
FEDERAL UNIVERSITY OF TECHNOLOGY
MINNA

# THE ELECTRIC POWER TRANSMISSION LINE - A VIABLE LINK FOR INTELLIGENCE TRANSMISSION

*By*

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***Professor of Electrical Engineering***

INAUGURAL LECTURE SERIES 41

17TH MARCH, 2016


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This 41st Inaugural Lecture was delivered under the Chairmanship of:

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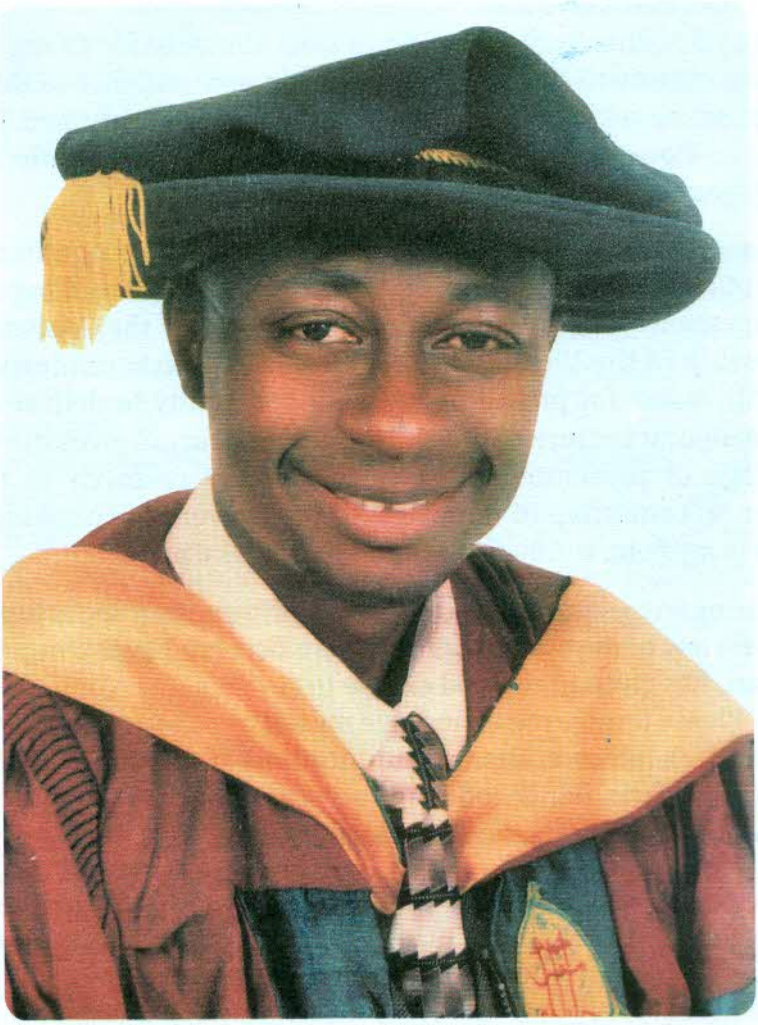
*Published by:*
**University Seminar and Colloquium Committee,**
Federal University of Technology, Minna.

**17th March, 2016**

*Design + Print:*
**Global Links Communications, Nigeria**
*✆: 08056074844, 07036446818*



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## 1. INTRODUCTION

I give praise, thanks and honour to God Almighty for giving n the opportunity to stand before this esteemed audience to sha a brief on my research activities, which has been captioned **Tl Electric Power Transmission Line – A Viable Link f Intelligence Transmission.**

An inaugural lecture marks the formal and official recognition promotion to Professorship, so I want to start by thanking t management of this great university under the visiona leadership of the Vice-Chancellor, Professor Musbau Adewu AKANJI, FNSBMB, for providing me the opportunity to deliver t 41st Inaugural Lecture of the University. This forum gives me t privilege of presenting an overview of my research to th audience, consisting of members of the University communi peers in my field, family, friends and the general public.

Preparing an inaugural lecture, particularly one that seeks to gi an overview of developments that have occurred over a numb of years, has given me a good excuse to revisit some of my earli work. Please forgive me if I indulge myself by reflecting a little my research in Powerline Communications at the Ahmadu Be University, Zaria, which led to the award of the degree of Doct of Philosophy (PhD) in Electrical Engineering.

My Vice-Chancellor sir, as powerline communications is somewhat quiet subfield of electrical engineering, kindly perm me to quickly run through Electrical Engineering and conventional subfields.

## 2. ELECTRICAL ENGINEERING AND ITS SUBFIELDS

Electrical engineering is a field of engineering that genera deals with the study and application of electricity, electronics a electromagnetism. Electrical engineering has now subdivid into a wide range of subfields. These include electronics, digi

computers, power engineering, telecommunications, control systems, signal processing, instrumentation and microelectronics. The subject of electronic engineering is often treated as its own subfield but it intersects with all the other subfields, including the power electronics of power engineering.

## 2.1 Power

Power engineering deals with the generation, transmission and distribution of electricity as well as the design of a range of related devices. These include transformers, electric generators, electric motors, high voltage engineering and power electronics.

## 2.2 Control

Control engineering focuses on the modeling of a diverse range of dynamic systems and the design of controllers that will cause these systems to behave in the desired manner. To implement such controllers, electrical engineers may use electronic circuits, digital signal processors, microcontrollers and programmable logic controls (PLCs).

## 2.3 Electronics

Electronic engineering involves the design and testing of electronic circuits that use the properties of components such as resistors, capacitors, inductors, diodes and transistors to achieve a particular functionality.

## 2.4 Microelectronics

Microelectronics engineering deals with the design and microfabrication of very small electronic circuit components for use in an integrated circuit or sometimes for use on their own as a general electronic component. The most common microelectronic components are semiconductor transistors, although all main electronic components (resistors, capacitors, etc.) can be created at a microscopic level. Nanoelectronics is the further scaling of devices down to nanometer levels.

## 2.5 Signal processing

Signal processing deals with the analysis and manipulation of signals. Signals can be either analog, in which case the signal varies continuously according to the information, or digital, in which case the signal varies according to a series of discrete values representing the information. For analog signals, signal processing may involve the amplification and filtering of audio signals for audio equipment or the modulation and demodulation of signals for telecommunications. For digital signals, signal processing may involve the compression, error detection and error correction of digitally sampled signals.

## 2.6 Telecommunications

Telecommunications engineering focuses on the transmission of information across a channel such as a coaxial cable, optical fiber or free space. Transmissions across free space require information to be encoded in a carrier signal to shift the information to a carrier frequency suitable for transmission. This is known as modulation. Popular analog modulation techniques include amplitude modulation and frequency modulation.

## 2.7 Instrumentation

Instrumentation engineering deals with the design of devices to measure physical quantities such as pressure, flow and temperature. The design of such instrumentation requires a good understanding of physics that often extends beyond electromagnetic theory.

## 2.8 Computers

Computer engineering deals with the design of computers and computer systems. This may involve the design of new hardware, the design of PDAs, tablets and supercomputers or the use of computers to control an industrial plant.

## 2.9 Related disciplines

Mechatronics is an engineering discipline which deals with the

convergence of electrical and mechanical systems. Such combined systems are known as electromechanical systems and have widespread adoption. Examples include automated manufacturing systems, heating, ventilation and air-conditioning systems and various subsystems of aircraft and automobiles.

Biomedical engineering is another related discipline, concerned with the design of medical equipment. This includes fixed equipment such as ventilators, MRI scanners and electrocardiograph monitors as well as mobile equipment such as cochlear implants, artificial pacemakers and artificial hearts.

Electrical engineers design, develop, test and supervise the manufacturing of electrical equipment, such as electric motors, radar and navigation systems, communications systems and power generation equipment as well as design and develop electronic equipment, such as broadcast and communications systems from portable music players to global positioning systems (GPS). Their work focuses on economy, quality, reliability, safety and sustainability.

## 3. THE ELECTRIC POWER TRANSMISSION LINES

Electric power transmission lines serve as a link between the generating station and the distribution station. A power system is composed of generation, transmission and distribution. Electrical power generation is that aspect of power system dedicated to the harnessing of primary energy resources with a view to the conversion of such energies to electrical energy. Nuclear energy, fossil fuels and water energy amongst others are the primary energy sources generally employed for electrical power generation purposes.

On generation, electrical energy has to be conveyed to the areas of utilization, which are, in most cases, urban areas and industrial plants, which may be located within or far from the urban areas.

The process of power transportation from the generating end to the areas of utilization is referred to as electrical power transmission.

Electrical power transmission systems basically consist of power transmission lines, which emanate from the generation station or power plant substation and terminates at the transmission substations also referred to as bulk receiving stations. The transmission lines apart from reaching the bulk receiving stations also serve to interconnect generating station or power plants.

An entire power system comprises high-voltage generators, transformers and associated switchgears at different locations separated by distance, all interconnected by high-voltage transmission lines forming a grid.

The Nigerian National Grid consists of many generating stations, 330kV transmitting stations and 132kV substations grouped into three major divisions, viz:

- Generating stations;
- Area control centres (ACC) and
- National control centres (NCC).

The voltage level of a particular system is determined by the amount of power to be transmitted and the distance over which it is to be transmitted. For high transmission efficiency, these voltages are made higher for longer distances. Transmission voltages above 230kV are referred to as extra-high voltages (EHV) and these are employed for very long distance transmission purposes. The higher the voltage level employed for power transmission, the higher the cost of insulation of transformer, switchgear and other terminal equipment that go with the system as well as the cost of cable insulators for underground cables where they are needed in the system. For very long distances however, the advantages far outweigh the