BIOGRAPHICAL SKETCH

Ryan A. Kettle was born in Hobart, Indiana on January 28, 1991 where he was raised and attended school until his family moved to Johnson City, Tennessee. There he graduated from Science Hill high school in 2009 and then attended Northeast State Community College receiving his Associates of Science in Pre-Engineering in 2011. Ryan then transferred to Tennessee Technological University and during this time to a co-op at Magneti Marelli in Pulaski, Tennessee. He completed his Bachelor of Science in Mechanical Engineering in 2014. He then accepted a position working for Dr. Steven Anton in the Dynamic and Smart Systems Laboratory at Tennessee Technological University.

EDUCATION

A.S. Pre-Engineering
Northeast State Community College, 2009-2011

B.S. Mechanical Engineering
Tennessee Tech University, 2011-2014

M.S. Mechanical Engineering
Tennessee Tech University, 2014-2018

College of Engineering

TENNESSEE TECH

The Department of

Mechanical Engineering

Announces the Thesis Defense

of

Ryan Kettle

In Partial Fulfillment of the Requirements

For the degree of

Masters of Science

March 14th, 1:30 pm

Held in

Prescott Room 225

FIELD OF STUDY

Mechanical Engineering

THESIS TOPIC

Electromechanical Impedance Based Microsecond State Detection

EXAMINING COMMITTEE

Dr. Steven Anton (ME, Advisor)

Dr. Mohan Rao (ME, Dept. Chair)

Guillermo Ramirez (CE)

ABSTRACT

This thesis concerns the development of various technologies necessary to increase the speed of electromechanical impedance based state detection to the microsecond timescale. The eventual end goal of this research is the creation of a microsecond state detection system for structures operating in highly dynamic environments capable of monitoring the structure during dynamic events in real-time. Measurements are made using the electromechanical impedance method, which utilizes a piezoelectric transducer bonded to the surface of the structure as both an actuator and sensor. State detection is the process of continuously monitoring a structure with the goal of detecting and identifying any physical change that effects the structure and so is related to the field of structural health monitoring. Conventionally though, structural health monitoring is applied to large civil structures which undergo slow structural changes, such as crack propagation and creep; therefore both the measurements and time between measurements of the structure take place over large time scales. By decreasing the measurement time sufficiently physical changes occurring in a structure during dynamic events can be detected. This drastic decrease in measurement time will be achieved through the use of: a novel multi-tonal excitation signal, field-programmable gate arrays, and high-frequency MHz excitation signals. This work applies these methodologies to static structure and lays the foundations for further work to be done on dynamic testing.