

# University of Toledo

Electrical Engineering & Computer Science Department

## Thesis Defense Announcement

11:00am 02/26/2021

### The Efficiency Measuring Apparatus for Li-ion Battery Equalizers

by

**Boluwatito Salami**

MS Candidate

#### Thesis Committee:

Dr. N. Mubenga, Chair

Dr. T. Stuart

Dr. R. Molyet

**Abstract:** Electric vehicles are mostly powered by Li-ion batteries because of their high power and energy density. The Li-ion battery cells experience voltage imbalance which leads to capacity mismatch as the cells undergo charge and discharge cycles. An electronic equalizer, EQU, can be used to balance the cell voltages. There are generally two types of equalizers available on the market today: Passive Equalizers (PEQs) and Active Equalizers (AEQs). A hybrid equalizer, consisting of both the PEQ and AEQ, called the Bilevel Equalizer (BEQ) solves the voltage imbalance issue at a high efficiency and low cost. This research designs and builds the Printed Circuit Board (PCB) for the production model of the 24V and the 48V Efficiency Measuring Apparatus (EMA), for low voltage and high voltage applications. The EMA is a device that measures the efficiency of charge transfer between cells or sections of cells. The AEQ Inductor Design Tool and the Equalizer Design App (EDA) were also developed and implemented in Python to design the inductors for the AEQ units and simulate the equalizer performance under different scenarios. The experimental results from the 24V and the 48V EMA validated the results from the Python AEQ Inductor Design Tool, while the BEQ experimental data validated the Python EDA results showing that they are adequate tools for simulating equalizer performance.



**Bio:** Boluwatito Salami received his B.S. degree in Electrical and Electronic Engineering from Obafemi Awolowo University, Nigeria in 2016. From 2016 to 2019 he worked as electrical engineer in telecommunications. He is currently pursuing his M.S. degree in Electrical Engineering at the University of Toledo, Ohio, USA. From 2019, he has been a Research Assistant at the University of Toledo. His research interests include battery management system, printed circuit board design and fabrication, and renewable energy. He is a student member of IEEE and the IEEE Power and Energy Society.