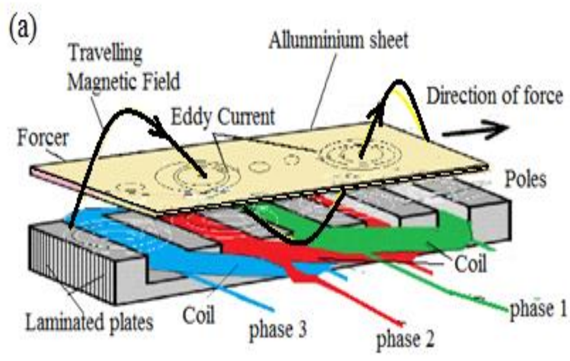

Figure 2 (a) Single-Sided Linear Induction Motor (SLIM) Geometry [3].

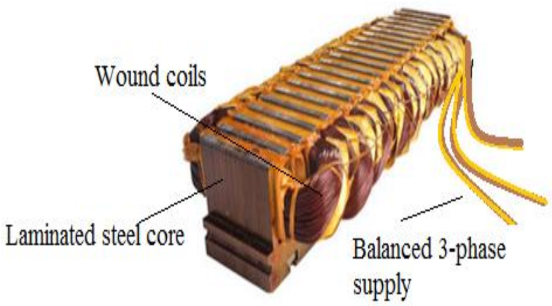

Figure 2 (b) Picture of a wound stator of LIM [4]

A single-sided linear induction motor (SLIM), as shown in Figure 2 (a) works by "unrolling" a conventional rotary induction motor to create linear motion instead of rotational torque. It consists of a primary side with polyphase windings and a secondary side, typically a conductive sheet with a back iron, that moves over the primary. SLIMs are used in applications such as transportation, elevators, and electromagnetic launchers; however, their performance is affected by factors like end and edge effects. A simple linear machine (flat type) as shown in figures 2(a) and 2(b), is composed of a stationary track (often laid with permanent magnets or electromagnetic coils) and a mover or rotor, both components making relative motion due to the interaction of electromagnetic fields. Figure. 2(b) shows the practical wound stator with wound 3-phase coils. In practice, these two roles can be switched, i.e., a mover embedded with magnets and a stationary track wound with coils. Each configuration has its pros and cons. The stroke length in any case can be increased by annexing more tracks one after the other [5, 15].

1.2 Operating Principles of SLIM

When a balanced three-phase voltage is applied to the coils of the motor, the current sets up a moving magnetic field as shown in Figure 2(a). The magnetic field cuts the aluminium plate (the mover/forcer/rotor) placed above, and EMF is induced in it. The EMF sets up an eddy current which circulates in the plate and in turn creates a magnetic field which interacts with that of the moving field [16, 17, 18]. As a result, a thrust is produced on the mover which moves with a force in the direction shown. The plate is laminated to reduce the eddy current and hence the amount of I^2R energy loss.

Based on construction [6, 19, 21], showed that LIMs are classified as single sided LIMs (SLIM) and double sided LIMs (DLIM). In SLIM, the primary which is the stator is placed under the secondary which is the rotor (forcer) as shown in figure 1c. But in double-sided LIMs (DLIM), primary is placed on either side of the secondary as shown in the figure. 3.

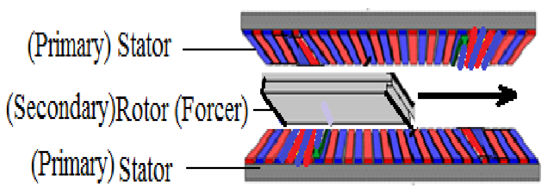

Figure 3: Double Sided LIM (DLIM) [7]

The 'short primary' and 'short secondary' concepts are of the same principle of operation but differ in applications. The arrangement of the air-gap between thickness of the aluminum rotor and the stator (poles) shown in figure 3 is typical of all LIMs. Three-phase external connections are also needed to set up the moving magnetic field.

This paper adapted the 'short primary' configuration for the following reasons [2]:

Available: https://doi.org/10.54117/7bpcvq17

- It saves the cost of the voluminous copper required for a lengthy stator covering the entire length of the rising building.
- The force/thrust generated by the cores of the stator is fully utilised in the mechanical energy required for the elevator movement because the cabin is directly coupled to the stator.
- It is less complicated as many electrical connections to the core phases of a short secondary formation are avoided. Etc.

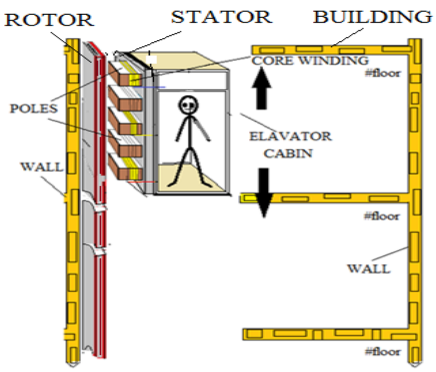

Figure 4: Illustration of short primary SLIM in elevator application. [8]

2. Methodology

2.1 The Elevator's Specified Physical Attributes.

A typical elevator's physical attributes include:
Size of cabin, (height ×length ×width) =2.5m ×2m×1m= 5mm^2
Total weight of cabin and bearing, *cabin w* = 500kg
Number of passengers in one cabin, *np* = 5
Average weight of each *passenger* = 75kg

Figure 5 shows a typical dimensioning of a SLIM showing the stator tooth width *wt*, and heights *Hs*; yoke height *his*, and slot width, *ws*. The magnetic air-gap is the sum of the physical air-gap and the aluminum thickness.

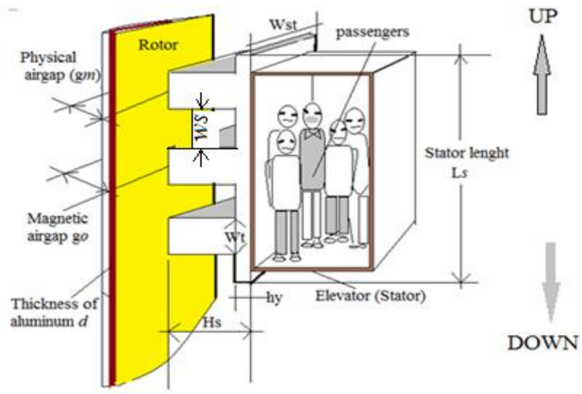

Figure 5: Typical dimensioning of a SLIM Elevator [9]

2.2 Calculating the Total Mass of the Moving System

So making use of L_s, W_{st} and h_y in fig. 5, where L_s is stator length=600; h_s is tooth length; W_{st} is stator width =600 and $h_y$is yoke height=12.5. The volume of the stator yoke is stated as follows:

$$V_{yoke} = L_s W_{st} h_y (mm)^3 \quad (1)$$

= 600 x 450 x 12.5= 3375000 $(mm)^3$

The volume of one tooth of the stator is obtained from:

$$V_{tooth} = W_t W_{st} h_s \, (mm)^3 \quad (2)$$

= 15.8 x 600 x 32.72= 310185.6 $(mm)^3$.

Where W_t is the tooth width.
The volume of the total uniform-sized tooth is calculated thus:

$$V_{teeth} = mpq_1 . V_{tooth} \quad (mm)^3 \quad (3)$$

= 3 x 4 x 1 x 310185.6=9991920$(mm)^3$

Where *m* is the number of phases =3; *p* is the number of poles =4; $q_1$is the slots in the stator.

Therefore, the volume of the iron core (made of copper) in the stator is

$$V_{iron} = V_{yoke} + V_{teeth} (mm)^3 \quad (4)$$

=3375000 + 9991920= 13366920$(mm)^3$
Having found the volume of the entire iron core, the total weight of the entire iron core is
In terms of the volume is given as:

$$W_{iron} = \rho_i V_{iron} \quad (kg) \quad (5)$$

where ρ_i is the iron resistivity.
= .000000097 x 13366920=1.2968
The weight of copper wire is found thus:

$$W_{copper} = \rho_{copper} A_{wire} T_{lw} \, (Kg) \quad (6)$$

= 1.72x10^{-8} x $(\frac{1}{4}\pi d^2)$x 650=0.00000187265 kg
Where ρ_{copper}, volume resistivity of copper is, A_{wire} is the cross-sectional area of wire
$\frac{1}{4}\pi d^2$ and, T_{lw} is total length of wire =650m; *d* is wire diameter=4.62(mm)
The weight of one stator unit is W_{stator} and consists of iron core and copper wire, and is
obtained using:

$$W_{stator} = W_{iron} + W_{copper} \quad (7)$$

= 1.2968 + 0.00000187265 =.0.002428kg
The number of the primary units needed for a specified cabin is estimated using:

$$n_{statorunits} = \frac{h_{cabin}}{1.2L_s} \quad (8)$$

= {2500/ (1.2 x 450=540)} = 4.6 ≈ 5 units
Where h_{cabin} is the height of the cabin = 2.5 m; and L_s is stator length=450mm.
The total mass M_t of the whole rising system (elevator) has to be determined from this
expression:

$$M_t = n_p W_{passengr} + n_{units} W_{stator} W_{cabin} \quad (9)$$

= (5 x 75) + (5 x 0.002428 x 500) =2.2767 + .006071 = **2280kg**
Where W_{cabin} is the total weight of the cabin and bearing=500kg, n_p is the number of passengers in
cabin =5; and $W_{passanger}$ is the average weight of each passenger, 75kg

The overall mass of the optimized machine's moving system is 2280 kg, requiring a thrust of 26580 N at a 10% slip and a rotor velocity of 10 m/s.

2.2. Effect of Elevator Loading on Thrust and Efficiency

After determining the moving system's total mass (2280 kg), the impact of loading on the slim elevator's thrust and efficiency is investigated. Assume a 10% slide with a fixed rotor speed of 10 m/s. The machine has an efficiency of 88.25% and a thrust of 26560 kN. The loading of the elevator is taken in 6 steps of 75 kg (which is the given approximate weight of each passenger) [3, 22]. At each step, the stated average weight of each passenger (75 kg) is added to that of the cabin and its bearing (500 kg) to obtain the cumulative weight of the rising system at that stage. The effect of each loading is recorded, and the changes in the following parameters are noted: (i) Input power (ii) Output power, (iii) Thrust and Efficiency.

2.3 Effect of Loading on Thrust and Efficiency under Optimal and Maximum Load Conditions.

As earlier stated, the study developed a user iterative optimization algorithm it refers to as the Wire Gauge Variation and Slot/Tooth Ratio (WGVSTR) which its computer program is written in MATLAB software. The main advantage of the developed WGVSTR programme is that it allows the user to achieve an objective function by adjusting the appropriate parameters to effect optimization [10, 23]. The purpose is to observe their respective effects on the set performance objectives. However, in the case of loading effect on thrust and efficiency, the weight of the moving system was used as the variable that determines the set the thrust and efficiency.

Hence, using the elevator's optimum parameter values, the elevator is further subjected to load condition to obtain the actual thrust and efficiency at optimal load and maximum Load under the same rotor and slip conditions [11, 20]. The obtained Thrust and Efficiency at maximum load are then compared with that obtained under no-Load to get the actual output thrust of the elevator. The above narration depicts the methodology used in this study and also reflects the process followed in the WGVSTR optimization algorithm.

3. Results and Discussion

Table 1 shows the result of the simulation to find out the effects of loading on the optimized machine's performance objectives, namely the thrust and efficiency, using the WGVSTR. The total weight of the rising system without the passengers = 2280-600 (weight of 8 passengers) = 1680kg.

From Table 1, the weight of each passenger is added at every step, resulting in an increase in the loading of the elevator by 75 kg until it gets to 600 kg in step 8 (225 kg above the allowable weight of 375 kg for 5 passengers as specified for the existing model). It could be observed that thrust and efficiency were not affected in steps 1 to 5 with the respective loads of 1755 kg, 1830 kg, 1905 kg, 2055 kg, and 2130 kg.

The load (2055 kg) in Step 5 is chosen as the **optimal load** because it contains the weight of the recommended 5 passengers/cabin and is moved by the full machine thrust of 26560N. More so, as it was also noticed that the machine output thrust dropped slightly immediately after it.

In steps 6, 7, and 8, the drop in thrust became noticeable as it dropped from 26555 N to 26530 N and then to 24500 N with respective loads of 2130 kg, 2205 kg, and 2280 kg. In step 7 with seven passengers, the thrust value became 26530 N, 20 N below the machine's consistent thrust of 26560 N with loadings up to 2055 kg. However, there was no significant drop in thrust at this step 7, and the drop in thrust after this step became significant by 2060 N; hence, 2205 kg at step 7 is taken as **the maximum load.**

The efficiency has remained unaffected up till step 6 when it declined to 87.28% with a load of 2130kg and 87.25% on maximum load, and then fell to 60.22% at step 8 with 2280kg loading.

Table 1: Effect of Loading on Thrust and Efficiency

	Parameter Description		Step1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8
1	Weight of passenger(s) at 75(kg) per passenger	None	75	150	225	300	375	450	525	600
2	Weight of the Rising system	1680	1680	1680	1680	1680	1680	1680	1680	1680
3	Total weight of the Rising system (kg)	2280 -600 = 1680	1755	1830	1905	1980	2055 optimal	2130	2205 maximum	2280
4	Effect of loading on Thrust (kN)	26560	26560	26560	26560	26560	26560	26555	26530	24500
5	Effect of load on Efficiency (%)	88.25	88.25	88.25	88.25	88.25	88.24	87.28	87.25	60.22

4. Conclusion

In conclusion**,** the simulation results of the optimized elevator's *Thrust* and *Efficiency* when on No-Load differ from those obtained when the machine is On-Load. However, no matter how insignificant the difference may be, caution must be observed to ensure that the elevator is not operated beyond 2130 kg, which is between the optimal and maximum loads. It is preferable to operate the machine at its optimal load for safety and optimal performance. Finally, it can be concluded that a SLIM elevator with a short primary is a suitable electric motor to fulfil all the safety requirements of a modern elevator system, provided it is used within the specified load capacity.

Funding: The authors declare that no funds, grants, or other support were received during the preparation of this manuscript.

Author contributions: All the authors contributed to the development of the work. All authors read and approved the final manuscript.

Declaration of interests. The authors declare that none of the work described in this study could have been influenced by

any known competing financial interests or personal relationships.

Competing interests: The authors declare no competing interests.

Data Availability The authors confirm that the data supporting the findings of this study are available within the article.

References

[1] Shodhganga. (2022), *Introduction to Linear Induction Motors*, Web search: introduction to LIM pdf. websearch-.inflibnet.ac.in> bistream (pdf).

[2] Nzeife, I.D., and Mbachu, C. B. (2024). *Effect of Loading On Single Sided Linear Induction Motor (Slim) Elevator And Its Load Optimization* International Journal of Innovative Engineering, Technology and Science (Journal Accepted) 8th April 2024

[3] Ezechukwu V. C, Nwobi-Okoye C.C, Onyenanu I.U (2015) Analysis of Waste Gases at INTFACT Beverages, Onitsha-Nigeria. Journal of Emerging Technologies and Innovative Research, India JETIR 1510026 Vol 2 issue 10

[4] Kelsy, B. T., Nwobi-Okoye, C. C., Ezechukwu, V. C., & Uche, R. (2023). Multi objective optimization of novel Al-Si-Mg nanocomposites: A Taguchi-ANN-NSGA-II Approach. Journal of Engineering Research. https://doi.org/10.1016/j.jer.2023.10.008

[5] Nzeife, I.D and Mbachu, C.B (2024). *Framework On Use Of Linear Wireless Sensor Network (LWSN) For Border Monitoring And Surveillance*: Advancing Nigeria: The Role Of Artificial Intelligence, Sustainability and Engineering. 5th International Conference on Engineering Adaptation and Policy Reforms for Industrial Development (ICEAPRID) (2024)

[6] Nzeife, I.D.and Mbachu, C.B. (2023)/ *Improving the Performance of Single-Sided Induction Motor Using Edge-End Effects Reduction Technique*. International Journal of Innovative Engineering, Technology and Science, ISSN:2633-7365.Vol.4, No 1, March-2023.

[7] Nzeife I.D., Mbachu, B.C. and Ohia, C.C. *Inherent Problems of Linear Induction Motors and Optimization: An Overview. International Journal of Innovative Engineering, Technology and Science*, ISSN:2633-7365.Vol.2, No 2, March-2019

[8] Odelga, P.E, Nzeife, I.D and Muoghala, C.N (2025). *Optimal Placement of Distributed Generation for Power Loss Reduction in Enugu Distribution Network*. International Journal Of Research Publication And Reviews (IJRPR),ID IJRPR-148441; vol.6, issue 5.

[9] Nzeife, I.D and Mbachu C. B. (2024): *Design, Construction And Comparative Cost Analysis of Automatic Water Level Controllers For Water Management: Nigeria Scenario* International Journal of Innovative Engineering, Technology and Science (Journal Accepted) 8th April 2024

[10] Odelga, P.E, Nzeife, I.D and Muoghala, C.N (2024). *Optimal Placement of Distributed Generation for Power Loss Reduction in Enugu Distribution Network*. Advancing Nigeria: The Role of Artificial Intelligence, Sustainability and Engineering. 5th International Conference on Engineering Adaptation and Policy Reforms For Industrial Development (ICEAPRID) (2024)

[11] Ezechukwu, V. C., Oghenekaro , . P. O., Onyenanu, I. U. ., Ayadinuno, G. ., & Agwaziam, J. O. (2025). Mathematical Modeling and Optimization of Plantain Chip Drying: A Parametric Study on Air Frying Conditions. IPS Journal of Engineering and Technology, 1(1), 42–52. https://doi.org/10.54117/ijet.v1i1.13.

[12] Deepakkumar, Y. (2020). *Linear Induction Motor, Moving Secondary fixed Primary Single Sided LIM*. Kumaryadav. GilderMaven (2015). *Standard 3 phase Linear Induction Motor Core and Windings*. Wikipedia.org

[13] Nzeife, I.D. and Nwabueze, C.A. *Framework on Wireless Sensor Network (WSN) for Oil and Gas Infrastructure Protection with Emphasis on Niger Delta Region of Nigeria*. International Journal of Innovative Engineering, Technology and Science, Vol.1, No 2, Dec 2016. Published also in Researchgate.net Dec. 2016

[14] Nzeife, I. D., Uju, I .U., Nwabueze C.A.(2017) *Microwave Radiation: Implications on the Use of Imported Secondhand Microwave Ovens* 3rd International Conference on Engineering Adaptation and Policy Reforms for Industrial Development (ICEAPR 2017)17th-18th May. 2017.

[15] Nzeife I. D. and Uju, I.U. (2018).*Analysis And Application Of Linear Motors: An Overview* International Journal of Innovative Engineering, Technology and Science (IJIETS) March 2018

[16] Nzeife, I.D. and Nwabueze, C.A. *Framework on Wireless Sensor Network (WSN) for Oil and Gas Infrastructure Protection with Emphasis on Niger Delta Region of Nigeria. ResearchGate; https//www. Researchgate.net 23 July 2019*

[17] Nzeife, I.D1., Prof. David Okali2., Saidu M Maishanu3, Sade Onadeko4, Jossy Thomas5 *Renewable Energies in Nigeria-A chance for the Future*. (2006). Organized and Published by Goethe Institute-www.goethe.de/lagos (for English version click on the Nigerian flag) Prof. David Okali, Nigerian Environmental Studies/ Action Team (NEST)2, Ibadan; Mr. Saidu M Maishanu, Sokoto Energy Research Centre, Usman Danfodio University, Sokoto3; Sade Onadeko, Earth First, Lagos / Oakland, USA4; and Mr. Jossy Thomas, United Nations Industrial Development Org. (UNIDO), Abuja5.

[18] Nzeife I. D,. Uju I. U., Nwabueze C. A. and Ohia C.(2017). *Engineering and Community Policing: A Framework on the Use of NV Cameras for Effective Night Surveillance*. 3rd International Conference on Engineering Adaptation and Policy Reforms for Industrial Development (ICEAPR 2017) of Faculty of Engineering, Anambra State University, Uli Campus, 17th-18th May 2017.

[19] Abdullahi, E and Nzeife, I. D. (2024). *Challenges and Future Prospects of Li-Fi Deployment in Commercial Spaces*. International Journal of Research Publication and Reviews (IJRPR), www.ijrpr.com India.

[20] Ezechukwu, V.C., Nwobi-Okoye, C. C., & Atanmo, P. N. (2020). Surface modification of Momordica angustisepala fiber using temperature-activated amino-functionalized alkali-silane treatment. The International Journal of Advanced Manufacturing Technology, 109(5–6), 1397–1407. https://doi.org/10.1007/s00170-020-05697-w

[21] Ezechukwu, V.C., Nwobi_Okoye, C.C., Atanmo, P.N., Aigbodion, V.S. (2020) Wear Performance of Value-Addition Epoxy/Breadfruit Seed Shell Ash Particles and Functionalised Momordica Angustisepala Fiber Hybrid Composites. Journal of Composite and Advanced Material, Vol. 30. No. 5-6 pp. 195-202. https://doi.org/10.18280/rcma.305-601

[22] Obinwa, C C., Ezechukwu, V C., Nwosu, A W. (2024). Optimization and Analysis of Mechanical Properties (Tensile Strength) in a developed Plantain Hybrid Fibre Reinforced Composite (PHFRC). International Journal Of Engineering Research And Development. e- ISSN: 2278-067X, p-ISSN: 2278-800X, 20, 12, 109-119 http://www.ijerd.com/

[23] Ezechukwu, V. C. (2024). Hybridization Effect on Thermo-mechanical Behaviour of Epoxy/breadfruit Seed Shell Ash Particles and Momordica Angustisepala Fiber Composites for High-temperature Devices Application. Proceedings of the IRE, 7, 2456-8880.

[24] Okpala, I. F., Onyenanu, I. U., Ezechukwu, V. C., & Ilochonwu, C. E. (2025). Performance Optimization of a Locally Developed Charcoal Briquette Machine Using Response Surface Methodology. Scientific Journal of Engineering, and Technology, 2(1), 55-66. https://doi.org/10.69739/sjet.v2i1.486

[25] Ezechukwu, V. C., Onyenanu, I. U. ., Ayadinuno, G. ., Agwaziam, J. O., & Ojinekeya, C. O. (2025). Corrosion Resistance of Developed Bolted Flange Made of Momordica Angustisepala Fibre (MAF) and Breadfruit Seed-Shell Particles (BFSAP). IPS Journal of Engineering and Technology, 1(1), 34–37. https://doi.org/10.54117/ijet.v1i1.4

[26] Unya N., Ezechukwu V C., Onyenanu I U., Owuama K C., Maduasi A H. (2025) Analysis of Thermal Insulation Characteristics in Epoxy Composites Reinforced with Hybrid Materials: Calabash and Rice Husk Ash. Research Journal in Civil, Industrial and Mechanical Engineering ISSN: 3079-2630 DOI: 10.61424/rjcime Journal Homepage: www.bluemarkpublishers.com/index.php/RJCIME

[27] Ezechukwu, V. C., Amogu, J. A., & Owuama, K. C. . (2025). Effects of Groove Angles and Quenchants on the Structural Integrity of a Single-Vee Butt Welded Joint of AISI 1024 Carbon Steel Weldment. IPS Journal of Engineering and Technology, 1(1), 1–12. https://doi.org/10.54117/ijet.v1i1.3

[28] Ogbuonwu, F. C., Owuama, K. C., & Ezechukwu, V. C. (2025). Performance Evaluation of a Reliable Portable Solar Power System. IPS Journal of Engineering and Technology, 1(2), 75–90. https://doi.org/10.54117/ijet.v1i2.16

[29] Ubani, N. O., Dara, J. E., & Ezechukwu, V. C. (2025). Solidworks Modeling of the Mechanical Strength of an Optimum High-Pressure A360 Die Cast. Arid Zone Journal of Engineering, Technology And Environment, 20(4), 828-835. Retrieved from https://azojete.com.ng/index.php/azojete/article/view/984

[30] Ezechukwu, V. C., Onyenanu, I. U., Ayadinuno, G., & Agwaziam, J. O. (2025). Structural simulation analysis of the developed hybrid of Momordica angustisepala fiber and Breadfruit seed-shell particles composites Bolted Flanges. IPS Journal of Engineering and Technology, 1(1), 13–20. https://doi.org/10.54117/ijet.v1i1.2.

• *Thanks for publishing with IPS Intelligentsia.*