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# PROFESSIONAL SUMMARY

Dr. Frank Kwabena Afriyie Nyarko is a Senior Lecturer at the Mechanical Engineering Department of Kwame Nkrumah University of Science and Technology, Kumasi, Ghana (KNUST). He holds a BSc. in Mechanical Engineering from KNUST, and an MSc Engineering Design from Loughborough University, UK, and a PhD in Mechanical Engineering from KNUST. He has over a decade Professional(industrial) and research (academia) experience in Machine Design, Computer Aided Design and Manufacturing, Machine Learning, Design and implementation of Robot Assistive Devices for rehabilitation of stroke patients, and Solar PV reliability studies.

He gained USAID fellowship on Solar Photovoltaic Reliability Research for Sub-Saharan Africa (PRESSA) project and was a visiting researcher at the Photovoltaic Reliability Laboratory (PRL) at Arizona State University (ASU) in the USA. He was also a researcher on the Norwegian Programme for Capacity Development in Higher Education and Research for Development within the Fields of Energy and Petroleum (NORAD, EnPE), and a participant on the ERASMUS+ Mobility programme at the Department of Human Machine Systems, Technische Universitat Berlin, Germany.

He was one of the Lead supervisors of the first KNUST 'Cycle Car' project, which is a collaboration between Art and Engineering. In 2021, he was one of the lead Supervisors of the Royal Academy of Engineering (RAE), UK collaborative project in higher education in Ghana (HEPSSA-Project) involving the KNUST and four selected Technical Universities namely, Koforidua Technical University, Cape Coast Technical University, Kumasi Technical University, and Ho Technical University. He is a registered professional Engineer at the Ghana Institution of Engineering.

As a researcher his primary goal is to inspire his students with creative principles and techniques in Engineering Design to address societal challenges by creating the products needed. He has contributed to several Engineering Design projects and over 20 peer-reviewed articles.

# RESEARCH AND TEACHING EXPERIENCE

* **Snr Lecturer:** Department of Mechanical Engineering, Kwame Nkrumah University of

Science and Technology, Kumasi **2021 -to-date,**

* **Lecturer:** Department of Mechanical Engineering, Kwame Nkrumah University of

Science and Technology, Kumasi **2015 -to-2021,**

* **Assistant Lecturer:** Department of Mechanical Engineering, Kwame Nkrumah University of Science and Technology, Kumasi **2010 -to-2015,**

**Subjects Taught:**

ME 159 Technical Drawing

ME 162 Basic Engineering Mechanics

ME 174 First-Year Design Project

ME 259 Application to Computer Graphics

ME 274 Second-Year Design Project

ME 373 Design of Machine Elements I

ME 374 Design of Machine Elements II

ME 473 Computer Aided Design and Manufacturing CAD/CAM

me 584 computer control of machines and processes IOE 572 Computer Integrated Manufacturing

ESM 557 Alternative and Renewable Energy Technology

**Selected Post Graduate Thesis Supervised:**

* Design and Development of a Smart Flexible Manufacturing System Laboratory as a Teaching Resource for Africa Centers of Excellence – **PhD**
* STEAM (Science, Technology, Engineering, Art and Mathematics) in Ghanaian Higher Education**:** Modelling STEAM Related Competencies of Students through a “CYCLE CAR TECHNOLOGY” - **PhD**
* Characterization of Recycled Plastics for Structural Applications – **PhD**
* Machine Learning Forecasting of Solar PV Production Using Single and Hybrid Models

Over Different Time Horizons- **MPhil. 2023**

* Design and Fabrication of a Robotic Rigid hand exoskeleton-**Mphil, 2024**
* Design, Fabricate and Test an Economical Pneumatic Hand

Exoskeleton Device to aid stroke patients in recovery-**MPhil. 2024**

* The use of Machine Learning approaches to Forecast Renewable Energy Generation in Ghana. (a case study of Kaleo solar power plant)- **MSc. 2024**

**Technical Operations Engineer**: Royal Bank of Scotland, Group Document Services (GDS), UK 2006 to 2008:

* Responsible for redesigning process flow charts to optimize Operational Effectiveness and Efficiency.
* Effectively organised processing environment to achieve ISO 14001 Certification.
* Led a team in implementing 5S in factory environment.
* Provided training and technical support for machine operators.
* Worked on operational improvement projects including Total Productivity Management (TPM), and Total Quality Management (TQM).

**Shift Charge Engineer**: Royal Bank of Scotland, Group Document Services (GDS), UK 2004 to 2006:

* Planned workflow and personnel deployment.
* Monitored and reported on Machine operational errors and faults.  Organised Planned and Predictive Maintenance schedules.

**Parts Sales & Support Engineer**: Mantrac Ghana Ltd (CAT), Ghana 2002 to 2003:

* Delivered sales & service support to Caterpillar (CAT) customers.
* Provided advise for dealers on parts & equipment service procedures.

**Teaching Assistant**: Kwame Nkrumah University of Science & Technology, Ghana 2001 to 2002:

* Delivered tutorial section for undergraduate students in Engineering Thermodynamics & the Strength of Engineering Materials
* Organised laboratory experiments & developed manuals for newly commissioned Laboratory Equipment.
* Organised Seminars for students and professionals from industry.

# **TECHNICAL SKILLS AND EXPERTISE**

* Siemens PLM NX, Solid Edge, Solid works – 3D CAD Modelling Software integrated with Finite Element Analysis (Nastran) and Ansys.
* Total Quality Management (TQM) and Total Productivity Management (TPM)  DFMA Boothroyd Dewhurst Software – Design for Manufacture Assembly  Microsoft Office: Word, Excel, PowerPoint, and Microsoft Project.

# **SELECTED PUBLICATIONS**

Journal Publications

1. Asiedu, S. T., Nyarko, F. K., Boahen, S., Effah, F. B., & Asaaga, B. A. (2024). Machine learning forecasting of solar PV production using single and hybrid models over different time horizons. *Heliyon*, *10*(7).
2. Ayetor, G. K., Nyarko, F. K., & Andoh, P. Y. (2024). Achieving cost parity for battery electric vehicles in Africa: a case study of Ghana. *Transportation Letters*, *16*(2), 144-156.
3. Fofana, S. B., Nyarko, F. A., Mensah, L. D., & Takyi, G. (2023). Implementation of flexible manufacturing systems in Africa: multiple case studies in the Gambia and Ghana. *Nigerian Journal of Technological Development*, *20*(1), 91-101.
4. Tannor, A. Y., Nyarko, F. K. A., Quao, B. O., & Adams, E. A. (2024). Africa region: Ghana. In *Rehabilitation Robots for Neurorehabilitation in High-, Low-, and Middle-Income Countries* (pp. 403-418). Academic Press.
5. Nyarko, F. K., Takyi, G., & Effah, F. B. (2021). Impact of the constitutive behaviour of the encapsulant on thermo-mechanical damage in (c-Si) solar PV modules under thermal cycling. Scientific African, 12, e00767. DOI: <https://doi.org/10.1016/j.sciaf.2021.e00767>
6. Afriyie Nyarko, F. K., Takyi, G., & Effah, F. B. (2021). Study on Creep Damage in Sn60Pb40 and Sn3. 8Ag0. 7Cu (Lead-Free) Solders in c-Si Solar PV Cell Interconnections under In-Situ Thermal Cycling in Ghana. Crystals, 11(4), 441. DOI: <https://doi.org/10.3390/cryst11040441>
7. Nyarko, F. K. A., & Takyi, G. (2021). Life prediction in c-Si solar cell interconnections under in-situ thermal cycling in Kumasi in Ghana. Soldering & Surface Mount Technology. DOI: <https://doi.org/10.1108/SSMT-10-2020-0045>
8. Nyarko, F. K. A., Takyi, G., Agyemang, A. A., & Sekyere, C. K. K. (2021). Crystalline Silicon (c-Si) Solar Cell Interconnect Damage Prediction Function Based on Effect of Temperature Ramps and Dwells on Creep Damage under Field Thermal Cycling. Crystals, 11(6), 633. DOI: <https://doi.org/10.3390/cryst11060633>.
9. Nyarko, F. K., Takyi, G., & Amalu, E. H. (2020). Robust crystalline silicon photovoltaic module (c-Si PVM) for the tropical climate: Future facing the technology. Scientific African, 8, e00359. DOI: <https://doi.org/10.1016/j.sciaf.2020.e00359>
10. Nyarko, F. K., Takyi, G., Amalu, E. H., & Adaramola, M. S. (2019). Generating temperature cycle profile from in-situ climatic condition for accurate prediction of thermo-mechanical degradation of c-Si photovoltaic module. Engineering Science and Technology, an International Journal, 22(2), 502-514. DOI: <https://doi.org/10.1016/j.jestch.2018.12.007>
11. Fofana, S. B., Nyarko, F. K. A., & Takyi, G. (2021). Flexible manufacturing systems in Africa (A review). Nigerian Journal of Technology, 40(6), 1048-1062.

DOI: <https://doi.org/10.4314/njt.v40i6.7>

1. Takyi, G., & Nyarko, F. K. (2020). Investigation of the Effect of Temperature Coefficients on Mono-Crystalline Silicon PV Module Installed in Kumasi, Ghana. Journal of Power and Energy Engineering, 8(09), 20. DOI: <https://doi.org/10.4236/jpee.2020.89003>
2. Tawiah, P. O., Andoh, P. Y., Agyei-Agyemang A., and Nyarko F. "Characterization of recycled plastics for structural applications." International Journal of Science and Technology 5, no. 6 (2016):259-267. <https://www.researchgate.net/publication/352101123_Characterization_of_Recycled_Plastics_for_Structural_Applications>
3. Sackey, S. M., Owusu-Ofori, S.P., Nyarko F., Designed Experiments for Studying Delamination in Drilling of Composite Laminates. Journal of Advances in Science and Technology Research (JASTER), 2016. 3(2): p. 5-11.

<https://www.researchgate.net/publication/361582579_Designed_Experiments_for_Studying_Delamination_in_Drilling_of_Composite_Laminates>.

# **EDUCATION**

PhD Mechanical Engineering

Kwame Nkrumah University of Science and Technology, September 2019

MSc Engineering Design

Wolfson School of Mechanical and Manufacturing Engineering, Loughborough University, LE 11 3TU, UK, August 2004.

BSc BSc. Mechanical Engineering

Kwame Nkrumah University of Science and Technology, June 2001.

# **LANGUAGES**

**Twi**: Native language, Advanced Speaker, Intermediate Reading, and Writing.

**English**: Advanced Listener, Advanced Speaker, Advanced Reading and Writing.

# **REFERENCES**

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