BIOGRAPHICAL SKETCH

Muhammad Enagi Bima was born in his hometown Enagi, Niger State, Nigeria in 1987. He was raised in Minna, Niger state, Nigeria and attended Federal Government Academy, Nigeria from 1998 to 2004 for his high school education. After that he proceeded to pursue his Bachelors in Engineering (BEng) degree in Electrical and Computer Engineering at Federal University of Technology, Minna, Nigeria from 2005 to 2010. After receiving his BSEng, he enrolled in the University of Manchester, in the United Kingdom to do a Masters of Science (MSc) degree in Communication Engineering from 2010 to 2011. After completing a year of service with the National Youth service Corps in Nigeria in 2012 he began a temporary job appointment with Galaxy Backbone Plc where he worked as a Network Support Engineer. He left after a few months to teach at the Federal University of Technology, Minna where he lectured for 4 years before leaving to pursue his Doctorate degree. He enrolled in Tennessee Technological University in 2017 in the Electrical and Computer Engineering Department. Muhammad is currently a Candidate for the Doctor of Philosophy Degree in Engineering at Tennessee Technological University.

EDUCATION

Ph.D. Engineering
Tennessee Tech University, December 2021 *(expected)*
Cookeville, Tennessee

M.Sc. Communication Engineering
The University of Manchester, December 2011
Manchester, United Kingdom

B.Eng. Electrical and Computer Engineering
Federal University of Technology, Minna, April 2010
Minna, Niger State, Nigeria

FUNDING

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College of Engineering

TENNESSEE TECH

The Department of

Electrical and Computer Engineering

Announces the Dissertation Defense of

Muhammad Enagi Bima

In Partial

Fulfillment of the Requirements

For the degree of

Doctor of Philosophy in Engineering

June 28, 2021

11:00 a.m.

Tennessee Tech University

Zoom Link:

https://tntech.zoom.us/j/86931466069?pwd=d0NZLzZGYUlVdzdkdzROS2RlalJOUT09

FIELD OF STUDY

Wireless Power Transfer

DISSERTATION TOPIC

Novel Magnetic Beamforming Technique and Coil Optimization for High-Efficiency, High-Power and Secure Wireless Power Transfer

EXAMINING COMMITTEE

Dr. Indranil Bhattacharya, Committee Chair
Associate Professor, Electrical and Computer Engineering

Dr. Syed Rafay Hasan
Associate Professor, Electrical and Computer Engineering

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Professor, Electrical and Computer Engineering

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Professor, Manufacturing and Engineering Technology

Dr. Charles Van Neste
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ABSTRACT

Inductive wireless power transfer is a technology that is gaining increased interest in both industry and academia. For it to become fully commercialized, certain limitations need to be addressed. These include its robustness to misalignment and the decay of power with distance. This research tried at proffering solutions to these problems. Towards this, a novel coil structure, called the Layered DD coil, was invented to channel the magnetic flux lines in order to minimize the losses. With each layer oriented such that magnetic field emanating from each layer add up constructively, the layered DD coil exhibits an inductance greater than what just a multiple of the layers would exhibit. Physical parameters of the coil structure were also investigated to determine how certain parameters impact the coil inductance and misalignment sensitivity. The recent drive towards charging of electric vehicles dynamically, i.e., while they are in motion on the road, has created the need for the coils to be able to dynamically adapt to the change in position of the vehicle. To address this, an array of coils was implemented. Also, a maximum power point tracking algorithm was developed using some artificial intelligence-based algorithm. The Jaya and crow search optimization algorithms were used in tracking the maximum power point. For the system to adapt to receiver location, a dynamic estimation of the coupling coefficient between each transmitter and receiver was implemented. This enabled each transmitter to tune its parameters such that the overall received power at the receiver is maximized based on a set target power. To reduce the runtime computational complexity of the coupling coefficient estimation, a trained neural network (NN) was employed. Relative location data in (X, Y) coordinate was provided to the NN which in turn gave the coupling coefficient as the output. A control mechanism was also implemented to keep the target received power at the specified value. This was based on a feed-forward approach. Optimization of the algorithms and tun-ability of circuit components like the resistors, inductors and capacitors would be further work in this area to realize the implementation of the schemes.