College of Engineering

TENNESSEE TECH

The Department of

Mechanical Engineering

Announces the Thesis Defense

of

Joshua Hooper

In Partial Fulfillment of the Requirements

For the degree of

Master of Science in Mechanical Engineering

April 5, 2021

2:30 p.m.

Tennessee Tech University

Zoom Link:
https://tntech.zoom.us/j/82713242954?pwd=dlJudG

FIELD OF STUDY

Mechanical Engineering

Thesis Topic

A Modeling Tool to Analyze the Performance of Industrial Cooling Towers

EXAMINING COMMITTEE

Dr. Ethan Languri (Co-Chairperson)

Dr. Glenn Cunningham (Co-Chairperson)

Dr. Jie Cui

ABSTRACT

Energy efficiency and energy savings have become important factors as industries look for ways to save energy and minimize their consumption while reducing their carbon footprint. Cooling towers are utilized significantly in industries for serving either chillers or process cooling. Depending on the size of the cooling tower, it can use a surprising amount of energy and water, which is why it is crucial to make sure that the facility has optimized their cooling tower.

A modeling tool has been developed to perform a thorough analysis of a cooling tower and its various operations, which will then allow the user to see potential ways to optimize their cooling tower. This model analyzes an annual base case in comparison with the revised case of a cooling tower operation. This modeling tool simulates 8,760 hourly calculations for fan power of various fan controls, water consumption, and pumping energy consumption and demand based on the user's location and its corresponding Typical Meteorological Year 3 (TMY3) weather data. This model is capable to simulate up to five cooling tower cells as one tower utilizing one pump or parallel pumping. The successful validated cooling tower model will assist industry to save energy at their facility through their cooling tower, whether they use it for process cooling or Heating Ventilation and Air Conditioning (HVAC) applications. The entering/leaving water temperatures based on a monthly operating schedule or a wet-bulb temperature schedule will be used as inputs along with various other inputs, and the model will then calculate and present savings in energy for various conditions including variable-frequency drive (VFD) on the fan/pump, drift eliminators, number of cycles of concentration, reduced water flow rate, etc.

BIOGRAPHICAL SKETCH

Joshua L. Hooper was born in Nashville, Tennessee on December, 1996. He graduated with honors from Siegel High School in Murfreesboro, TN in May 2015. Joshua entered Tennessee Tech University in August 2015 and graduated with a Bachelor of Science in Mechanical Engineering in May 2019. He then continued his education at Tennessee Tech University in August 2019 and will be receiving a Master of Science degree in Mechanical Engineering in May 2021.

EDUCATION

M.S. Mechanical Engineering
Tennessee Tech University, 2019-Present

B.S. Mechanical Engineering
Tennessee Tech University, 2015-2019

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